



An introduction to road safety audit

Phillip Jordan - Road Safety *International*

Road Safety Audit

My objectives today:

- to outline the road safety audit process,
- to encourage the introduction of the road safety audit process in your national road authority,
- to encourage you to undertake audits especially during the design stages of new road projects, and
- to answer your questions about the audit process

What is road safety audit?

Why do we
need audit?

How do we do an audit?

Where?

When?

Road safety audit is especially important for CAREC – with the new highways underway, it is vital for safety to “get it right the first time”

Save time, save money, save lives.

Road Safety Audit

An introduction to road safety audit

What is it?

How do we do an audit?

When should we do audits?

Why do we need it?

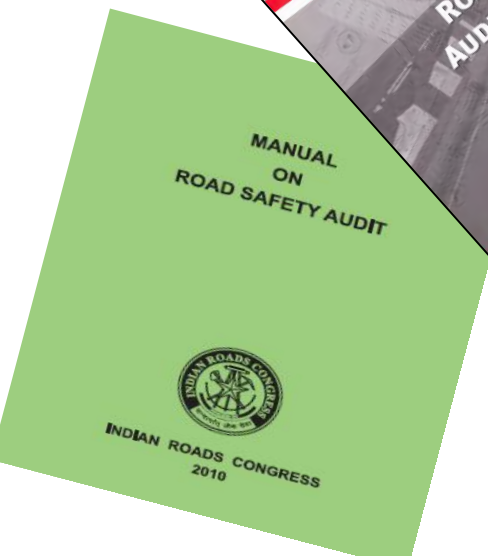
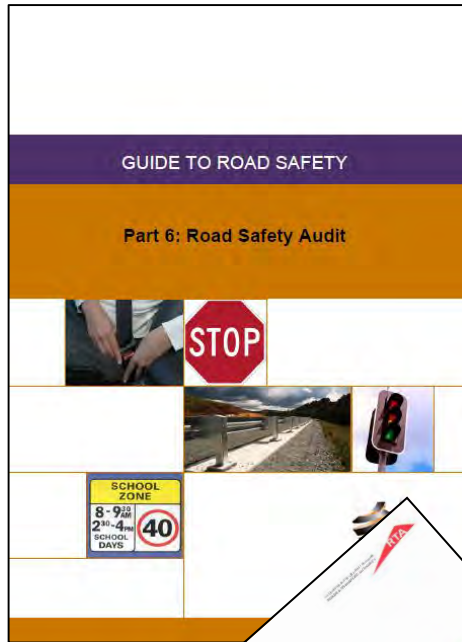
What are the costs and benefits?

Road Safety Audit

Prevention is better than cure



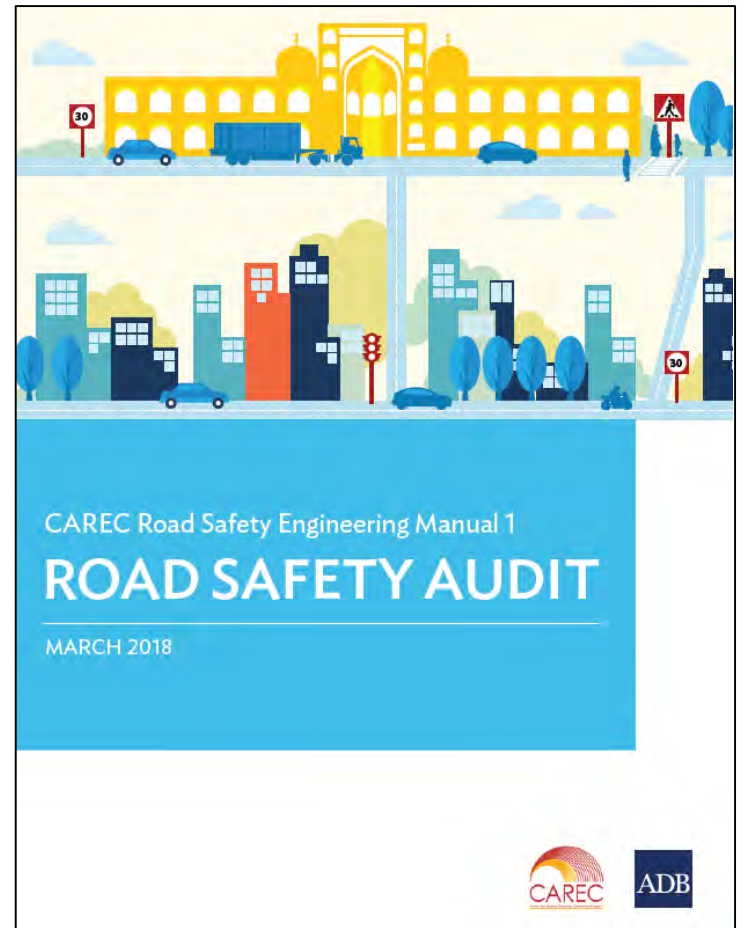
Road Safety Audit guidelines



Prevention is better than cure

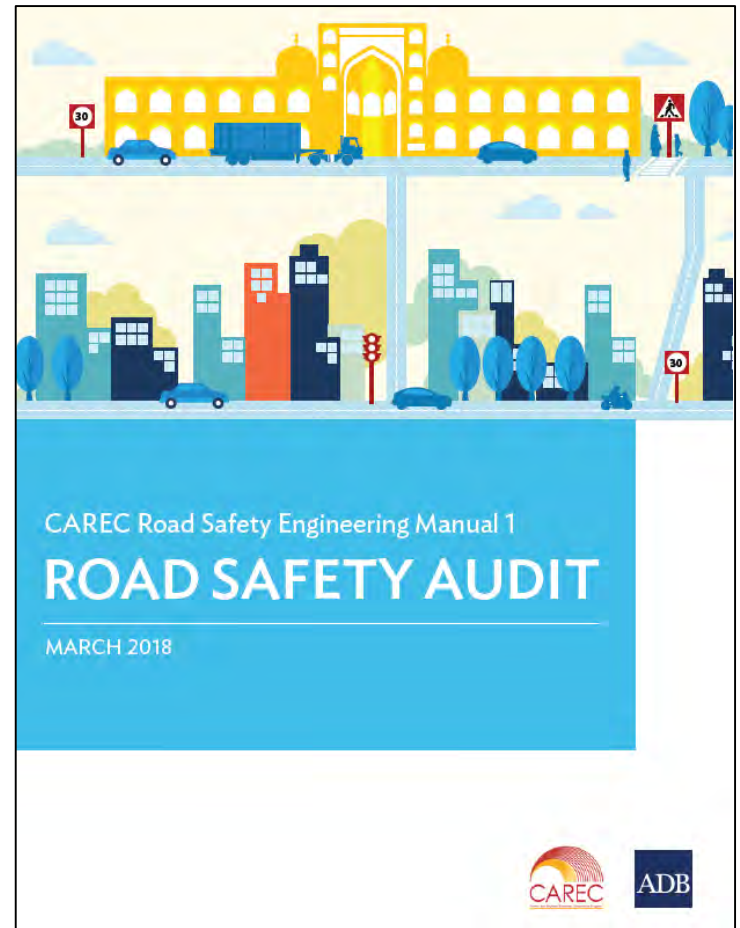
A road safety audit is.....
“a formal, systematic and detailed examination of a road project by an independent and qualified team of auditors that leads to a report listing the potential safety concerns in the project.”

(CAREC 2018)



A road safety audit is.....
“a **formal, systematic and detailed** examination of a road project by an **independent and qualified team of auditors** that leads to a report listing the potential safety concerns in the project.”

(CAREC 2018)



An audit is:

- **A formal process – not an informal check**
- **Carried out by people who are independent of the design**
- **Undertaken by people who have appropriate experience and training**
- **Restricted to road safety issues**

Road Safety Audit is NOT

- another name for a blackspot investigation
- a substitute for a blackspot investigation
- an opportunity to redesign a scheme
- a design standards check, or a compliance check



But please remember that a road safety audit does not take over the responsibility for the project



That responsibility remains with the Project Manager



Road safety audit is PROACTIVE

Blackspot investigations are REACTIVE

Road safety audit applies practical safety experience at the design stages of a project to ensure ...

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ДАР ХОНАИ ШУ
САРФАҶУИИ
ЭНЕРГИЯИ БАРҚ ТО

МУҲАММАД, 1/1, тел. : (44) 600 7890, хиёбони Ч. РАСУЛОВ, 55/1, тел. : (44) 600 7733, кўчаи Н. МАХСУМ, 126, тел. :



unsafe features are not introduced

Road safety audit applies practical safety experience at the design stages of a project to ensure ...



unsafe features are not introduced



I am a problem finder!

Engineers are problem solvers

Auditors need to be problem finders!



Road safety audit combines art with science - the art of assessing how the road users will use the road, and the science of proven road safety engineering principles.

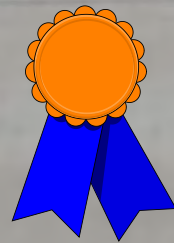
Objectives of road safety audit

- To minimise the risk of crashes occurring on a new road project, and to minimise the severity of the crashes that do occur;
- To minimise the risk of crashes occurring on adjacent roads (that is, to avoid the possibility that the project creates crashes elsewhere on the network);
- To recognise the importance of safety in road design (so that the needs and perceptions of all road users are met, and to achieve a balance between needs where they may be in conflict);
- To reduce the long term costs of a new road project, bearing in mind that unsafe designs may be expensive (or even impossible) to correct at a later stage;
- To improve the awareness of road safe engineering principles by all involved in the process of planning, design, construction and maintenance of roads.



Road safety audit is “Safety Insurance” for a new road

Road safety audit
helps a project



How do we do a road safety audit?



How we do an audit – the key steps

Table 1: Key Steps in the Road Safety Audit Process

Road Safety Audit Step	Responsibility
1. Determine if an audit is needed.	Project manager
2. Select an audit team leader, who then engages the audit team.	Project manager and road safety audit team leader
3. Draft the pre-audit communication to provide information (drawings and design reports) about the project to the team leader, outlining the project and discuss the audit ahead.	Designer (via project manager) and road safety audit team leader
4. Assess the drawings for safety issues (the “desktop” audit).	Audit team
5. Inspect the site both during daytime and nighttime.	Audit team
6. Write the audit report and send to the project manager.	Team leader with assistance from audit team
7. Discuss the key safety issues and clarify outstanding matters during post-audit communication.	Project manager (plus designer) and road safety audit team leader
8. Write a response report, referring to each audit recommendation.	Project manager
9. Follow up and implement agreed changes.	Project manager (and designer)

Select audit team

Pre-audit communication

Desktop audit

Inspect site

Write audit report

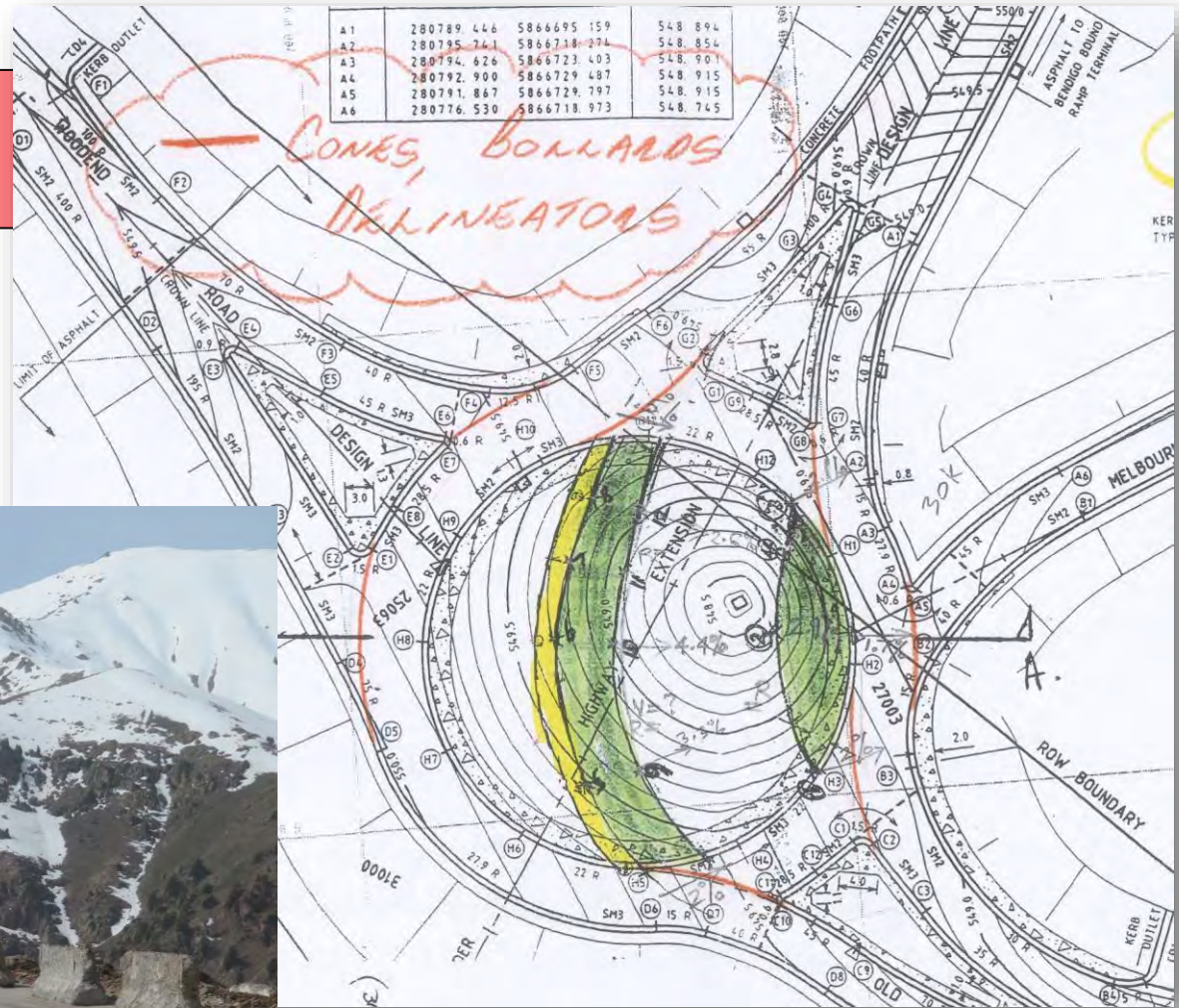
Post-audit communication

Respond to the report

Implement

Key audit steps....

Closely review drawings



Use checklists

Key audit steps.... inspect the site, day and night



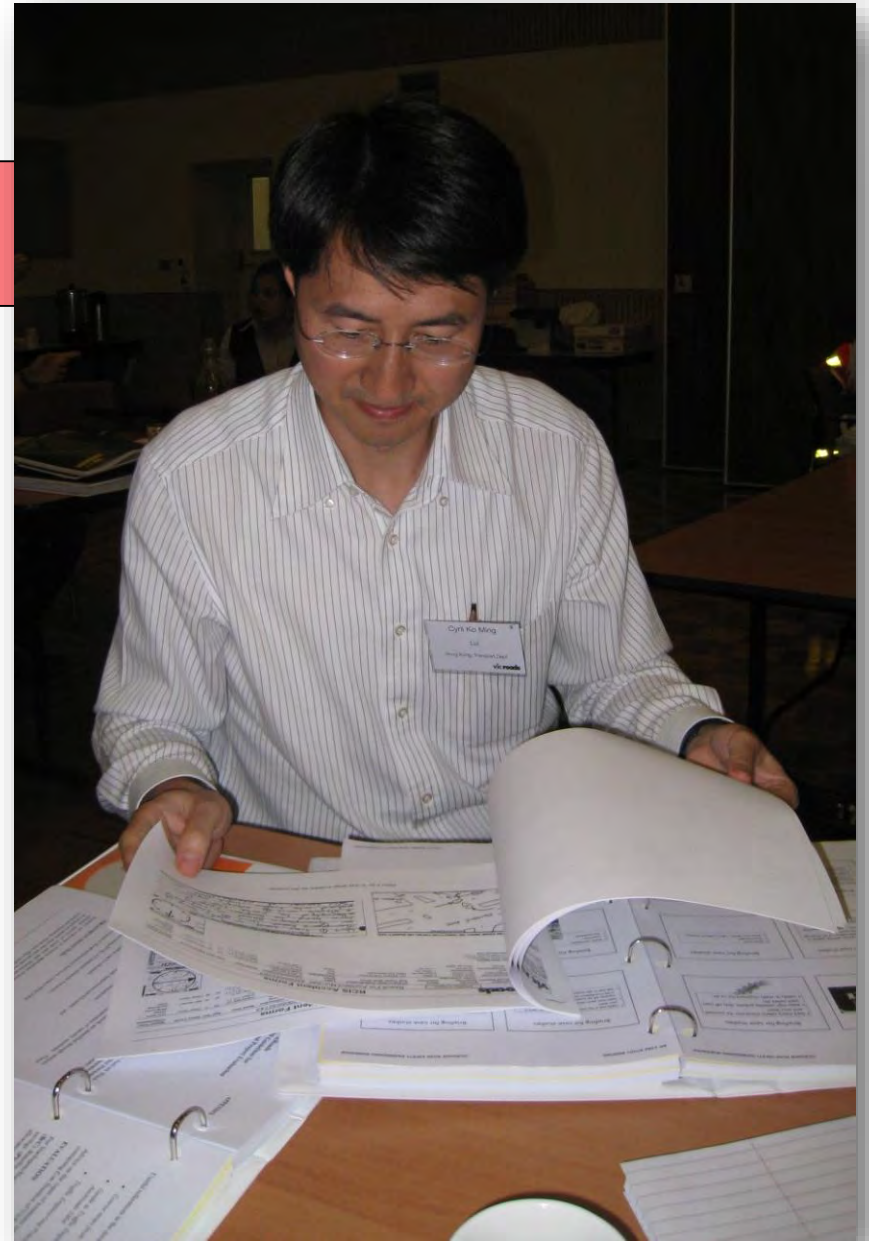
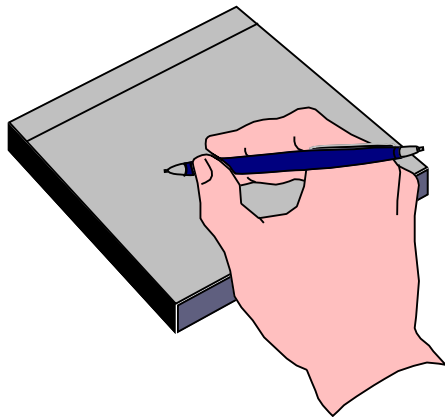
**Use checklists
to prompt....**

Key audit steps.... write the audit report



Key audit steps....

Respond to the audit report



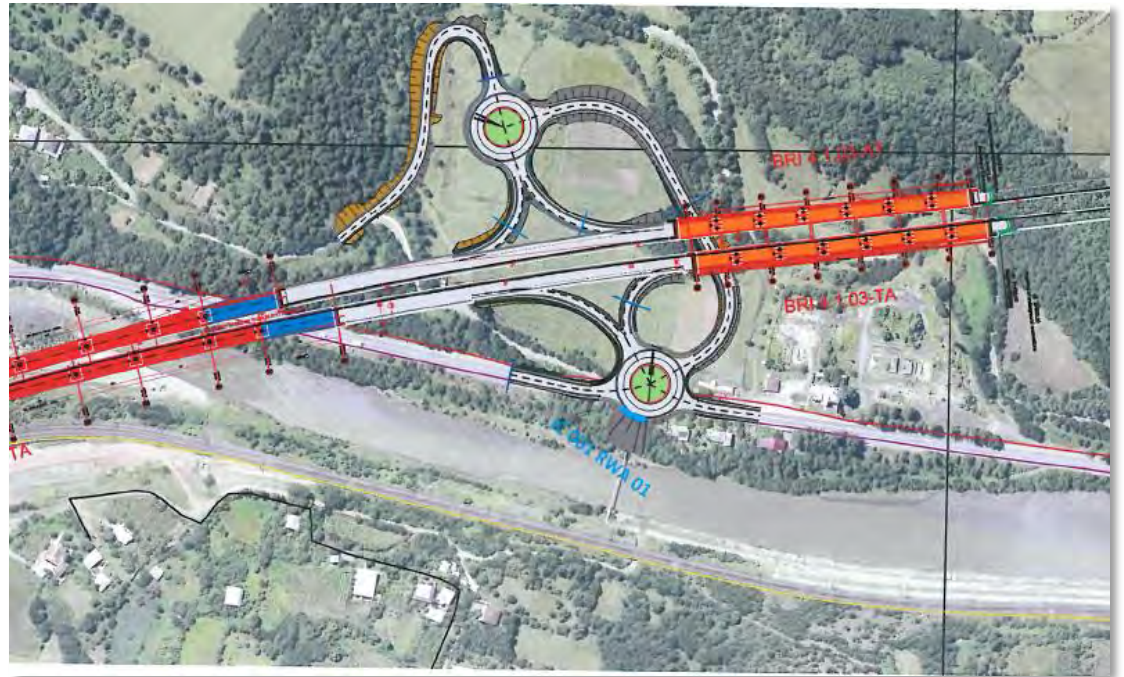
When do we do road safety audits?

There are six
agreed stages



The 6 international stages of road safety audit

- Planning
- Preliminary design
- Final design
- Traffic management
- Pre-opening
- Existing road (called inspections)



Existing road audits are called “inspections” – their overuse is not recommended as they.....

- lead to unfulfilled expectations if remedial work is not undertaken
- May cause misunderstandings with the benefits of design stage audits
- May cause confusion with crash investigations (blackspots)
- Should already be part of a good maintenance regime.



Road safety audit reports on safety issues - only!

What projects should be road safety audited?

All road projects – big
and small



What projects should we audit?

- Big road projects
- Small road projects
- Urban projects
- Rural projects
- Traffic management schemes
- Pedestrian projects
- Roadworks
- Any work that interacts with the road

Road safety audit is for big projects



Road safety audit is for small projects



Road safety audit is for rural projects



Road safety audit is for urban projects



Prevention is better than cure - Philip Jordan

Road safety audit is for urban projects



Road safety audit is for road works





Road safety audit is for bicycle projects



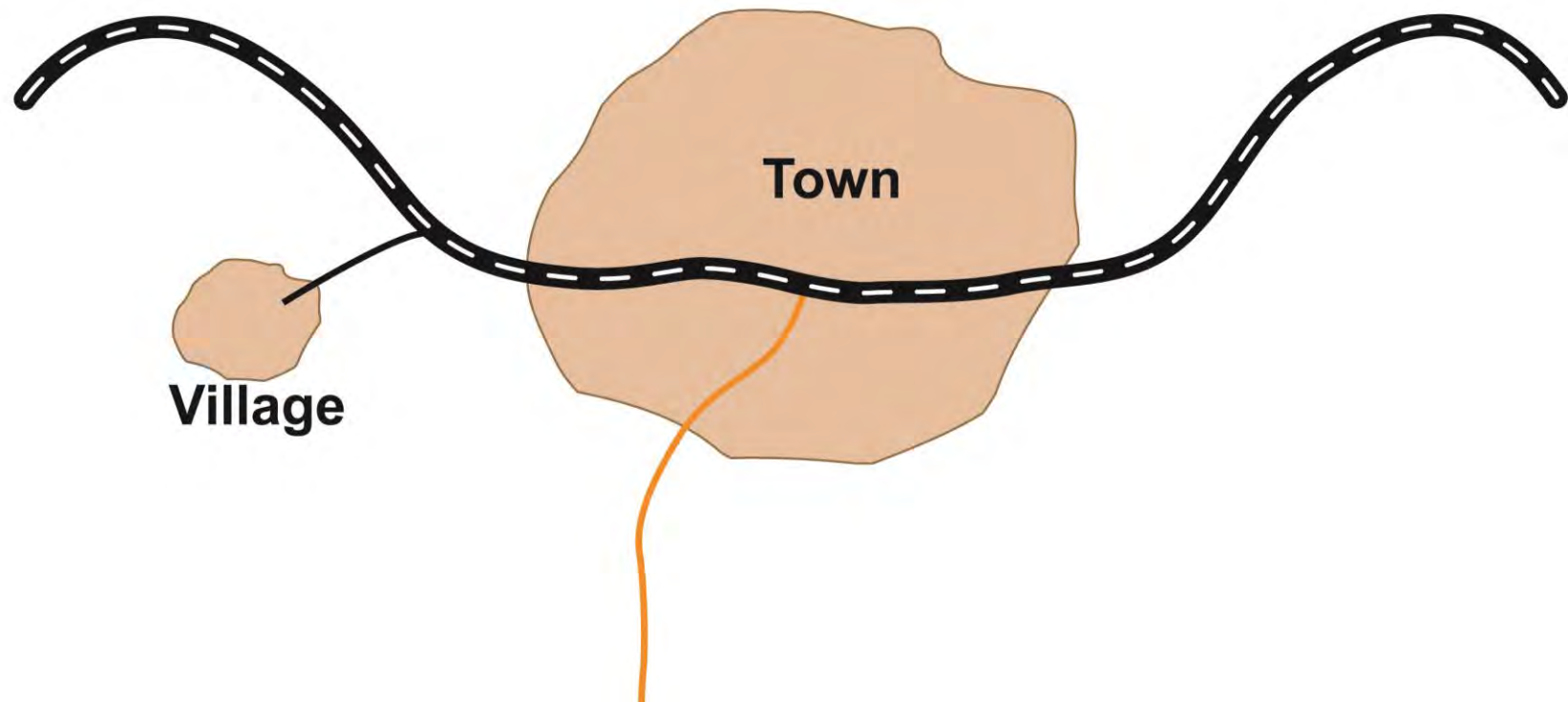
Road safety audit is for pedestrian projects

Prevention is
better than cure

Road Safety Audit

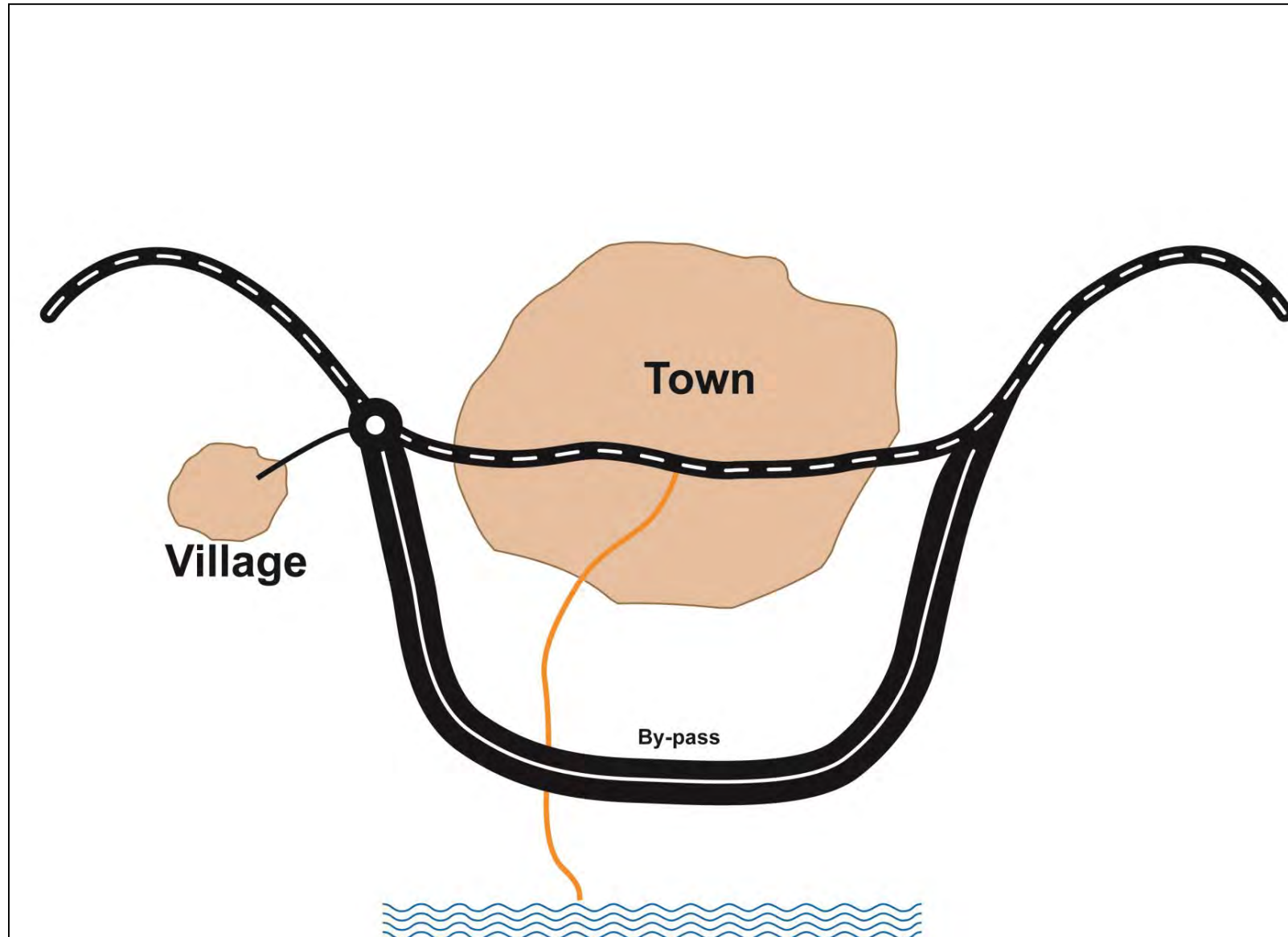
Planning stage audits consider.....

- **route choice**
- **design standards**
- **impacts on the adjacent road network**
- **intersection types....and much more**

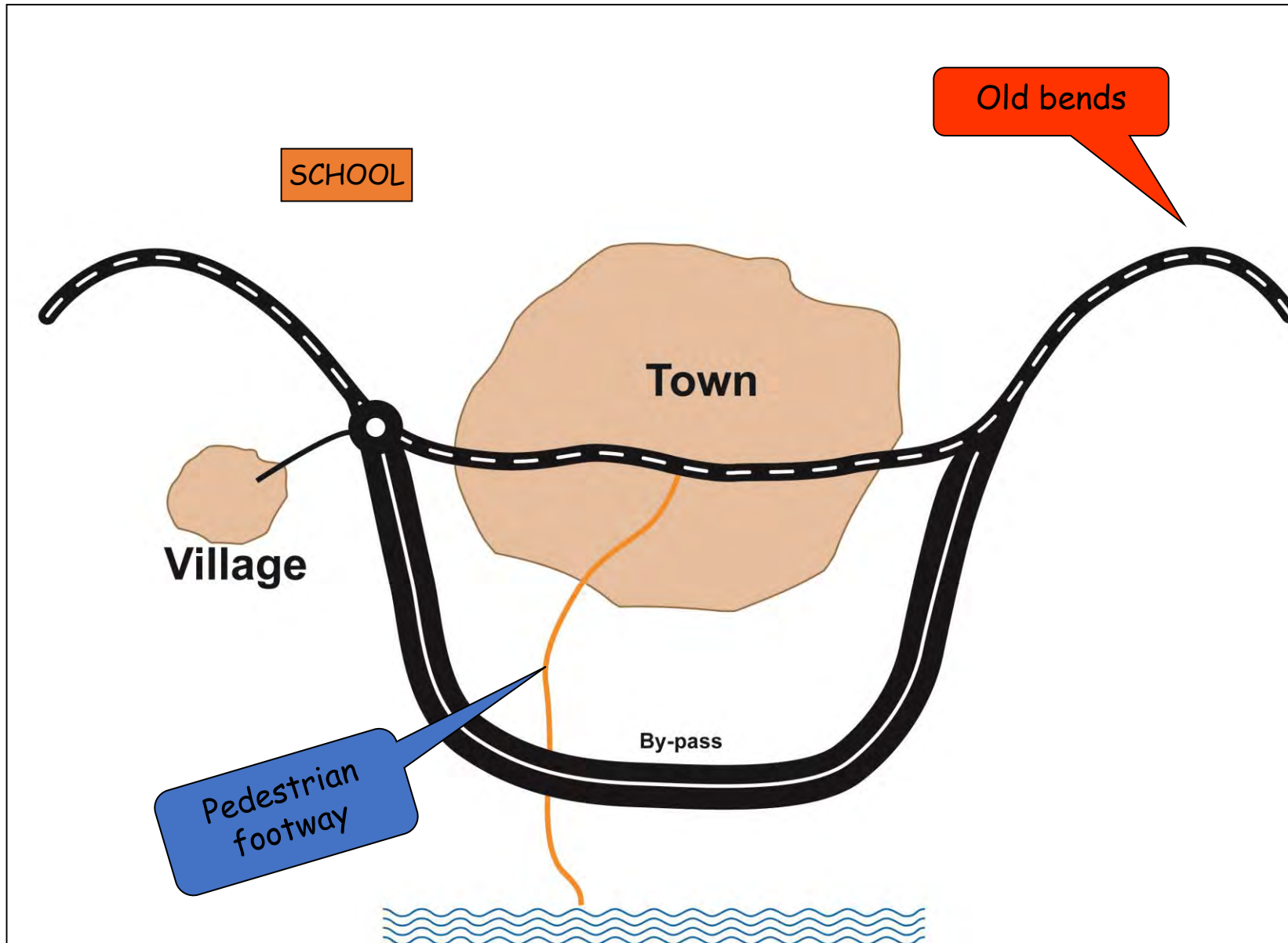


A town in the western part of your country has problems because of a busy highway. A By-Pass is proposed.....

The By-Pass will take through traffic away from the highway and the development. Of course it will be safer. Does it need to be audited?



An audit team looks at, and beyond, the proposed scheme

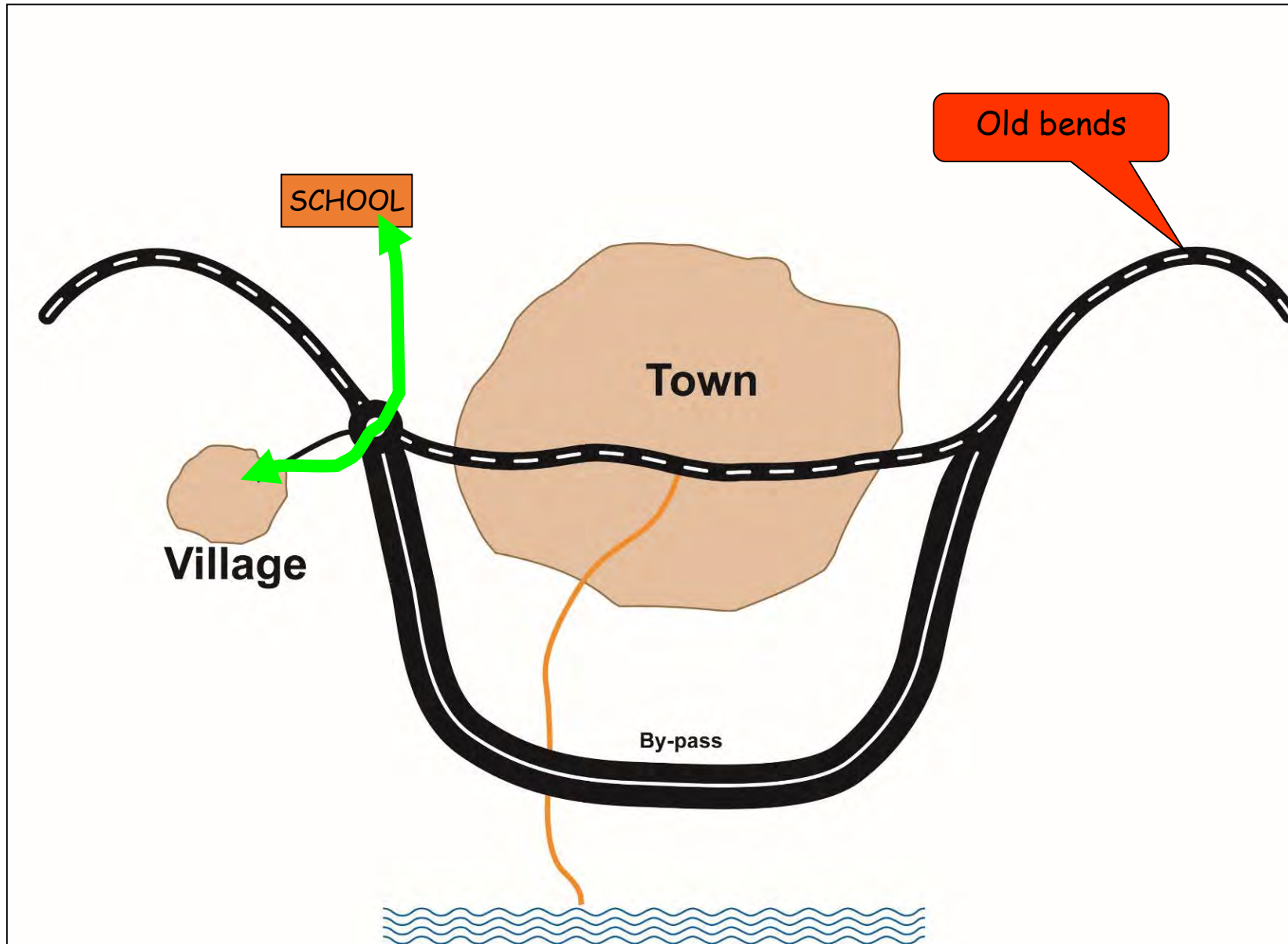




Old curves outside project

Prevention is better than cure

The audit team reports on:

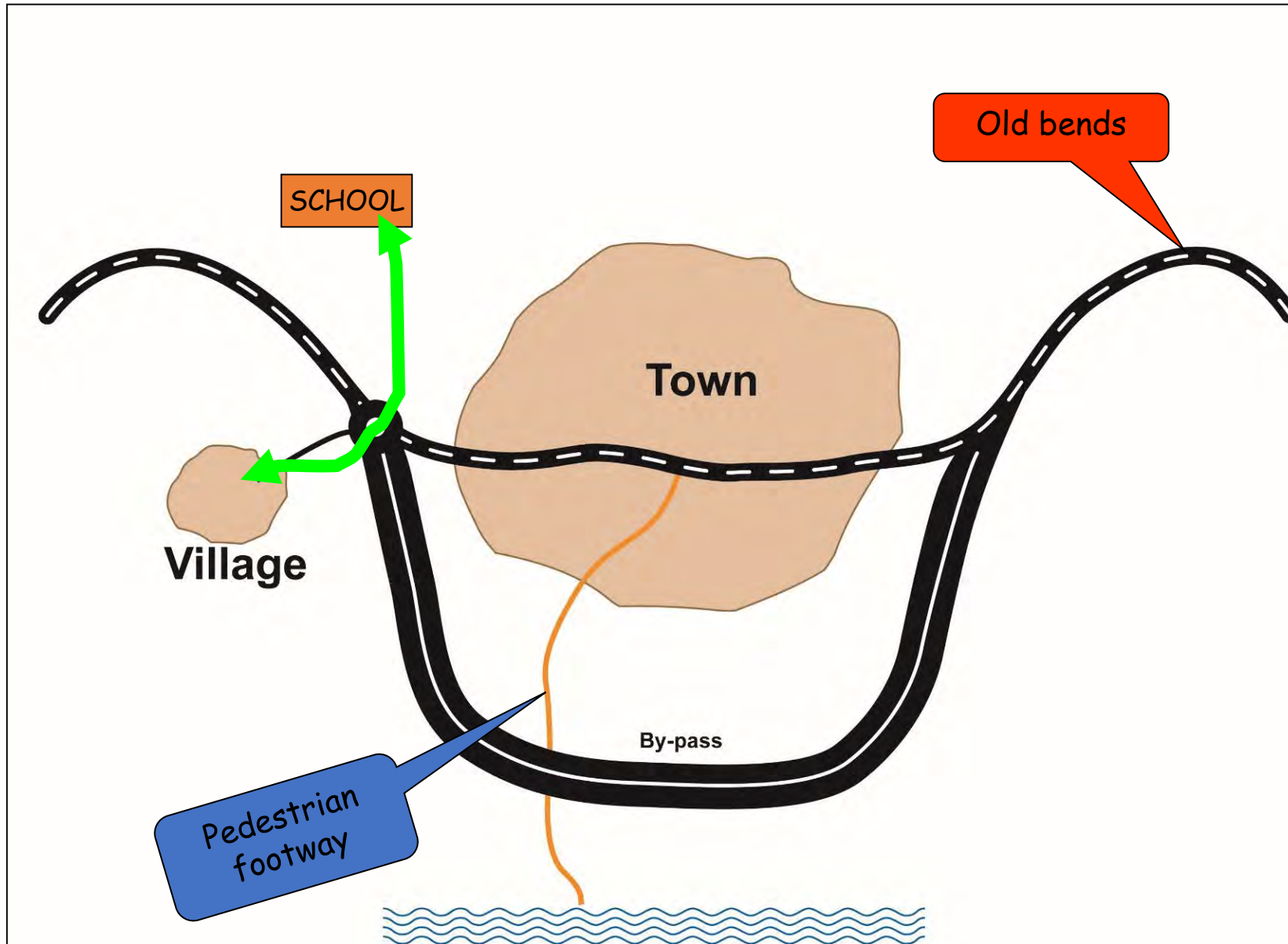




A similar existing roundabout in the same area – the proposed roundabout will look like this

Prevention is better than cure

The audit team reports on:





Prevention is better than cure

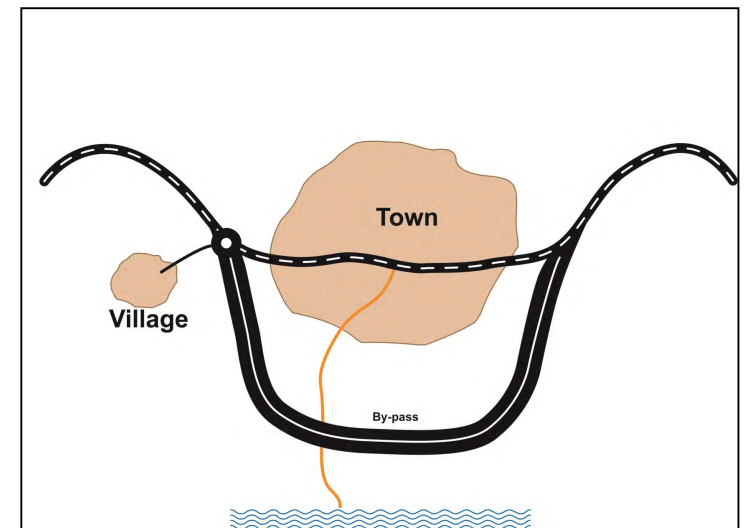
The audit team reports on the possible safety concerns of.....

Young pedestrians & cyclists at large roundabouts

Pedestrians attempting to cross the By-Pass

Higher speeds entering the old bends

The Project Manager is then required to respond to these safety concerns and to follow up with necessary improvements.....





Higher speeds entering the old bends

Prevention is better than cure

What should the Project Manager decide?

Children at proposed roundabout

- Difficult
- Offer options to the design team
- Maybe a Stop/Give Way cross road?
- The designers are responsible for deciding and submitting new drawings to Project Manager



What should the Project Manager decide?

Pedestrians crossing high speed road

- Difficult
- Offer options to the design team
- Overpass/underpass?
- Traffic signals?
- Break in median?
- Nothing!
- Not a zebra crossing!!!



Some people think road safety audit is a compliance check with standards.....

- What standards are involved in this example?
- None!
- Road safety audit is not a compliance check against standards

Preliminary design stage audits consider...

- geometrics
- alignments
- intersection layouts
- cross sections
- vulnerable road users.....and more

Preliminary design stage audit of the Parallels Road Section R881-2C



An audit team spent one day examining the drawings
It visited the site – daytime and night time
It then wrote the audit report

Initial findings:

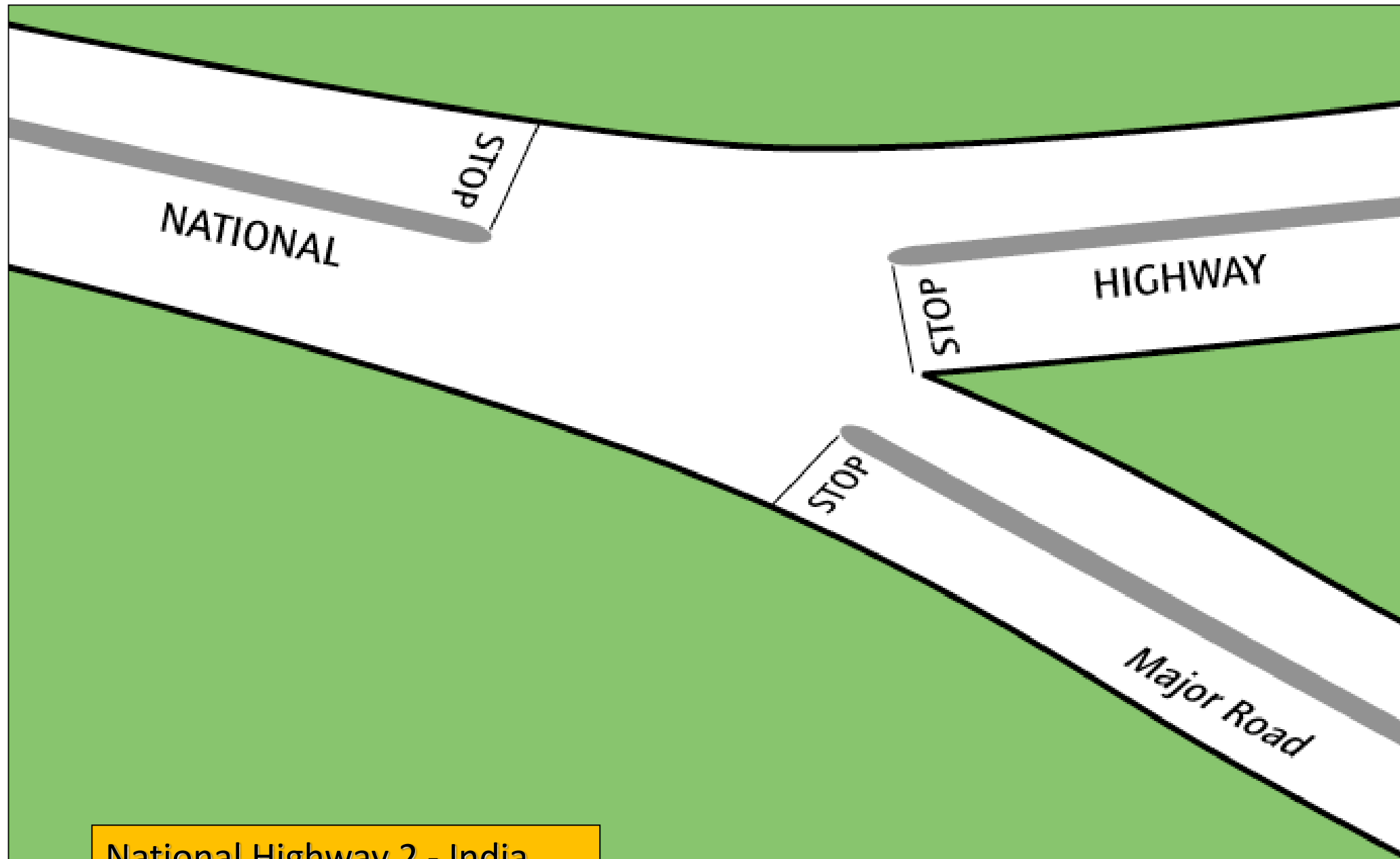
- Two trap lanes – one ending in a high speed short radius curve
- A potential “rat run” that will encourage traffic to avoid the signals - a planning stage issue
- Potential difficulties with direction signing at the final design stage



**Preliminary design stage
audit of the Parallels Road Section R881-2C**

Final design stage audits consider...

- clear zone issues
- signs/line marking
- crash protection
- traffic control
- geometric design
- lighting.....and more



National Highway 2 - India



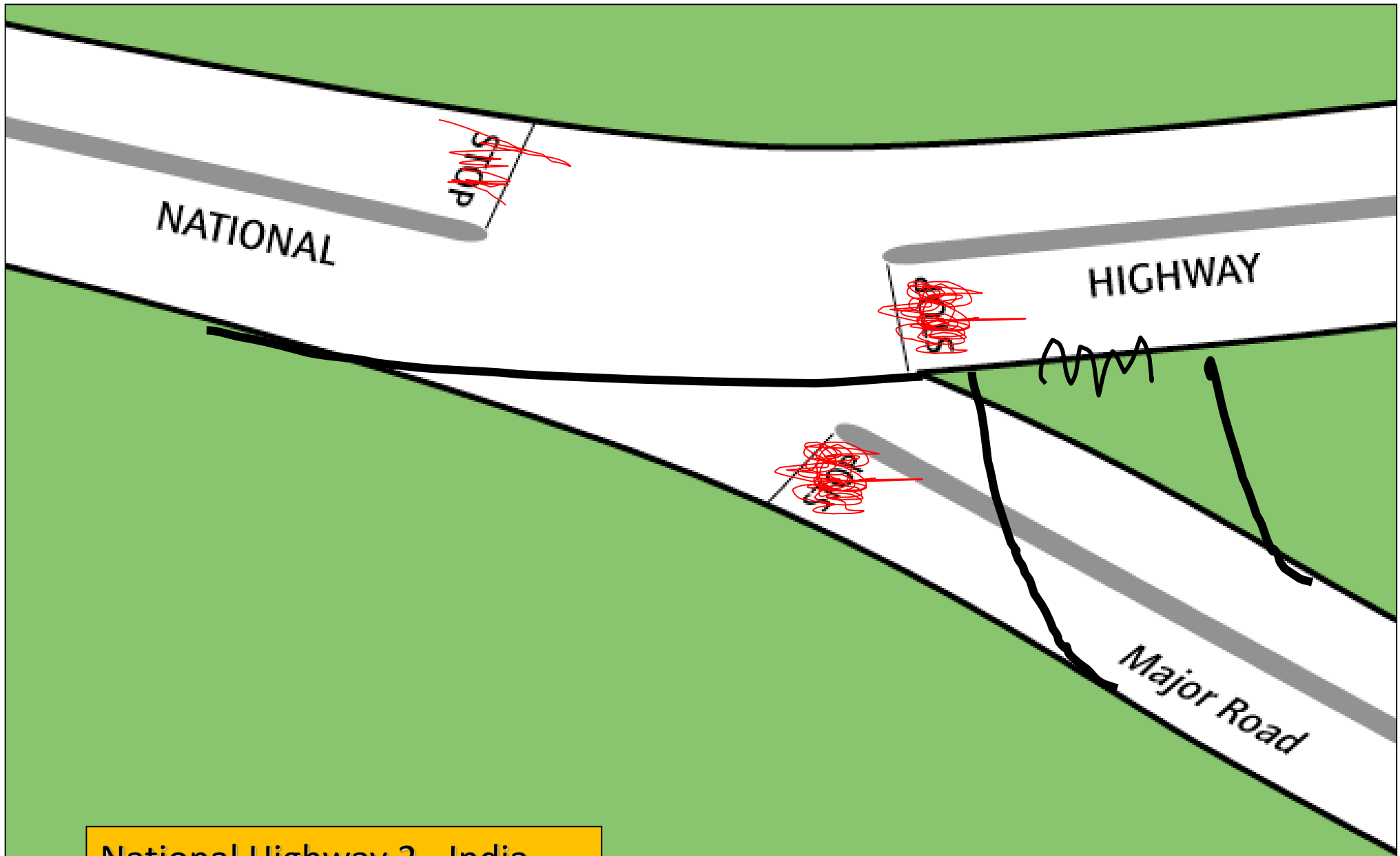
National Highway 2 - India

Prevention is better than cure

A Global Problem



Different roads, similar problems



National Highway 2 - India

Audits of traffic management of road works consider....

- crash protection at the work site
- delineation
- traffic control
- traffic management
- safety of workers
- signs, lightingand more



A sign is useless.....

Prevention is better than cure



... unless it can be seen !



Not enough advanced warning!

Think of this work site at night!





Traffic approaches at 130km/h.
Consider trucks at night!

Prevention is better than cure

Pre-opening audits consider....

- previous audit issues
- crash protection
- correctness of signs/markings
- the users viewand more



- Poles too close to road
- Poles in footpath
- Crash barrier issues
- Geometric issues
- Incorrect signs

Pre opening audit in
Melbourne



Pre opening audit



Pre opening audit



Pre opening audit - India



A footpath may be a standard treatment but in this case is unnecessary and is a hazard



Audits of existing roads consider.....



..all issues relevant to the crash potential of the road...

Pre/post- opening audit

57 km of newly duplicated highway.
Opened to traffic December 2015.
8 fatalities in first 6 months of 2016.
6 of these were pedestrians!



- High traffic speeds through villages (high risks for pedestrians).
- Geometric and traffic control issues (intersections and U-turns).
- Cattle and livestock.
- Variations in cross sectional (particularly the width of paved shoulders).
- Roadside hazards (including barriers, concrete barricades, lighting columns, bridges, open drains and culverts).

Pre/post-opening stage audit



Pre/post-opening stage audit



Pre/post-opening stage audit



???

Pre/post-opening stage audit



Pre/post-opening stage audit



Pre/post-opening stage audit



Pre/post-opening stage audit



Pre/post-opening stage audit



Pre/post-opening stage audit





Audits of existing roads (road safety inspections) consider all issues relevant to the crash potential of the road...



Confusing, unsafe - but low cost to rectify











If an existing road audit identifies a *potential* safety issue, how can the road manager justify spending money to rectify it, while there are “black spots” (with proven crash records) waiting for funds ?

But audits of existing roads....

- Can be useful in countries (like some African, Central and SE Asian and Middle Eastern countries) with incomplete crash data.
- It can guide engineers to high risk locations for improvement.

But remember, too many audits of existing roads may.....

- lead to unfulfilled expectations
- cause a misunderstanding of the benefits of design stage audits
- cause confusion with crash investigations



Road safety audit is a positive process



Road safety audit -the earlier, better - safer, cheaper



Road safety audit..... may be the only time that road safety is explicitly considered in a project

The costs and the benefits of road safety audit

- **Road safety audits are a small part of the design cost...**

Road safety audits are a small part of the design cost...

- 1-2% of total design costs
- Well under 0.5% of total project costs

The costs and the benefits of road safety audit

- **Surrey County Council**
 - 19 audited sites were compared with 19 non-audited sites
 - 2+ years of crash data were compared
 - Audited sites had a casualty saving of 1.25 pa
 - Non-audited sites had a casualty saving of just 0.25

The costs and the benefits of road safety audit

- **UK Highways Agency**
 - **TRL examined 22 audited sites on trunk roads**
 - **The costs of implementing the audit recommendations were compared with the costs of rectifying the sites after the project was constructed**
 - **Average saving per site of £11,373**

The costs and the benefits of road safety audit

▪ Jordan

- 9 sites that had been constructed in the past decade (not audited) and had become safety problem sites
- It was assumed that, if the sites had been audited, they would not have required improvements later
- First year rate of return of 120%

The costs and the benefits of road safety audit

▪ Denmark

- Assessed 13 schemes that had been audited during the design phase
- An evaluation panel conducted cost benefit analyses of these safety audits
- a general crash prediction method was used
- First year rate of return of 146%

The costs and the benefits of road safety audit

- **AUSTROADS**

- Design audits had benefit cost ratios ranging from 3:1 up to 242:1
- Existing road audits had benefit cost ratios ranging from 2.4:1 up to 84:1

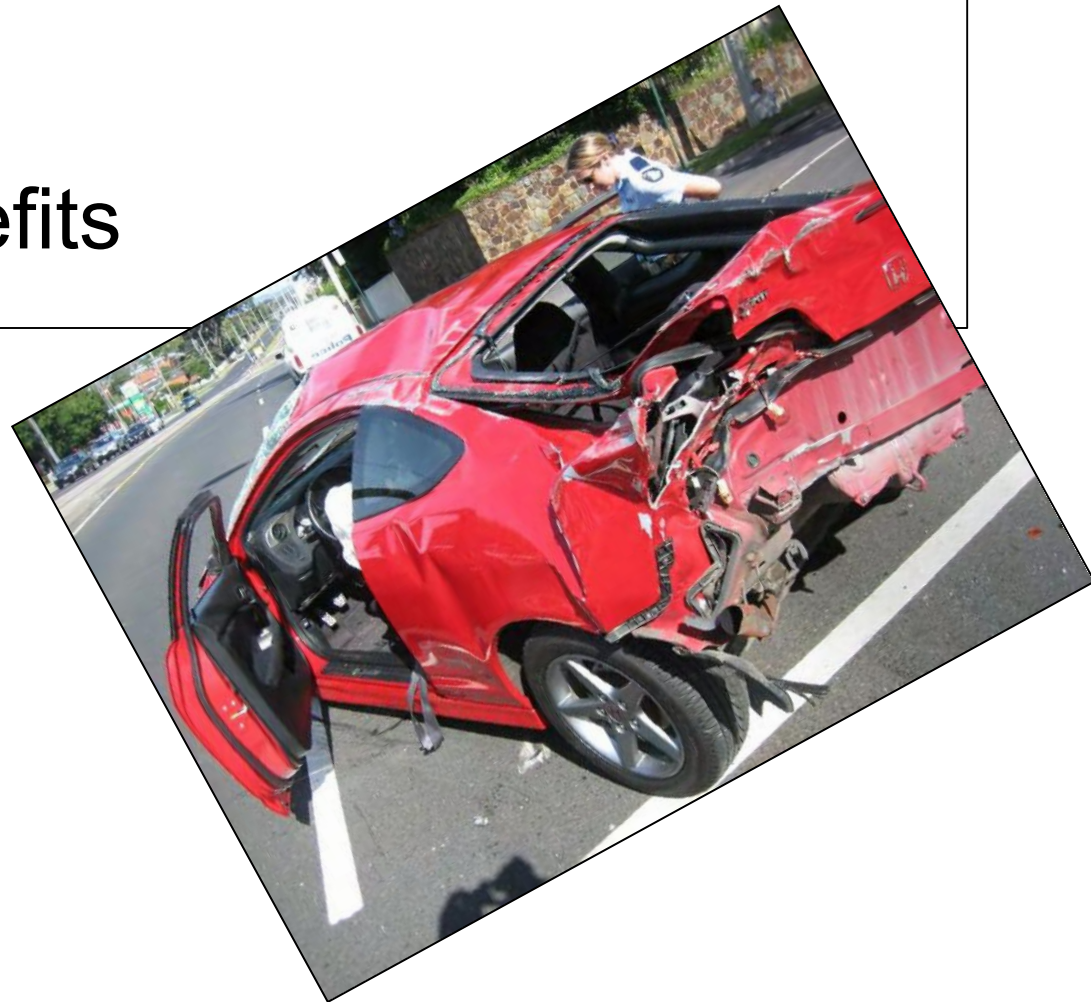
One road crash fatality in CAREC costs \$\$??



The costs and the benefits of road safety audit

In summary:

- Audits are low cost.
- Audits are high benefits



CONCLUSION

Road safety across CAREC will benefit from road safety audit for a number of reasons.....

- experience elsewhere has shown that the optimum road safety outcome is not achieved solely by compliance with standards
- road safety audit will provides some “protection” against total reliance on standards
- road safety audit is a low cost process - with demonstrated high benefits

- It is a “transparent” process – open for all to see and ask questions about
- it demonstrates professional responsibility in road safety engineering
- It is attractive - bureaucratically as well as politically

- There are growing concerns about road safety in CAREC now. That will increase.
- You have several large road projects underway.
- You want to “get it right the first time”
- Who wants to build a blackspot?

What projects for your country?

SUGGESTED RSA POLICY

“All road projects will be road safety audited at the following stages according to the class of road, in accordance with the procedures contained in the CAREC Road Safety Audit manual”

What projects for your country?

AUDIT	EXPRESSWAYS & INTERNATIONAL HIGHWAYS	NATIONAL HIGHWAYS	MAJOR ROADS (URBAN/RURAL)	LOCAL STREETS & VILLAGE ROADS
FEASIBILITY	√	Optional	Optional	N/A
PRELIMINARY DESIGN	√	Optional	Optional	N/A
DETAILED DESIGN	√	√	√	√
ROAD WORKS	√	Optional	Optional	Optional
PRE-OPENING	√	√	√	√
SAFETY REVIEWS OF EXISTING ROADS	ACCORDING TO LOCAL POLICY AND RESOURCES			
NO. OF AUDITS	5	Minimum 2	Minimum 2	Minimum 2

I wish you well for this important road safety process, and I look forward to your questions

Prevention is better than cure.