Introduction to Road Safety

Audit: Approach and Methodology

by

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PRESENTATION OUTLINE

✓ Back Ground on National Road Crash Scene AND ITS Comparison with China
✓ Evolution of the Philosophy of Safe Roads
✓ Road Safety Audit Process and Stages
✓ Summary and Inferences
## Increasing Trend of Road Deaths in India

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Deaths</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000</td>
<td>78,911</td>
</tr>
<tr>
<td>2001</td>
<td>80,888</td>
</tr>
<tr>
<td>2002</td>
<td>84,674</td>
</tr>
<tr>
<td>2003</td>
<td>85,998</td>
</tr>
<tr>
<td>2004</td>
<td>92,618</td>
</tr>
<tr>
<td>2005</td>
<td>94,968</td>
</tr>
<tr>
<td>2006</td>
<td>105,749</td>
</tr>
<tr>
<td>2007</td>
<td>114,444</td>
</tr>
<tr>
<td>2008</td>
<td>119,860</td>
</tr>
<tr>
<td>2009</td>
<td>126,896</td>
</tr>
<tr>
<td>2010</td>
<td>133,938</td>
</tr>
<tr>
<td>2011</td>
<td>142,485</td>
</tr>
<tr>
<td>2012</td>
<td>139,091</td>
</tr>
<tr>
<td>2013</td>
<td>1,37,900</td>
</tr>
<tr>
<td>2014</td>
<td>1,41,523</td>
</tr>
</tbody>
</table>
A COMPARATIVE DATA ON ROAD ACCIDENT FATALITIES BETWEEN INDIA AND CHINA

<table>
<thead>
<tr>
<th>Year</th>
<th>India</th>
<th>China</th>
</tr>
</thead>
<tbody>
<tr>
<td>2008</td>
<td>118239</td>
<td>73484</td>
</tr>
<tr>
<td>2009</td>
<td>126896</td>
<td>67759</td>
</tr>
<tr>
<td>2010</td>
<td>133938</td>
<td>65225</td>
</tr>
<tr>
<td>2011</td>
<td>136834</td>
<td>62387</td>
</tr>
<tr>
<td>2012</td>
<td>139091</td>
<td>59997</td>
</tr>
</tbody>
</table>

Share of Urban and Rural (India)

<table>
<thead>
<tr>
<th>Type of Motor Vehicle</th>
<th>% share</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pedestrians</td>
<td>13.20</td>
</tr>
<tr>
<td>Two Wheelers</td>
<td>21.10</td>
</tr>
<tr>
<td>Car, Taxis etc.</td>
<td>13.20</td>
</tr>
<tr>
<td>Buses</td>
<td>7.20</td>
</tr>
<tr>
<td>Bicycles</td>
<td>5.90</td>
</tr>
<tr>
<td>Auto Rickshaws</td>
<td>6.30</td>
</tr>
<tr>
<td>Trucks</td>
<td>11.30</td>
</tr>
<tr>
<td>Other Motor Vehicles</td>
<td>8.80</td>
</tr>
<tr>
<td>Non-motorized vehicles &amp;</td>
<td>13.00</td>
</tr>
<tr>
<td>other objects</td>
<td></td>
</tr>
</tbody>
</table>

Overall Share of victims from Vulnerable Road User (VRU) category - 60% at Pan India Level
Fatalities by road user type, *Delhi*

**Share of VRUs at City Level - 86%**

- Pedestrian: 47%
- Bicycle: 10%
- Two Wheeler: 26%
- Three Wheeler: 3%
- Car: 3%
- Bus: 4%
- Truck: 3%
- Other Motorized Vehicle: 1%
- Other Non-motorized Vehicle: 3%
Road Crashes / Fatalities / Injuries in Urban and Rural Areas

<table>
<thead>
<tr>
<th></th>
<th>Urban Area</th>
<th>Rural Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Accidents</td>
<td>46.3%</td>
<td>53.7%</td>
</tr>
<tr>
<td>Fatalities</td>
<td>59.4%</td>
<td>42.0%</td>
</tr>
<tr>
<td>Injuries</td>
<td>58.0%</td>
<td>42.0%</td>
</tr>
</tbody>
</table>

(Source: Road Accidents In India 2014, Ministry Of Road Transport & Highways Transport Research Wing)
Major Causative factors for Fatalities

(Source: Road Accidents In India 2014, Ministry Of Road Transport & Highways Transport Research Wing)
States with high fatalities

(Source: Road Accidents In India 2014, Ministry Of Road Transport & Highways Transport Research Wing)
# Indications from Available Data

- Growth of fatalities much higher than crashes
- Fatalities in roads in rural area is about 1.5 times than urban
- Developed and underdeveloped states have high fatalities
- > 50% victims are of productive group
- National and State Highways account for > 60% of accidents
- Intersections account for about 57% of fatalities
- Drivers fault is cause of accidents (?)
- Accident trend in India much higher than other countries

- High speeds but unsafe roads
- Unsafe rural highways
- No attention to road safety irrespective of development
- Avoidable economic loss to nation
- More attention for safe infrastructure for NHs and SHs
- More attention to intersections
- Safe infrastructure to account for human failings and shortcomings
- Immediate dedicated efforts are needed
International Road Assessment Programme (iRAP) Report in April 2012 for Andhra Pradesh, Assam, Gujarat and Karnataka

3000 km roads (2-lane, single carriageway rural network) surveyed and assessed for system of star ratings

- 5 star rating is safest and 1 star is least safe
- None of the network achieved a 5-star rating and only 11% achieved a 4-star rating for vehicle occupants and motorcyclists.
Complexities to be Tackled

Implementation of successful road safety models from the developed countries hinges on:

- Proper regulatory framework with necessary laws / legislations
- Obtaining adequate political priority for organizational reform and enactments of laws
**Basic Requirement for Safe Road Environment**

- **Road Infrastructure Systems** designed from historical knowledge from similar road environments
- **Safe Road Infrastructure Design**
- Continual monitoring of road operational and safety conditions
Road Safety can be enhanced by Highway Engineers at all the various stages of a project as follows:

1. Planning Stage
2. Design Stage
3. Construction Stage
4. Maintenance and Operation Stage
Safety in Planning Stage

- **Through Land Use Control**
- **Providing Bypasses for congested towns and linking them by Spurs**
- **Creating self contained zones to avoid non essential traffic in the neighborhood**
Safety in Design Stage

- Designing “self-explaining roads” and “forgiving roadside” by selecting the most desirable design standards (and NOT the minimum standards) involving:
  - Design Speed
  - Horizontal and Vertical Geometry
  - Cross-sectional elements,
  - Design of at-grade and grade separated junctions,
  - Provision of service roads for segregation of slow and fast traffic,
  - Designing effective road furniture viz. Guard Rails, Traffic signage, roadside illumination provisions etc.
Safety in Construction Stage (shall strictly conform IRC:SP-55 [2013])

- Proper Separation of the construction zone through effective barricading
- Construction of proper traffic diversions
- Provision of Road Signage
- Environmental controls including dust, noise and air pollution
Safety in Maintenance and Operation Stage

Providing an Automated Traffic Management System (ATMS) for safe operation of traffic and Incident Management. This may include providing:

- Dissemination of Traffic Information Through Variable Message Signs (VMS),
- Weigh-in-Motion (WIM) System and
- Establishment of Central Control Room for Traffic Surveillance for the high density road corridors to start with
## Design for Safety

<table>
<thead>
<tr>
<th>Design/Planning Element</th>
<th>Undesirable</th>
<th>Desirable</th>
<th>Principle to be Applied</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alignment Selection and Land Use</td>
<td><img src="image1.png" alt="Undesirable Alignment" /></td>
<td><img src="image2.png" alt="Desirable Alignment" /></td>
<td>Major Arterials and Expressways should bypass major towns which should be connected by Spurs. There should be clear zones identified for linear land use control.</td>
</tr>
<tr>
<td>Horizontal Geometry</td>
<td><img src="image3.png" alt="Undesirable Geometry" /></td>
<td><img src="image4.png" alt="Desirable Geometry" /></td>
<td>Consistency of horizontal geometry avoiding monotonous straight lines or abrupt change of speed.</td>
</tr>
</tbody>
</table>
### Design for Safety (Contd...)  

<table>
<thead>
<tr>
<th>Design/Planning Element</th>
<th>Undesirable</th>
<th>Desirable</th>
<th>Principle to be Applied</th>
</tr>
</thead>
<tbody>
<tr>
<td>Horizontal Geometry</td>
<td><img src="#" alt="Undesirable" /></td>
<td><img src="#" alt="Desirable" /></td>
<td>Adequate offset distance from natural road side features.</td>
</tr>
<tr>
<td>Vertical Geometry</td>
<td><img src="#" alt="Undesirable" /></td>
<td><img src="#" alt="Desirable" /></td>
<td>Undivided Carriageways designed desirably for Overtaking Sight Distance (OSD)</td>
</tr>
</tbody>
</table>
### Design for Safety (Contd…)

<table>
<thead>
<tr>
<th>Design/Planning Element</th>
<th>Undesirable</th>
<th>Desirable</th>
<th>Principle to be Applied</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cross-sectional Elements</strong></td>
<td><img src="image1" alt="Undesirable Cross-sectional Elements" /></td>
<td><img src="image2" alt="Desirable Cross-sectional Elements" /></td>
<td>Wider Lane widths and shoulders for high speed roads especially expressways.</td>
</tr>
<tr>
<td><strong>Cross-sectional Elements</strong></td>
<td><img src="image3" alt="Undesirable Cross-sectional Elements" /></td>
<td><img src="image4" alt="Desirable Cross-sectional Elements" /></td>
<td>Inside widening for sharp curves</td>
</tr>
<tr>
<td>Design/Planning Element</td>
<td>Undesirable</td>
<td>Desirable</td>
<td>Principle to be Applied</td>
</tr>
<tr>
<td>-------------------------</td>
<td>-------------</td>
<td>-----------</td>
<td>------------------------</td>
</tr>
<tr>
<td>Cross-sectional Elements</td>
<td><img src="image1.png" alt="Undesirable" /></td>
<td><img src="image2.png" alt="Desirable" /></td>
<td>Wider depressed median for high speed roads to prevent glare and jumping of vehicles</td>
</tr>
<tr>
<td>Cross-sectional Elements</td>
<td><img src="image3.png" alt="Undesirable" /></td>
<td><img src="image4.png" alt="Desirable" /></td>
<td>Recoverable slopes for out of control vehicles</td>
</tr>
<tr>
<td>Design/Planning Element</td>
<td>Undesirable</td>
<td>Desirable</td>
<td>Principle to be Applied</td>
</tr>
<tr>
<td>-------------------------</td>
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<td>-----------</td>
<td>-------------------------</td>
</tr>
<tr>
<td>Cross-sectional Elements</td>
<td><img src="image1" alt="Undesirable" /></td>
<td><img src="image2" alt="Desirable" /></td>
<td>Separate slow moving non–motorized traffic (cycles, rickshaw etc) from fast moving traffic</td>
</tr>
<tr>
<td>Entry/Exit</td>
<td><img src="image3" alt="Undesirable" /></td>
<td><img src="image4" alt="Desirable" /></td>
<td>Entry Exit only through slip lanes with proper acceleration and deceleration lanes</td>
</tr>
</tbody>
</table>
# Design for Safety (Contd...)

<table>
<thead>
<tr>
<th>Design/Planning Element</th>
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<th>Desirable</th>
<th>Principle to be Applied</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Passenger Transit</strong></td>
<td><img src="image1.png" alt="Undesirable Diagram" /></td>
<td><img src="image2.png" alt="Desirable Diagram" /></td>
<td>Separate Lay bye for buses and taxis to avoid restriction and improve visibility</td>
</tr>
<tr>
<td><strong>Junction Design</strong></td>
<td><img src="image3.png" alt="Undesirable Diagram" /></td>
<td><img src="image4.png" alt="Desirable Diagram" /></td>
<td>Channelization, provision of stacking lanes, adequate turning radii</td>
</tr>
</tbody>
</table>
## Design for Safety (Contd…)

<table>
<thead>
<tr>
<th>Design/Planning Element</th>
<th>Undesirable</th>
<th>Desirable</th>
<th>Principle to be Applied</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pedestrian Facilities in Urban Areas</td>
<td><img src="image1.png" alt="Undesirable Pedestrian Facilities" /></td>
<td><img src="image2.png" alt="Desirable Pedestrian Facilities" /></td>
<td>Provision of Raised Footpath for pedestrians in Urban Areas</td>
</tr>
<tr>
<td>Facilities for differently abled</td>
<td><img src="image3.png" alt="Facilities for differently abled" /></td>
<td><img src="image4.png" alt="Facilities for differently abled" /></td>
<td>Footpath merging in a slope with a cross street, bus bays flushed with foot boards etc.</td>
</tr>
<tr>
<td>Design/Planning Element</td>
<td>Undesirable</td>
<td>Desirable</td>
<td>Principle to be Applied</td>
</tr>
<tr>
<td>-------------------------</td>
<td>-------------</td>
<td>-----------</td>
<td>-------------------------</td>
</tr>
<tr>
<td>Barriers</td>
<td><img src="image1.png" alt="Non-standard Hump" /></td>
<td><img src="image2.png" alt="Standard Hump" /></td>
<td>Barriers should be designed to deflect the vehicle and not crash it.</td>
</tr>
<tr>
<td>Road Signs</td>
<td><img src="image3.png" alt="Non-standard Signs" /></td>
<td><img src="image4.png" alt="Standard Signs" /></td>
<td>The road signs should be standardized throughout the country and need for Spacing between successive Signs</td>
</tr>
<tr>
<td>Traffic Calming</td>
<td><img src="image5.png" alt="Non-standard Hump" /></td>
<td><img src="image6.png" alt="Standard Hump" /></td>
<td>Properly designed traffic calming devices like speed humps, rumble strips, Chicaning etc. as per IRC-67 (2012)</td>
</tr>
</tbody>
</table>
Good Practice of Safe Design

Mild Side Slope (Forgiving Roadside Treatment)

Recovery Zone (Hard Shoulder)
Good Practice of Safe Design (Contd...)

Road Side Feature (Protected with W-Beam Crash Barriers)

Bevelled End of a concrete culvert (Safer Design)
Good Practice of Safe Design (Contd...)
Good Practice of Safe Design (Contd...)
Good Practice of Safe Design (Contd...)
Good Practice of Safe Design (Contd...)

Safer Road Design:
Speed Limit
Painted on the Micro Bitumen Asphalt

Safer road design:
Speed Calming Measures
Key Stakeholders

Roads Authority

Planning

Design

Construction

Maintenance

Key Functions

Road Safety Cell

RSA

Identify Hazardous Locations

Development Control

Safety Campaigning Design

Axle Load Control

Police

Planning

Public

Transport
Negligence by Designers
Negligence by Designers (Contd...)

Safety Issues: The junction was originally proposed as left-in/left-out, but later-on median opening given under some compulsion. This will cause high speed movement from NH to side road.

Suggestions: Layout shown above will compel turning traffic to turn at lower speed and also the side road has been aligned perpendicular to NH. These techniques would have great impact on safety of junction, which can be accomplished without any more land acquisition.
Negligence by Designers (Contd...)

SH 21 - Nayagarh
Negligence by Designers (Contd...)
NH 49, Sambalpur
Negligence by Designers (Contd...)

Putting in speed breakers or rumble strips as quick fix solutions!
Placing signs that may look good but achieve little
Wrong installation of W-Beam Crash Barriers (too high, overlapped wrong way, posts facing wrong way)
History of RSA

Traffic engineers in U.K. developed the idea of RSA as a safety check for new and improved road projects and schemes in the early 1980’s. Countries like Australia, Denmark, New Zealand, Canada, France, Greece, Hong Kong, Iceland, Ireland, Italy, Malaysia, Netherlands, Perm, Singapore, U.S. etc. have developed RSA.
International Progress With Road Safety Audit ..... 

There is strong support for audit in several Canadian provinces, and several US states have carried out pilot audits. Interest is growing rapidly.

The USA is learning from Canada and others
Audit guidelines have been developed for Nepal, and Bangladesh by consultants working for the World Bank, Eritrea soon Vietnam and China have had road safety audits carried out by ADB and World Bank consultants.

Thailand has had a national seminar on RSA plus training courses
International Progress With Road Safety Audit

ITE, PIARC, TRB and AUSTROADS all have committees addressing RSA issues.

In summary – road safety audit is progressing rapidly around the globe, in ways which best suit each country.
Road Safety Audit Is a Positive Process

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

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

Road safety audits are a small part of the design cost 1-2% of total design costs

Road safety audits offer great benefits … First year Rate of Return of 120% if audit recommendations had been followed

(Jordan study 1998)
Road safety audits offer great benefits ...First Year Rate of Return of 146% due to audit recommendations being implemented

(Denmark study 1995)

Very healthy BCR 36:1 for design stage
6:1 for existing roads

(AUSTROADS study 2001)
ROAD SAFETY AUDIT IS:

1. Minimizing the likelihood of crashes occurring through safety-conscious planning and design;
2. Ensuring that, if a crash occurs, then the likelihood of the injury is minimized (such as provision of anti-skid surfacing and crash barriers);
3. Ensuring that safety related design criteria (e.g. critical sight distances) have been met;
4. Managing risks, such that the risk of major safety problems occurring is less than the risk of minor problems occurring;
5. Reducing the whole-life cycle costs of a design (unsatisfactory designs are expensive to correct after they are built);
6. Minimizing the risk of crashes on the adjacent road network (particularly at intersections) as well as on the new road scheme;
7. Enhancing the importance and relevance of road safety engineering in highway design work and to enhance consideration of the safety of all road users in all new and existing.
Road Safety Audit is Not

1. A way of assessing or rating a project as good or poor;
2. A means of ranking or justifying one project against others in a works programme;
3. A way of rating one option against another;
4. A check of compliance with technical/design standards;
5. An accident investigation;
6. A redesign of a project;
7. It is not a check on the designer’s competence
8. It is not a technical audit
9. Something to be applied only to high cost projects or only to projects involving safety problems;
10. The name you use to describe informal checks, inspections or consultations;
11. An opportunity to raise subjective personal concerns.
A few things RSA is NOT:

- It is not a check on whether standards have been followed
- It is not a redesign
Who Does The Safety Audit?

To be effective, the safety audit needs to be carried out by specialists, who are independent of the design process so as to take a fresh look at the project focusing on safety. Audit team should possess expertise and experience in road safety engineering.
What Type of Projects should be Audited?

- New expressways
- Major four-laning projects
- Reconstruction and realignment projects
- Intersection projects both signalized and non-signalized
- Pedestrian and bicycle routes
- Deviated access roads near project roads
- Local area traffic management schemes, and
- Accident reduction schemes
A road safety audit is .... "a formal examination of road/traffic project in which an independent, qualified team reports on the project’s accident potential”

(AUSTROADS 2001)
Road Safety Audit is “a formal procedure for assessing accident potential and safety performance in the provision of new road schemes, the improvement and rehabilitation of existing roads and in the maintenance of existing roads”.

Manual for Safety in Road Design (India)
Objectives of Road Safety Audit

- To ensure high levels of safety on new road projects
- Reduce whole-life costs of projects
- Minimise accident risk on the adjoining road network
- Promote the safety of all road users
- Promote road safety engineering
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.
Key Audit Steps ...
Background on Road Crashes: An epidemic

- 1.4 million people are killed and 50 million are injured worldwide per annum due to road crashes.
- Developing countries account for 90% of the casualties.
- It’s the leading cause of death of young people worldwide.
- If unabated, the number of deaths will increase to 1.9 million per annum (worldwide) by 2020.
- The economic cost to developing economies amounts to around $100 billion a year.
- India has poor track record as far as road safety is concerned with about 1.4 lakh fatalities & 5.5 lakh grievous injuries in a year.
World Health Organization (WHO) has declared 2011-2020 to be the Decade of Action for Road Safety with the following goal:

Prevent five million road traffic deaths globally by 2020; India has rightly joined this endeavour
Road Safety Audit Process and Stages: 

Two Basic Concepts of RSA

**Prevention Is Better Than Cure**

- Safety audit seeks to minimize the risk of accidents occurring as a result of changes to the highway.

**Drive, Ride, Walk in Safety**

- Highlight the needs of Vulnerable Road Users (like Pedestrians, Cyclists and Two Wheelers)
Key RSA steps ....

- Select Audit Team
- Gather Information
- Commencement Meeting
- Closely Review Drawings / Site Inspection
- Write Report
- Closure Meeting
- Respond to Report
RSA at Different Stages

- Feasibility study
- Preliminary design
- Detailed design
- During construction
- Pre-opening
- Existing roads

*Audits can also be undertaken to assess the safety of:
  - temporary traffic schemes for roadworks, and
  - the new road, sometime after it has opened*
Stages of Road Safety Audit

- Feasibility Stage
- Preliminary Design Stage
- Detailed Design Stage
- Construction Stage
- Pre - Opening Stage
- Existing Road
Road Crash Site Improvement Programs

- Identify Road Crash Prone Sites
- Preliminary Road Crash Analysis
- Final Diagnosis
- Site Visit
- Develop Countermeasures
- Detailed Design
- Monitoring & Evaluation
- Implementation
Audit of the Study Section by the Road Safety Team

Collection of Secondary Data
Data and Check List preparation

Data Collection:
Field Studies investigations
Traffic Studies and Road Crash

Data Analysis and Interpretation: Review and Analysis of data collected through primary surveys and Secondary Source

Assessment of Safety Situation and comparison with Standards

Collection of Road Crash Data for the Study section from the Police Stations and respective road owning authorities

Referring to IRC Codes like IRC-67 (2012)

Recommendations / Remedial measures
Recommendations / remedial measures based on the identified Safety Deficiencies and Action Plans for implementation

A Typical Study Methodology
Key audit steps ....

Closely review drawings

ALIGNMENT & CROSS SECTIONS
Key Audit Steps …

Inspect site
Stages of Road Safety Audit

- Feasibility
- Preliminary design
- Detailed design
- During construction
- Pre – opening
- Existing road
Feasibility Stage Audits Consider ..

Route choice

Design standards

Impacts on the adjacent road network

Intersection types … and much more
Preliminary Design Stage Audits Consider

Geometrics,

Alignments

Intersection layouts

Vulnerable road users ..... and more
Detailed Design Stage Audits Consider

- Clear zone issues
- Signs / line marking
- Crash protection
- Traffic control
- Lighting .... and more
Non provision of Service Road

- Non provision of service road at start of project road can promote lawless

Recommendations

- Provide service road for safe management of traffic in built up areas from Zeerakpur intersection to start point of project road.
Plan and Profile: Gaps in dividers

• Closely spaced gaps in divider particularly near intersections, ramps and bus bays on service road can promote lawless movement.

Recommendations

• Provide minimum gaps in the divider with adequate acceleration/ deceleration zone, weaving/ merging/ diverging space, turning radii, and road signage.
Audits During Construction Consider

Crash Protection

Delineations

Traffic Control

Traffic Management

Signs, Lighting ..... And more
Absence of information about commencement or end of work zone

<table>
<thead>
<tr>
<th>Average Approach Speed (km/hr)</th>
<th>Length of Advance Warning Zone (m)</th>
<th>Length of Approach Transition Zone (m)</th>
<th>Length of Working Zone (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>50 or less</td>
<td>100</td>
<td>50</td>
<td>Varies</td>
</tr>
<tr>
<td>51-80</td>
<td>100 - 300</td>
<td>50 - 100</td>
<td></td>
</tr>
<tr>
<td>81-100</td>
<td>300 – 500</td>
<td>100 - 200</td>
<td></td>
</tr>
<tr>
<td>More than 100</td>
<td>1000</td>
<td>200 - 300</td>
<td></td>
</tr>
</tbody>
</table>

Table: Recommended Length of Components of a Traffic Control Zone

![Diagram of Traffic Control Zone](image)
Non-usage of PPE

Various situations on work sites on NH 22 bye-pass which show scant respect for observance of safety guidelines for use of PPE by construction workers.
AN AUDIT OF THIS WORK WOULD HIGHLIGHT THE DANGERS OF FELLING TREES ON TO ROADS
An Audit of This Maintenance Work Would Highlight a Lack of Delineation and Warning, Plus Unsafe Work Practice
Pre Opening Audits Consider..

- Previous audit issues
- Roadside crash protection
- Correctness of signs/markings
- The users view ..... and more
AUDITS OF EXISTING ROADS

CONSIDER

ALL ISSUES RELEVANT TO THE ACCIDENT POTENTIAL OF THE ROAD
RSA of Existing Roadway Sections

- Road Inventory
- Classified Volume Counts
- Speed Surveys
- FIR’s from Police Stations
Audits of Existing Roads …

Can be useful if an independent team looks at the road with crash potential as its only issue.

Can assist if there is no or incomplete crash data.

But – the maintenance crew and local traffic engineers should already be improving safety on the existing network.
URBAN EXPRESSWAY IN SANTIAGO

- 6-Lane divided carriageway
- Detailed Markings
- Median with wire rope fencing
- Crash Barriers
- Pedestrian Walkway
- Building line
- 2-Lane Service Road
- Separation
Thank you