Public Works, Ports and Inland Water Transport Department

Road Safety Review
Field Guide

Edition One - 2013

Foreword

This Road Safety Review Field Guide is a fully comprehensive document that has been developed to assist Public Works, Ports and Inland Water Transport Department engineers and others as they undertake road safety reviews of roads in Karnataka.

It draws together the best and most current international practices in this subject. It is to be used for all road safety reviews undertaken in Karnataka. It explains the essential components of the review process and it provides guidance to assist you as you undertake a review. It:

- Guides you through the key steps in the review process
- Offers advice on the selection of a review team
- Offers useful tips about how to inspect a site
- Provides expert advice about how to write a review report
- Contains a practical checklist to assist you during your review

This Field Guide also offers background information about some of the most important technical road safety topics that commonly arise in reviews in Karnataka. An example of a recent local review is provided to show you an effective way to set out your review reports.

I commend this field guide to those with a responsibility for road management or maintenance in Karnataka. Road safety reviews are a positive and low cost way to improve safety on our roads.

I thank Mr. Phillip Jordan, Road Safety Expert, and Dr. Robert Smith, Team Leader for the assignment representing VicRoads, Melbourne, Australia for their efforts in the preparation of this guide.

Mr H.S. Prakash Kumar
Project Director,
PIU, KSHIP

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This field guide has been prepared to assist you to undertake a road safety review of an existing road, an existing intersection or an existing interchange.

If you need to undertake a road safety audit of a road proposal at the planning or design stage, you should use the Road Safety Audit Field Guide.

PART A - ROAD SAFETY REVIEW PRINCIPLES

1. Road safety review

Road safety reviews assess an existing road from the point of view of the safety needs of all road users, including –

- Car drivers and passengers
- Pedestrians
- Truck and bus drivers and passengers
- Bicyclists and motorcyclists
- Auto-rickshaws and other small vehicles
- Animal-drawn vehicles

"A road safety review is a formal and detailed examination of an existing road by an independent, qualified team of reviewers that reports on the potential road safety concerns of that road".

When you undertake a road safety review your objective is to identify the safety concerns of a road. Road safety reviewers are safety problem finders. By identifying safety concerns on a road and making recommendations for change you can improve safety on the road.

2. The objectives of road safety review

The objective of a road safety review is to identify the road safety concerns on an existing road and to make recommendations to remove these or to reduce their impact. A road safety review may be requested because:

- Of concerns about a high number of crashes along a road, but there is no reliable crash data for that road.

- Of a need to identify high crash frequency locations in order to commence a “blackspot” program. Without reliable crash data, road safety reviews offer one way to identify high risk locations.

- Of a proposal to improve a road (duplication, widening etc) and the Executive Engineer wishes to identify existing safety concerns so that he/she can direct the design team to eliminate these during the design of the new work.

3. How does a road safety review differ from a road safety audit?

A road safety review is very similar to a road safety audit. Both are proactive processes and both try to prevent road crashes from happening. Both use a small team of independent qualified professionals to identify safety concerns. The only difference is that a road safety review looks for safety concerns on an existing road. A road safety audit looks for safety concerns at the planning, design, construction and pre-opening stages of a proposed new road project.

PART B - KEY STEPS IN A ROAD SAFETY REVIEW

Road safety review step	Responsibility
1. Decide that a review is to be undertaken	Executive Engineer /Client
2. Select a road safety review team	Executive Engineer
3. Provide background information (if any) to the review team	Executive Engineer
4. Inspect the site – day time and night time	Review team
5. Write the road safety review report	Review team
6. Hold a completion meeting – to discuss the key safety concerns and clarify outstanding matters	Executive Engineer plus Review Team Leader
7. Write a response report, referring to each review recommendation	Executive Engineer
8. Follow-up, implement agreed changes	Executive Engineer

1. Decide that a review is to be undertaken

The Executive Engineer will decide if a review is needed based on the needs of the Karnataka road safety program. Most road safety reviews are undertaken during the development of a road safety program that is looking for potential sites to be improved as part of a “blackspot” program.

2. Select a road safety review team

A road safety review Team Leader is appointed by the Executive Engineer. The Team Leader should be a registered Senior Road Safety Auditor in the register of auditors maintained by the PWP& IWT Department of Karnataka.

The Team Leader will then select a reviewer or a team of reviewers to assist him/her with the review. If you are the Team Leader there are two matters to decide:

- How many people do you need for your team?
- What backgrounds should they have?

A team of at least 2 qualified reviewers (you plus one other) is required for all reviews in Karnataka because:

- Two people bring different views about safety concerns due to their diversity of backgrounds and experiences.
- Cross fertilization of ideas can result from discussions.
- Additional people in a team can increase the chance of detecting less obvious safety concerns.

The Team Leader is responsible for managing the review, for communicating with the Executive Engineer and for ensuring that the report is completed on time. The Team Leader is usually the most experienced member of a review team and he/she will provide guidance and leadership to the rest of the team.

All review team members are to be qualified Road Safety Auditors. Unless you have a very large review, one other registered reviewer will usually be sufficient to join you. To decide who that reviewer should be, ask a few simple questions such as:

- Is the reviewer independent of the subject road?
- Has the reviewer successfully attended an approved road safety audit workshop?
- Is the reviewer able to see potential road safety concerns from the point of view of different road users'?

To be a Senior Road Safety Reviewer in the register of auditors administered by the PWP&IWT Department, a person is required to:

- Have completed an approved road safety audit training workshop, and
- Have a minimum of 2 years practical experience in a road safety related field, and
- Have previously completed at least 5 road safety reviews under the guidance of a Senior Road Safety Reviewer

To be a Road Safety Reviewer in the register of auditors administered by the PWP&IWT Department, a person is required to:

- Have completed an approved road safety audit training workshop, and
- Have a minimum of 2 years practical experience in a road safety related field.

There is no substitute for an experienced road safety review team that understands the review process and is able to foresee potential safety concerns in the "real world".

3. Provide background information (if any)

The Executive Engineer is to provide a copy of any relevant reports to the road safety review Team Leader. In most cases there are no such reports that are relevant to a road safety review. It is most important that the review team is clear about the location and length of road or the specific location of the intersection to be safety reviewed. For this reason they should be given clear directions in writing by the Executive Engineer.

4. Inspect the site – day and night

The site is to be inspected – by the entire review team – during day time and again at night time. During the site inspection, you and your review team should put yourselves "into the shoes of the road users".

Remember that your inspection should be undertaken from the point of view of all the likely road user groups - not just motorists. Karnataka has a wide variety of road users and they have quite differing safety needs. Do your best to consider them all in your reviews.

Drive the road, walk the road, speak with locals and try to anticipate as many road user movements as reasonably practical. Take many photographs from all locations – they will serve as useful reminders of site specific issues later and some of the more relevant ones can be added to your report for clarity.

Take notes while on site or, better still, use your mobile phone or a small digital recorder to record your observations while on site. This is usually much quicker and allows more details to be gathered.

While doing this, reviewers need to anticipate whether different weather (fog, rain) conditions may create safety concerns on the road. Your team should look beyond the limits of the specific review and examine consistency between road sections.

Remember that a review is more than a compliance check with standards. Your job as a reviewer is to put yourself “into the shoes of the road users”. What safety problems do some of them encounter on the road today?

Be aware that compliance with standards is no guarantee of a safe road. There are situations for which no standards apply, and there are some situations which need more than a standard treatment. Think broadly and keep checking for unsafe features, even those that may meet present standards.

5. Write the road safety review report

Writing the report is the responsibility of the Review Team Leader. The team members may check the report, and provide comments on it, but in most cases the Team Leader is the one who completes the report.

Your review report should be a concise report with a brief, clear description of each of the safety concerns that have been identified during the review. Your review report should contain:

- A title page – with the name of the road, and the exact location of the review.
- A brief description of the road, its topography and its users.
- The names of the road safety review team members.
- Dates and times of the review inspection(s), with a statement about the weather conditions while on-site.
- A table of the safety concerns found from the site inspection, each with a risk rating (see below), together with a recommendation for corrective action for each.
- Digital photographs to emphasise important safety issues.
- A statement signed and dated by the Team Leader to certify that the team has inspected the site and identified the road safety concerns listed.

Reporting all of the safety concerns you have found is the most important part of your review report. Each safety issue you find must have a clear recommendation made for corrective actions. Therefore, when writing the review report and developing appropriate recommendations, you should:

- Clearly and simply describe the safety concern and where it is located.
- State what type of crash may occur if the safety concern is not rectified.
- Consider high cost/low cost and short term/long term recommendations.
- Be clear with your recommendations, but avoid designing a countermeasure. The design team will carry out any design if/when commissioned by the Executive Engineer.
- Be realistic and practical - take into account the level of risk associated with the safety concern and the cost likely to rectify it.

List all the safety concerns (and your recommendations for each) either:

- in order of highest risk to lowest risk, or
- grouped together into groups of similar safety concerns, or
- by location (chainage) along the road.

It is best if the report follows an agreed style or format. This makes it easier for the team to write, and importantly it assists the Executive Engineer when reading it. The case study given in Section C of this Field Guide gives the recommended layout for road safety review reports in Karnataka.

Risk assessment

The following tables outline a risk assessment process to assist you to provide an indication of the level of risk for each safety concern.

- Estimate which category in Step 1 and Step 2 the safety concern best fits.
- From those, select the risk category in Step 3.
- The Executive Engineer then determines a course of action based on Step 4.

STEP 1 ESTIMATE THE POSSIBLE CRASH FREQUENCY

Frequency	Definition
Frequent	One or more per month
Probable	One or more per year (but less than one per month)
Occasional	Once every five or ten years
Improbable	Less often than once every ten years

STEP 2 ESTIMATE THE LIKELY CRASH SEVERITY

Severity	Description	Examples
Catastrophic	Multiple deaths are likely	High speed, multi-vehicle crashes on expressways or highways. A bus collision at high speed with a bridge abutment
Serious	A death and/or serious injuries are likely	High/medium speed vehicle/vehicle collisions or collisions with fixed roadside objects. Pedestrian crashes on highways
Minor	Minor injuries only are likely	Low speed collisions, such as a bicyclist sliding on a sandy road surface, a rear end crash in a slip lane, or a pedestrian hit in a car park
Limited	Trivial injuries or property damage only	Very low speed vehicle collisions. Pedestrian trips on uneven footpath, a car collides with a median island in a car park.

STEP 3 DETERMINE THE LEVEL OF RISK

RISK		From Table 1 - Frequency			
		Frequent	**Probable**	**Occasional**	**Improbable**
From Table 2 – Severity	**Catastrophic**	**Intolerable**	**Intolerable**	**Intolerable**	**High**
	Serious	**Intolerable**	**Intolerable**	**High**	**Medium**
	Minor	**Intolerable**	**High**	**Medium**	**Low**
	Limited	**High**	**Medium**	**Low**	**Low**

STEP 4 DETERMINE A COURSE OF ACTION (EXECUTIVE ENGINEER)

RISK	Suggested Treatment Approach
Intolerable	Safety concern “must” be corrected at any cost.
High	Safety concern “should” be corrected (or the risk significantly reduced), even if the cost is high.
Medium	Safety concern “should” be corrected (or the risk significantly reduced), if the treatment cost is moderate, but not high.
Low	Safety concern “should” be corrected (or risk reduced), if a treatment cost is low.

6. Participate in a completion meeting

The Executive Engineer is to arrange a Completion meeting involving:

- The review Team Leader,
- The Executive Engineer, and
- Any engineers within the Division with an involvement in the remedial work for the road.

This meeting provides an opportunity to outline your review findings and your recommendations, and to discuss ways to overcome the identified safety concerns. Do not entertain any suggestion to "soften" your review report. You are a professional and your primary responsibility is to represent the safety concerns of the road users.

7. Respond to the review report

The Executive Engineer is required to respond in writing to every review recommendation in your report. Each recommendation can be responded to in one of three possible ways:

- Accepting it, and developing a solution to overcome/reduce the problem;
- Accepting it in part or 'in principle' but, due to other constraints, implementing changes which go only part of the way to resolving the safety problem; or
- Not accepting the recommendation, and stating why.

The Executive Engineer should feel free to call for independent assistance on how to respond to each review recommendation. He/she may not be familiar with all possible options and, if in doubt, should seek professional assistance from consultants or experienced members of a Road Safety Unit.

To provide useful feedback, the Executive Engineer should send a copy of the response report to the Review Team Leader for information. The review team should read and note each response, aware that this is not an opportunity to take up an on-going dispute over which recommendations have or have not been accepted. The Executive Engineer remains responsible for decisions about the road.

8. Following up and implementing changes

Many of the recommendations from a road safety review can be implemented at low cost. Renewed line marking, replacement of missing direction or warning signs, or trimming of overgrown vegetation can sometimes make a big safety improvement. At times however, a review may reveal safety concerns that cause difficult decisions to be made by the Executive Engineer – usually because the cost of remedial action is high. Major intersections that require significant re-channelisation or roadside hazards that require substantial lengths of new crash barrier are examples of safety concerns that may require substantial funds.

In some of these cases an Executive Engineer may seek lower cost (and possibly less effective) countermeasures, or may stage the improvements over a long period. Sometimes, he/she may decide not to do anything – and risk the consequences. Other options available to the Executive Engineer include seeking an increase in the project budget to allow the desired countermeasures, or shortening the project (say by 10%) and placing the savings into safety improvements. These are all valid decisions, and they must be committed to writing in the Response Report.

PART C - SOME COMMON SAFETY CONCERNS ON KARNATAKA'S HIGHWAYS

1. Remember the safety of the road users

Experienced road safety reviewers put themselves "into the shoes of the road user" in an effort to anticipate the road safety concerns at a site. They will know that roads cater for a wide variety of road users. They will understand that humans make mistakes on the roads, and they will take this into account in their work.

Checking compliance with standards is a useful starting point for assessing that a road is as safe as practicable. However, ensuring that minimum standards are satisfied is not a guarantee of safety. Some standards have nothing to do with safety; some minimum standards only apply in conventional locations - they may not be suited to all situations. Experienced review teams appreciate that strict adherence to standards does not always result in roads that are as safe as they need to be.

A key element in any road safety review is judgement. There are few rights or wrongs when it comes to safety, but there are many areas in between. As a reviewer you will need to look for road safety concerns. To do this, keep asking yourself questions such as:

- Is this road consistent with the surrounding road network? Do not surprise your road users - with different signs, or cross sections, or roadside hazards.
- Is the traffic control appropriate for the location, traffic volumes and types?
- Does the road cater to the needs of the vulnerable road users? Pedestrians and motorcyclists are the largest groups of road users in India but are often forgotten.
- What is the speed environment? Higher speeds often mean higher risk.
- Ask what you would do if you were a pedestrian/motorcyclist/driver at this site? Always put yourself "in the shoes of your customers" – the road users of Karnataka.

An experienced review team will go through the review checklist and will ask questions such as:

- Is the geometry of the road clear and easily understood by the road users?
- Are the shoulders sealed? Sealed shoulders assist motorcyclists, pedestrians and animal drawn vehicles?
- How do pedestrians cross the road, or walk along the road? Are safety improvements possible?
- Are line markings clear and consistent?
- Are all the road signs necessary and do they all comply with the "6C's" of good signage?
- Does the road provide sufficient information to assist and guide road users?
- Are sight lines adequate from all directions?
- What will happen if a vehicle runs off the road?
- Are there any roadside hazards within the clear zone? What can be done to reduce the risk of these hazards?

A few safety issues that commonly arise during road safety reviews in Karnataka are included later in this Section. The safety tips illustrate many things, one of which is that making a decision in a road safety review if often a complex interaction of several elements. Sound judgement and logical thinking are essential for a road safety reviewer.

2. A Case Study from Karnataka

An example of a road safety review carried out along a section of State Highway in central Karnataka is included below to show an acceptable layout of a review report. It also provides a practical example of typical road safety concerns found in reviews in this state. There are a number of key messages from this review:

- The quality of a review is dependent on the experience and judgement of the review team in identifying road safety concerns from the drawings. Ensure an experienced team (2-3 people) undertakes each review.
- Site inspections are vital – day time and night time.

- The review team should set a good example for personal safety – wear safety vests and take all necessary safety precautions while on site.
- There are benefits in taking many photographs of the site, and inserting these into the review report to illustrate the key safety concerns.
- Review reports take time to write. Every safety concern needs to be carefully written to explain quite clearly what and where the concern is. A standard tabular format is used in this case study to clearly present the review findings.

This report provides just a few of the results of the road safety review of a State Highway in central Karnataka.

Description of the Highway

The section of State Highway in this road safety review is a two-lane two-way Highway that runs in a south westerly direction from the T-junction at the Raichur – Bagalkote Road to the cross road junction approximately 31.1km north of Sindhanur in central Karnataka. This section of Highway has a history of crashes. The Karnataka State Public Works, Ports and Inland Water Transport Department wishes to reduce the number and severity of crashes along this Highway.

No reliable crash data was available for this Highway and therefore it was not possible to undertake traditional blackspot investigations. Instead, a road safety review was carried out along this 31.1km length of Highway to establish how safety can best be improved.

This road safety review

This road safety review was carried out in accordance with the Road Safety Review Field guide. It was undertaken by AAAAA and BBBBB. Both are registered Senior Road Safety Reviewers in the PWP&IWTD register of road safety reviewers. Both reviewers are independent of the project. The highway was inspected on 12th and 13th May (day and night). The weather was fine and hot during the inspections.

At several locations, local residents provided details of recent fatal crashes. By using that information, by inspecting the highway in both directions (day and

night in a car and also on foot), and by observing the road users on the Highway, the road safety review team has been able to establish a list of the safety concerns along the Highway.

These safety concerns have been given a risk rating by the review team – based on an estimate of the likelihood of a crash occurring due to the safety concern, together with the potential consequences of that crash.

KEY SAFETY FINDINGS FROM THIS REVIEW

A number of general road safety concerns were detected during this road safety review:

Cross section

The standard cross-section for the highway has:

(i) Two 3.5m wide lanes, with 2.0m unsealed shoulders.

(ii) A 2-3m wide central median for 7km of the 31kms.

The first concern is the unsealed shoulder. When wet and muddy, pedestrians walk on the road in preference to the muddy shoulders. There are deep (up to 150mm) drop-offs in many parts that present a risk for motorcyclists.

The second concern is the narrow median. A 2-3m median does not allow sheltered right turn or U turn lanes. This means that vehicles slowing to make turns at the five median openings are at risk of being struck from the rear.

Road side hazard management

The road side has a number of hazards, including trees, culverts, poles, bridge end posts, bus shelters and steep side slopes. Internationally recognised clear zone guidelines indicate a clear zone of 7m is appropriate for a road such as this (with operating speeds of 80km/h, and traffic volumes of about 10,000vpd). Action is needed to remove, relocate or shield the hazards that are closer than 7m from the edge of the Highway.

Crash barriers

There are several concerns with the crash barriers on this Highway:

- *Two bridges have barrier installed but it is not connected to the abutments. There is a risk of "pocketing" at these locations.*

- *Two other bridges do not have any barrier but they require it to shield the abutments.*
- *A bridge near Km 68.8 should have barrier installed to shield the side slopes as well as the abutment. On side slopes greater than 1:6, and with a vertical height difference exceeding two metres, crash barrier should be installed.*

Pedestrians

There are several villages along the highway. Motor vehicles travel too fast through these villages, putting the pedestrians and slow moving animal-drawn vehicles at risk. There is a need to seal the shoulders in each village, to provide bus stopping places that are off the Highway and to control traffic speeds.

REVIEW CONCLUSIONS

This road safety review has identified features of the existing State Highway that should be altered, redesigned or removed to improve road safety on this road.

AAAAA
(Senior Road Safety Reviewer)

REFERENCES USED DURING THE REVIEW

1. *Road Safety Review Field Guide, 2013.*

NO.	REVIEW FINDINGS	RISK	RECOMMENDATIONS	CLIENT RESPONSE
SAFETY CONCERNS ALONG THE STATE HIGHWAY (BETWEEN KM 45.5 AND 76.6)				
1	This highway has 2m wide unsealed shoulders. In several sections, typically at bus stops and opposite median openings, there are substantial drop offs from the pavement (sometimes up to 150mm). This is dangerous for motorcyclists and animal drawn vehicles, especially as these vehicles are sometimes forced off the road by on-coming overtaking trucks or buses.	**HIGH**	• Seal the shoulder along the whole length of this Highway, for at least 1.5m on each side. • If this is not possible, ensure that the shoulders are sealed at critical sections such as in the villages and at bus stopping areas. • Repair the existing shoulder and remove the large drop-offs.	
2	There is a 7km length of divided highway in this review. The median is narrow (varying from 2.5 and 3.0m between the face of kerbs).There are just five median openings in this section but none of these has a sheltered right turn lane. This means that a vehicle waiting to turn right or to do a U turn is at risk of being struck from the rear.	**HIGH**	• If opportunities arise to widen the highway, seek to achieve a median that is 6m wide so that sheltered turn lanes (3m wide) can be constructed. • Until then, install warning signs (Median Opening) and suitable lane markings approximately 100m in advance of each opening to alert drivers/riders to the possibility that vehicles may be turning ahead. • Install at least one street light at each opening to maximise night time conspicuity.	
3	In this divided section, many pedestrians and some farm animals cross the road. It is difficult to see them until they are on the carriageway because the shrubs on the median have become very bushy and do not appear to be regularly trimmed.	**HIGH**	• Trim these shrubs heavily. • Consider removing them altogether.	

NO.	REVIEW FINDINGS	RISK	RECOMMENDATIONS	CLIENT RESPONSE
4	The junction with the side road near Km 55.5 has a triangular island in the middle. Traffic passes 2-way on each of the three sides of this island. This creates many conflict points and this increases the risk of a crash. In addition, an old advertising sign on the southern side blocks sight lines to the right. It is an unnecessary hazard.	MED	• Redesign this intersection to eliminate the triangular island. • Design this as a T junction, with left turning islands as necessary to shelter vehicles and to minimise "corner cutting". • In the meantime, use line marking and a Give Way sign on the NW corner to clarify the traffic movements here. • Remove the old advertising sign.	
5	There are five bridges; two of them have W beam crash barrier installed but neither has it firmly affixed to the bridge abutments. There is a risk that an impacting vehicle could "pocket" into the bridge abutment.	MED	• Firmly affix the W beam guardrail to the abutments to shield the bridge abutments.	
				
This intersection near Km 53 has numerous conflict points. It should be re-constructed as a simple T junction. Until then, a Give Way sign and line marking is recommended to improve driver compliance.		*There are numerous locations with substantial drop offs from the pavement (sometimes up to 150mm). This is dangerous for motorcyclists especially. Sealed shoulders are recommended.*		

NO.	REVIEW FINDINGS	RISK	RECOMMENDATIONS	CLIENT RESPONSE
				
	Two of the five bridges on the Highway have W beam crash barrier installed but neither has it firmly affixed to the bridge abutments. There is a risk that an impacting vehicle could "pocket" into the bridge abutment. All barriers are to be affixed firmly to the abutments.		*Pedestrians are amongst the largest users of this Highway. As such they warrant special safety attention. It is recommended that gateway treatments be developed for each village. Sealed shoulders are also recommended.*	
6	Two remaining bridges also require W beam guardrail to be installed to shield the bridge parapets. In addition, at the fifth bridge, the guardrail should be extended so that it shields the entire slope on both sides of the Highway that is more than 2m high. The side slope here is a roadside hazard.	**MED**	• Install W beam barrier to shield the abutments at these two bridges. • Extend the barrier on the fifth bridge to shield the steep side slopes. • Ensure that correct and safe terminals are used on each section of barrier.	
7	Traffic speeds through each village are too high for the safety of the pedestrians and other vulnerable road users. Speeds need to be reduced and maintained at 40km/h or less.	**MED**	• Implement traffic calming (Gateway treatments) at each village. • Use large yellow signs with "Welcome To….." on them to create a visual gateway at each village.	

NO.	REVIEW FINDINGS	RISK	RECOMMENDATIONS	CLIENT RESPONSE
	Police enforcement will be necessary but better signage and lighting is also needed. The shoulders are unsealed – and many pedestrians walk along and stand on the road, especially in wet weather.		• Install duplicate 40km/h speed restriction signs on these gateway treatments and at 500m spacings through each village. • Paint large yellow 40km/h signs on the road at these points. • Seal the shoulders through each village.	
8	The cross road in the first village is a central stopping point for buses and small trucks to pick up/set down passengers. However, most buses/trucks stop on the highway, blocking the lane and risking rear end collisions. They need to be encouraged to stop off the road.	**MED**	• Provide a sealed stopping area off the highway for these vehicles. • Install a street light and passenger shelter for all-weather protection and night time security. • Seek operator co-operation so that drivers are encouraged to stop on the new sealed bus stop.	
9	All of the chevron alignment markers (CAM's) have been struck and damaged on the curve near Km 64.4. The edge line has been worn out and the guide posts have also been demolished here. The curve is left with no delineation; run-off-road crashes are now likely, especially at night.	**MED**	• Replace the chevron alignment markers. • Renew all line marking. • Install new plastic guide posts (do not use concrete guide posts).	

The Review Team has carried out this road safety review according to the Road Safety Review Field Guide.

SIGNED: ..... on behalf of the RSR Team by the Team Leader (23rd May)

3. What to look for when you are on- site

When you are on-site for your review inspection, remember to:

- Park your vehicle well off the road.
- Wear your reflective safety vest – for your own protection and to show that you are serious about safety.
- Look for safety concerns in the geometry first.
- Move on to intersection layouts and traffic control.
- Think of signs and line markings.
- Remember to consider the needs of pedestrians, motorcyclists and animal drawn vehicles – not only crossing the road but walking along it. Are the pedestrian paths continuous, obvious, and well separated from high speed traffic? Make sure you walk the road too!

Geometrics, cross-sections and sight distances

Check that curves have sufficient (but not excessive) superelevation and that it is positive (not negative). Look for sub-standard curves (horizontal) as well as sharp crests (vertical). Look for consistency in cross-section along the road. Look for squeeze points and inconsistent lane widths or lane arrangements. Look to see that high speed roads, such as highways, have a sealed shoulder wide enough for a stationary vehicle to be clear of the traffic lanes. A sealed shoulder at least 1.5m wide is desirable.

Look to see that the full pavement width and full shoulders are carried across all culverts, bridges, overtaking lanes and intersections. Any reduction in shoulder width at such locations creates squeeze points which may catch some road users (especially motorcyclists) by surprise.

Central medians should be wide enough to shield small vehicles wishing to cross the road (generally 6m for cars and small vehicles), and to serve as useful refuges for pedestrians and bicyclists to cross one carriageway at a time (it is safer and easier than judging gaps in

both directions at once). All medians should have sheltered right turn lanes for turning vehicles.

Sight distance can be affected by parked vehicles, trees, fences, bus shelters and buildings. An experienced review team will anticipate a variety of traffic conditions and will look for any safety concerns that could arise due to road users not seeing a conflicting vehicle in time.

Sight distance out of side roads can be a major safety concern. Inspect each side road and look for sight restrictions – such as parking or trees – that may restrict sight distance to approaching highway traffic.

Intersections

Intersection layouts should be simple and obvious to approaching motorists, motorcyclists and pedestrians. Review teams should look carefully at intersections from all approaches to check the traffic control is clear, simple, visible and operating correctly. Check visibility in each direction. Look for “visual deceit” – is there a possibility that some drivers/riders may not see the intersection in the way it is meant to be seen?
The traffic control used at an intersection should be clearly understood. Traffic signals need to be conspicuous and easy to understand. Pedestrian signals are highly desirable to assist pedestrians (including the disabled) to cross at specific intersections.

Roundabouts are a safe form of intersection control – they must have adequate deflection on entry and they must have the correct signing. For safety, roundabouts should be signed correctly with both regulatory and direction signs. In addition, road users should be made aware to give way on entry to the roundabout. This is a weakness with roundabouts in India at present; it will eventually need a public awareness campaign plus Police enforcement to overcome this problem.

Pedestrians and vulnerable road users

Check to see if the road provides for the young, the elderly, the disabled or the intoxicated pedestrian. It is sometimes difficult to put yourself “into the shoes of these various groups” but it is something that you need to consider. What can you recommend to assist pedestrians to safely cross the road, or to walk safely along the road?

Are speeds commensurate with the offset of the pedestrians from the road? The closer the vulnerable road users are to the road, the slower the traffic speeds should be. Are footpaths available, or sealed shoulders? Is there a need for lighting?

Speed management and traffic calming

High speed is a major contributor to road crash frequency and severity. You should look to see that the operating speeds of the road are within levels that are appropriate for the design speed of the road and for the abutting roadside development.

Does the road have a suitable speed limit? Not too low, and certainly not too high. A speed limit needs adequate speed restriction signs along the route to remind drivers/riders of the speed limit.

Consider the need to reduce operating speeds through “self-enforcing” measures such as traffic calming (such as rumble bars, raised crossings, road humps) or through speed enforcement (such as Police presence or speed cameras). Road safety review is a proactive process that tries to prevent the first crash from happening on a new road. It is unacceptable to remain silent on the need for traffic calming or speed cameras if you believe they are needed. Such items – if needed – should be listed in your review report.

Do not install “speed breakers” on any road. “Speed breakers” are hazards that should not be used.

Night visibility

Roads are used both day and night, and so they should be inspected during day time as well as night time. Some locations look very different at night; they may or may not have street lighting. Older people generally have poorer eyesight and this makes reading road signs more difficult than it is for younger people. This is worsened after dark, so particular attention should be paid to night time conspicuity and visibility for the elderly. Perception of widths and distances by older drivers also becomes more difficult at night time.

Visual deceit

Sometimes there are visual cues along a road that give the wrong message to a driver. A long row of trees, or power lines, can give an impression that the road continues straight. But if the road takes a bend, some drivers will be misled by the trees or the power poles – regardless of the number of warning and guide signs used to tell them otherwise. This impression may be so strong that the bend and any warning sign will go unnoticed by some motorists, and run-off-road crashes will result.

Some street lighting can create visual deceit - look carefully in case a row of lights may mislead some drivers about the correct way to go.

PART D - ROAD SAFETY REVIEW CHECKLIST

A road safety review checklist is provided on the following pages. It has been designed as a prompt to assist you in your reviews and to help to minimise the risk that your team may overlook something important during the review. It is not a substitute for knowledge and experience.

- The checklist has been designed to be photocopied, so that the copy may be used as a set of field sheets.
- Remember that a successful review is not achieved by simply ticking off a checklist. The topics in the checklist cover only the more common safety concerns; they are not exhaustive and reviewers should use their own skills and judgement about the safety of any feature.
- If a listed topic is not apparently relevant to the road under review, take a broad view of the topic to see if it prompts a relevant question. For example, sight lines may be obstructed by features not listed in the checklists, and perhaps only at particular times of day.
- Do not append the checklists to your review report. The written review report should contain sufficient explanation of its recommendations, without any need to refer to hand written notes on checklists.

Road safety review checklist

Issue	Yes	No	N A	Comments
1. Cross section				
Is the cross section "safe" for the volume and mix of traffic?				
Are lane widths, shoulders, medians and cross sections adequate for the function of the road?				
Are median widths adequate and safe for pedestrians, for turning vehicles (sheltered U turns and right turns) and for road furniture such as signs and signals?				
Are shoulders sealed and/or in good condition with no drop offs?				
2. Intersections				
Are the intersections free of sight obstructions (due to crash barriers, fences, landscaping, parking or other obstructions)?				
Are approach sight and stopping distances adequate?				
Is the intersection control "safe"?				
At traffic signals, are they functioning properly and is the signal phasing "safe"?				

Can all the traffic signals be clearly seen and understood?				
Is adequate time allowed for all traffic and pedestrian movements at the signals?				
Are pedestrian signals easy to see and with adequate crossing time?				
If the intersection is controlled by a roundabout, is it visible and recognisable from all approaches?				
Is there adequate deflection on all approaches?				
3. Pedestrians, bicyclists and motorcyclists				
Does the road provide for motorcycles, bicycles, hand carts and animal drawn vehicles in safety?				
Is there safe provision for all pedestrians (elderly, disabled, and children) on this road?				
Are all the crossing points for pedestrians as “safe” as practical?				
Are bus stops safely located, with suitable lay-bys located off the main carriageway?				
Is the road safe (wide, free of pot holes and gravel/sand) and continuous for bicyclists?				
Are there any “squeeze points” for bicyclists?				
Is the road safe (free of pot holes, no loose gravel/sand etc) for motorcyclists?				
Are shoulders sealed to give motorcyclists and bicyclists and pedestrians the option to ride/walk along them instead of in the traffic lane(s)?				

4. Signs, line markings and delineation				
Do all signs and pavement markings satisfy the 6C's of good signage and line marking practice? (See Part C of the Road Safety Audit Field Guide)				
Are there adequate signs to warn, inform, guide, control and delineate?				
Do any signs need replacement (old, damaged, non-reflective)?				
Is the speed zone safe, and clearly signed?				
Are all road markings correct, visible, and well maintained?				
Is good delineation (curve warning signs, advisory speed signs, guide posts and chevron alignment markers) provided where required?				
Are there any damaged or missing guide posts that need replacement? (NOTE Always use plastic guide posts with large reflective strips. Do NOT use reinforced concrete guide posts).				
5. Roadside hazards				
Has the 5 step roadside hazard strategy been followed? (See Part C of the Road Safety Audit Field Guide)				
Has everything been done to keep the vehicles on the road?				
Are crash barriers provided only where necessary?				
Are all the barriers installed correctly (with correct offset from the road, sufficient space behind for deflection, and correct height, length and overlap?)				
Are approved "safe" terminals used on each crash barrier?				

6. Interchanges				
Are sight lines open and free of obstruction at all merges and diverges?				
Are the distances between decision-making points sufficient for safety?				
Is the direction signing scheme for each interchange clear and easily understood for the operating speed of the traffic?				
Are any roadside hazards created by the interchange structure?				
7. General road safety considerations				
Is the road generally well maintained (with all signs in place, clear line marking, no pot holes, no drop offs from the pavement, crash barrier correctly installed where necessary)?				
Is the road free of any "visual deceit"? (See Part C of the Road Safety Audit Field Guide)				
Does any encroachment cause a road safety concern (restricted sight lines)?				
Is the road well drained, free of ponding water?				
Is any transition between single and dual carriageway (either way) handled safely? (Check that "Two Way" warning signs are in place where needed).				
Is lighting required? If so, has it been adequately provided?				
Is the road surface free of gravel and sand, and with good skid resistance?				
Is any landscaping "safe" in terms of roadside hazards and sight lines?				