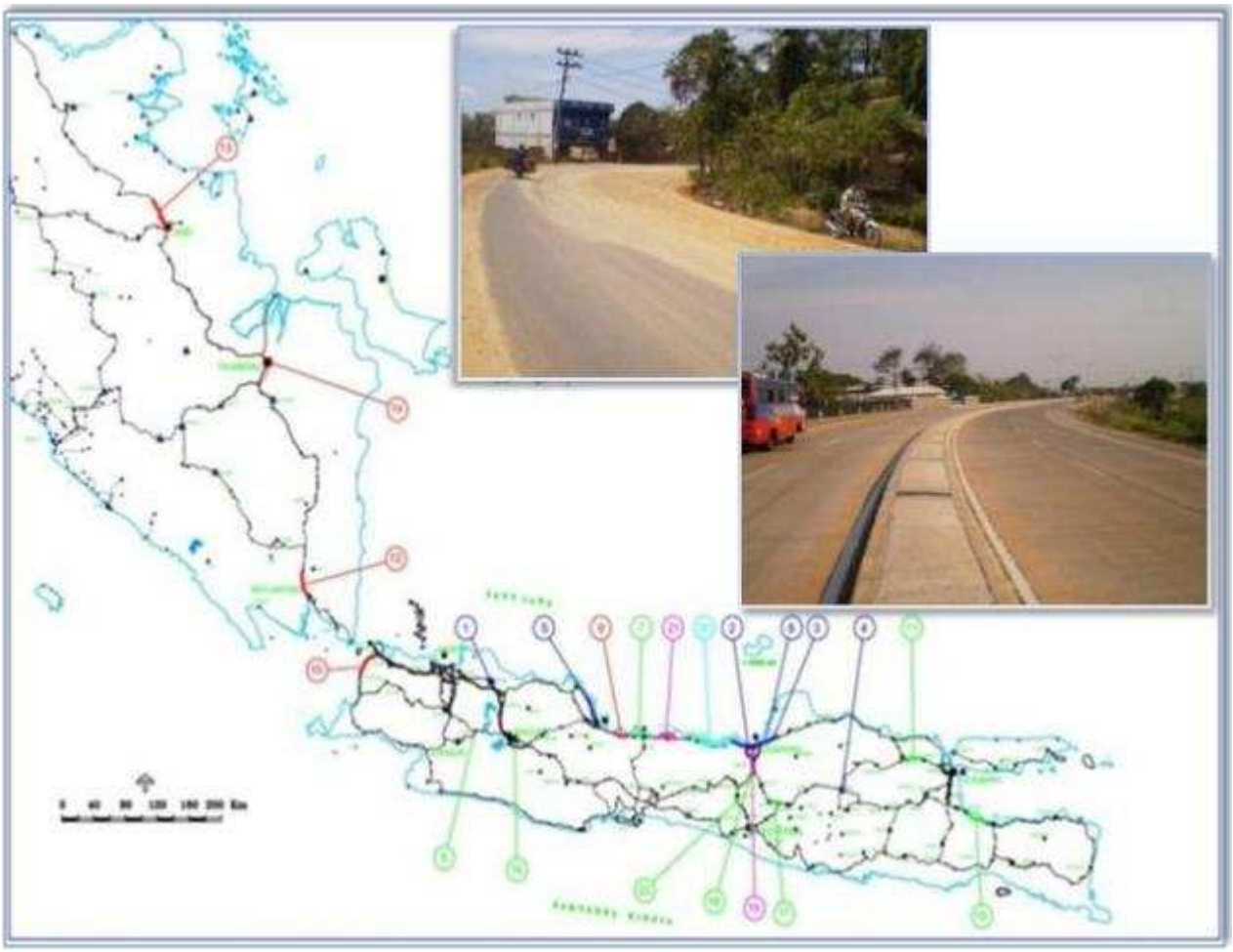
REPUBLIC OF INDONESIA
MINISTRY OF PUBLIC WORKS
DIRECTORATE GENERAL OF HIGHWAYS
DIRECTORATE OF PLANNING



SEMARANG NORTHERN RING ROAD
ROAD SAFETY AUDIT REPORT
As Constructed

January 2011

THE PROJECT MANAGEMENT UNIT
STRATEGIC ROADS INFRASTRUCTURE PROJECT
Under IBRD Loan 4834 / 7786 ID

Republic of Indonesia
Ministry of Public Works
Directorate General of Highways

Strategic Roads Infrastructure Project (SRIP)

Technical Assistance for Core Team Consultants (CTC)
To Support the Management Unit
IBRD Loan No. 4834-IND

SEMARANG NORTHERN RING ROAD
ROAD SAFETY AUDIT REPORT
As Constructed
June 2010

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Contents

SUMMARY OF PROBLEMS & RECOMMENDATIONS

〉 U Turns

There are two major U turn facilities that are poorly signed. The road is the extension of a high speed toll-way and weaving and confusion needs to be minimized for safety's sake.

Recommendations

- **Review all signs and markings at U Turns.**
- **Add new lane markings, arrows and large secondary direction signs at entrances to U turns. Ensure consistency of destination.**
- **Improve the visibility of the standard advance warning signs using additional "Exclamation Sign" or yellow backing board.**

〉 Guardrails

Several sections of guardrail have exposed ends that could increase severity of injuries in crashes.

Standard drawings show ends pointed at traffic should be tapered away and down, and others protected.

Connections with bridge parapets can also be made more severe by poor guard rail design. Vehicles that hit the guardrails will be directed to a serious collision with the parapet.

Guardrails are required at water hazards, particularly on high speed roads, but are missing at a lake next to road.

Recommendations

Review all guardrails and improve ensure the following;

- **All ends are buried or protected as per standard.**
- **Guardrails do not start at beginning of bend - but in advance.**
- **All water hazards protected.**
- **All bridge parapets are connected to guard rails.**

〉 Local Roads

The signing to the local road system varies from excellent to missing and the local roads lack many items of street furniture essential for safety - particularly with the adjacent water hazards.

Recommendations

- **Carry out review of exits and local roads.**
- **Improve the directions signs and add reminders.**
- **Increase numbers guideposts and lengths of guardrail at waterside.**
- **Protect exposed ends of guardrail.**

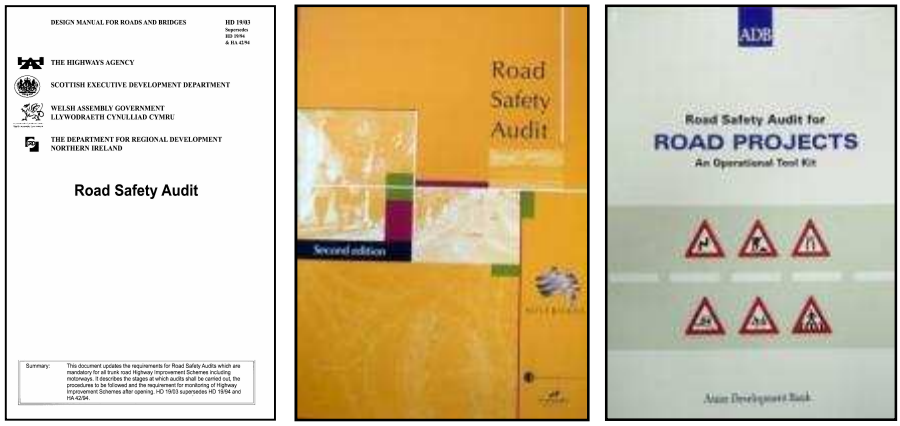
1. INTRODUCTION

1.1 Audit Process

Road Safety Audit (RSA) can be defined as a formal examination of a future highway or traffic project in which an independent qualified auditor or team of auditors reports on the road safety problems associated with the designs or construction of the project and makes recommendations on improvements.

It started in the UK some twenty years ago and is now common practice around the world. There are several Road Safety Audit Guidelines that are used as standard practice for Audits where a country does not have its own guidelines, as is the case in Indonesia.

It is understood that the original Australian AUSTROADS Road Safety Audit Guidelines were translated for use in Indonesia, but these were not widely available and are now out of date. This Audit has however been carried out using international procedures commonly used around the world and adopted in Indonesia.



UK, Australian & Asian Development Bank RSA Guidelines

Audits can be carried out at **various stages** and arguably the earlier the better:

- Feasibility
- Preliminary Design
- Final Design
- Construction
- Pre-Opening
- Existing Road, (as Constructed)

This Road Safety Audit Report is of the existing road as recently constructed

1.2 SRIP

The Strategic Roads Infrastructure Project (SRIP) was developed to meet the increasing traffic demand and institutional requirements following easing of the 1997 financial crisis in 2001. SRIP, which is supported by the World Bank under IBRD Loan 4834-IND, is being implemented by the Directorate General of Highways within the Ministry of Public Works over the five-year Loan period following its effectiveness date of 01 November 2007. Project implementation is expected to continue through to end 2012, with a possible extension to 2014 to accommodate implementation of the Performance Based Contract component of the Project.

SRIP is composed of twenty two (22) Civil Works packages of road betterment capacity expansion and new roads / bridges, including a trial Performance Based Contract (PBC), encompassing urban and inter - urban National Roads in 7 provinces (4 provinces on Java and 3 provinces on Sumatra). Details for these packages are given in Appendix A. The Implementation Support Component includes two (2) road safety components: Integrated Road Safety Management System (IRSMS) for Directorate General of Land Transport (DGLT) and Directorate of Traffic Police.

SRIP project implementation will be supported by four key consulting assignments: **(i) Core Team Consultants (CTC);** (ii) Construction Supervision Consultants for non-Metropolitan roads (CSC-1); (iii) Construction Supervision Consultants for Metropolitan roads (CSC-2); and (iv) Procurement Advisor.

Road Safety Audits have been carried out in Indonesia for several years but to date the GOI has not formally established policy or guidelines. This was confirmed in discussions with PMU & DGH

1.3 Structure of Report

A summary of the safety problems is given at the start of this report as an easy reference.

Chapter 2 lists the Problems and Recommendations

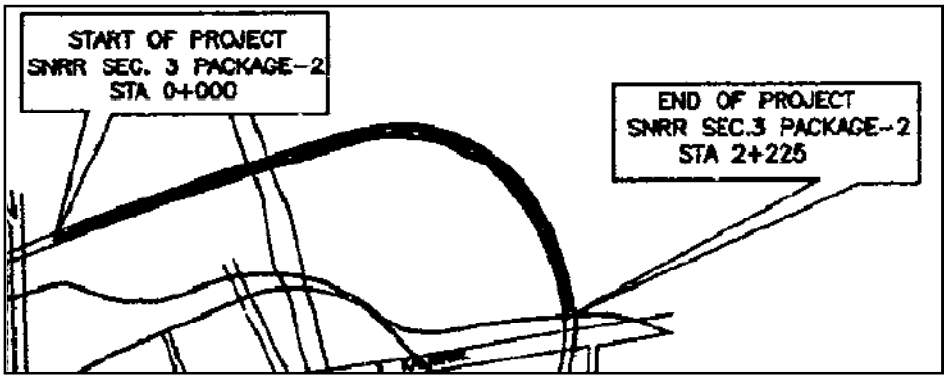
1.4 Project

Semarang Northern Ring Road is adjacent to two other completed SRIP projects under construction, they are the **Semarang Demak** and the **Demak Bypass**, see below. They were included in a site visit and some documents also obtained from these projects relevant to the safety on all SRIP contracts.

Understanding the adjacent network is an important part of the road safety audit process

Three Adjacent SRIP Projects

Semarang Northern Ring Road



Project Location

REPUBLIC OF INDONESIA
MINISTRY OF PUBLIC WORK
DIRECTORATE GENERAL OF HIGHWAYS

STRATEGIC ROADS INFRASTRUCTURE PROJECT
IBRD LOAN NO : 4834 - IND

PROJECT CODE

INTERNATIONAL COMPETITIVE BIDDING

PACKAGE : SEMARANG N.R.R.

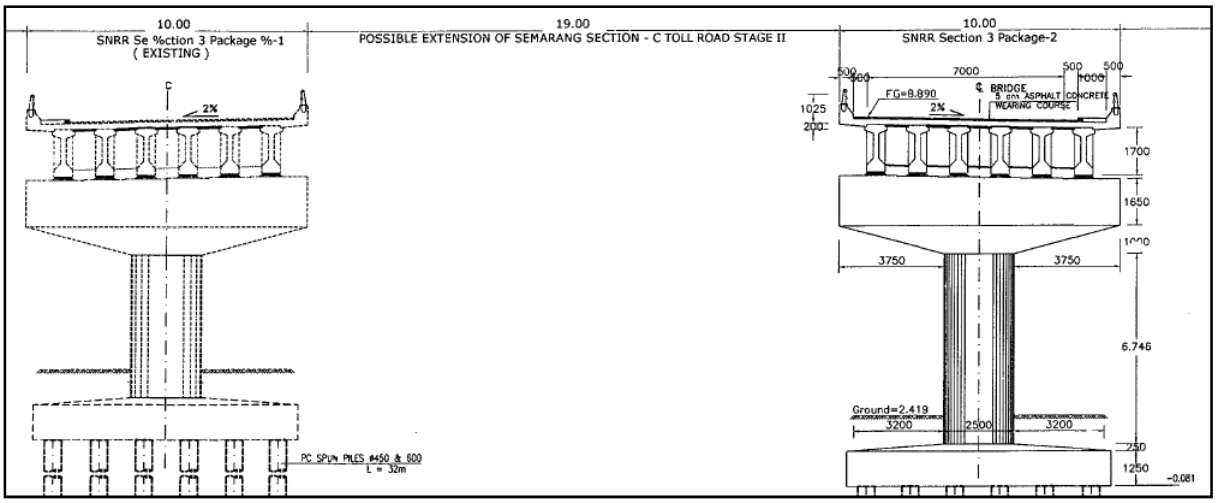
SECTION VI-3

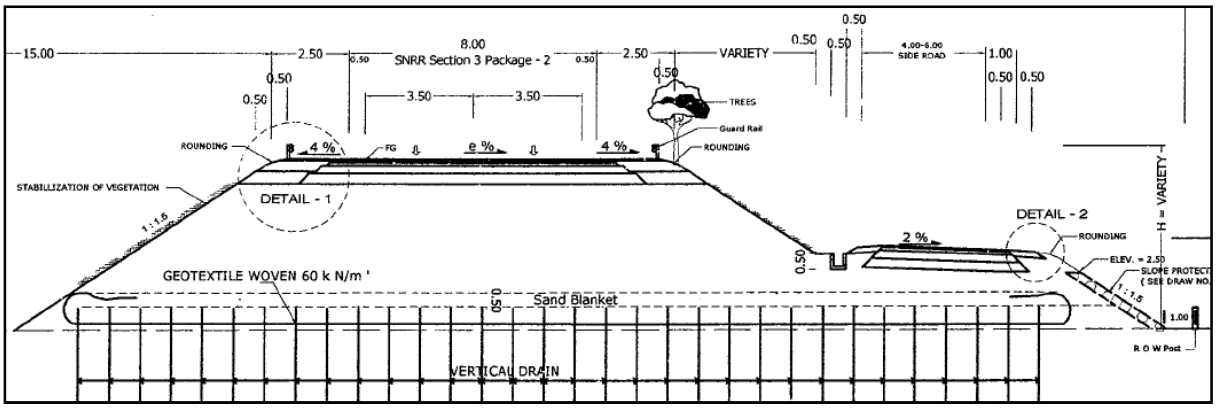
DRAWINGS

APRIL 2007

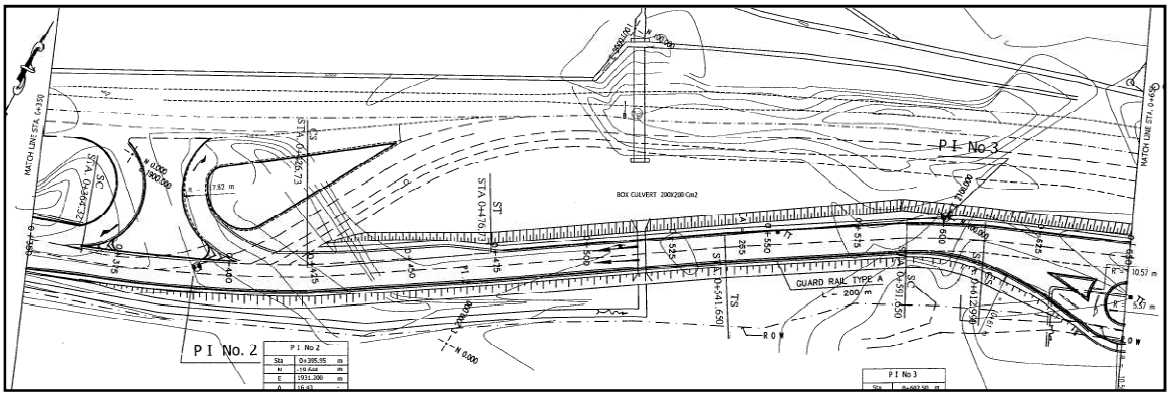
Contract Drawings April 2007

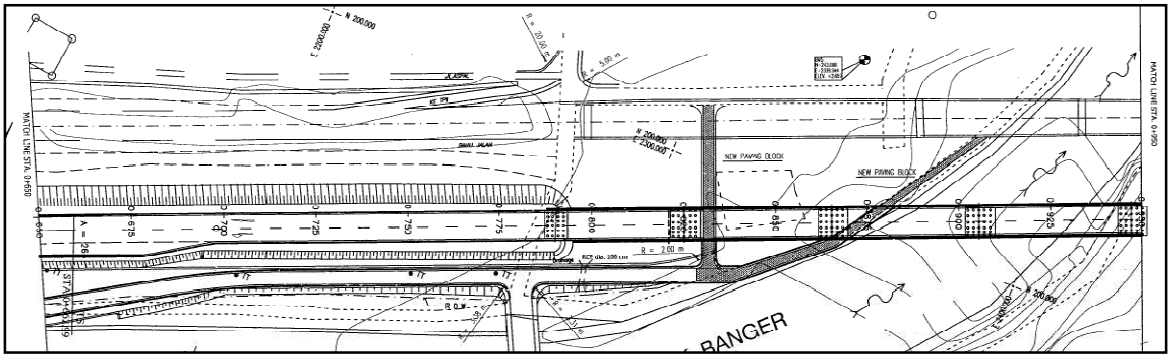
The project included the construction of a new major bridge parallel to an existing one together with local roads running below the elevated highway, see below:

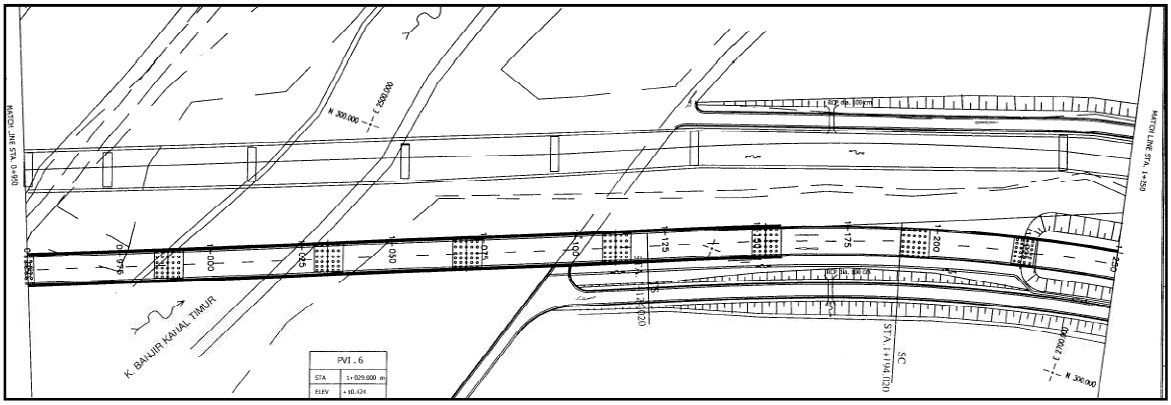




Ring Road and Local Access Road, See Plans below:







1.5 Site visit

The road safety audit team are all members of the Core Team Consultant of SRIP and composed of the following:

Mike Goodge	- Senior Road Safety Audit Engineer
Bayani J. Lusica	- Senior Highway Engineer
Agus Herudianto	- Road Safety Audit Engineer

The auditors traveled to Semarang from June 1st to 3rd 2010. The project was visited at different times on all three days along with visits to the adjacent SRIP projects on Demak Bypass and Semarang Demak. The road was travelled during morning, afternoon, dusk and darkness.

2 PROBLEMS & RECOMMENDATIONS AS CONSTRUCTED

2.1 U Turns

Problem

There are two major U turn facilities that are poorly signed - see photos below travelling northward from start of project. The road is the extension of a high speed toll-way and weaving and confusion needs to be minimized for safety's sake.

Old Advance Direction Sign

Standard U Turn Warning Sign

Unclear Signing & Markings at U Turn - Close Up Below

Very Poor Directional Signing at U Turn - Different Names from Advance Sign

The Southbound facility is easier to see and understand for road users but could still be improved. It has clear lane markings, hatching and turning arrow but no reminder directional signing - see below

Clear Road Markings but Lack of Direction Sign

Recommendations U Turns

- **Review all signs and markings at U Turns**
- **Add new lane markings, arrows and large secondary direction signs at entrances to U turns. Ensure consistency of destination**
- **Improve the visibility of the standard advance warning signs using additional "Exclamation Sign", see below or yellow backing board**

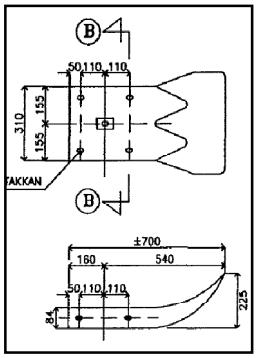
2.2 Guardrails

Problem

Several sections of guardrail have exposed ends that could increase severity of injuries in crashes.

Exposed but Protected end of Guardrail at start of bend

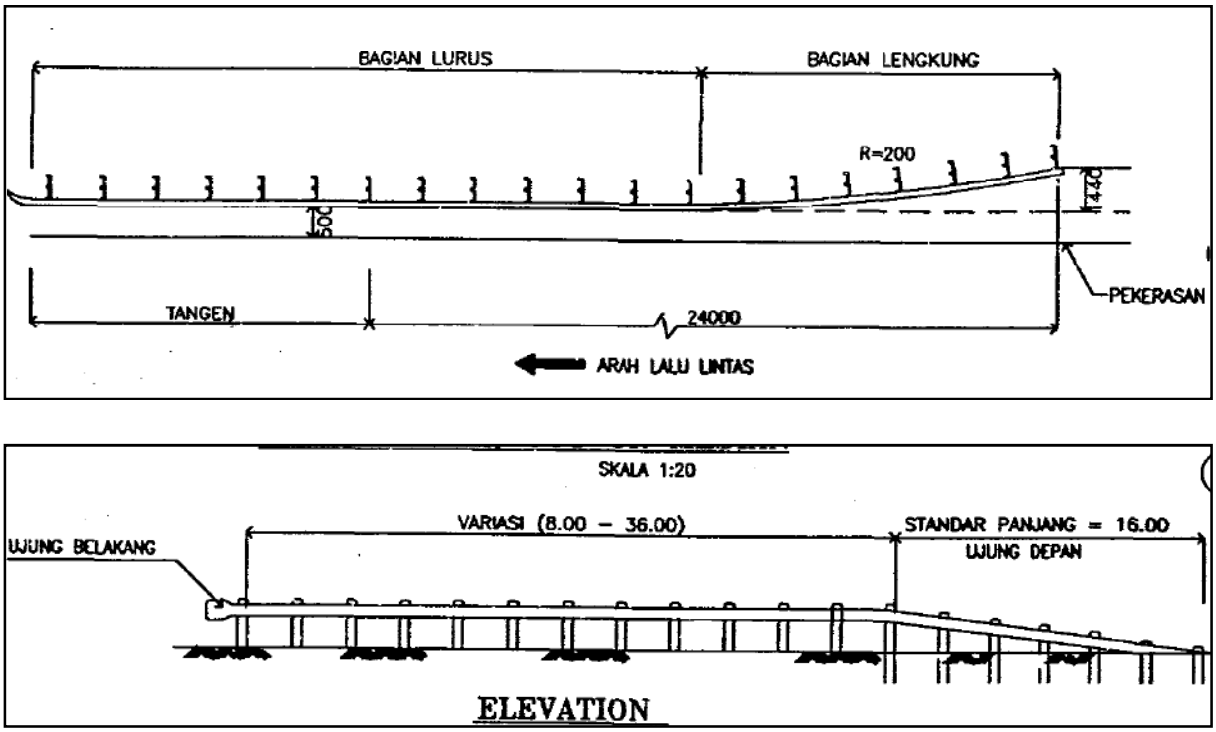
Exposed Unprotected Ends of Guardrail



Exposed Unprotected Ends of Guardrail **Standard**

Collisions with poorly design guardrails can be very severe

Standard drawings show ends pointed at traffic should be tapered away and down, and others protected, see below:



Connections with bridge parapets can also be made more severe by poor guard rail design. Vehicles that hit the guardrails shown below will be directed to a serious collision with the parapet

Guardrails are required at water hazards, particularly on high speed roads, but are missing at location shown below:

Missing Guard Rails at Lake

Recommendations Guardrails

Review all guardrails and improve ensure the following:

- **All ends buried or protected as per standard.**
- **Guardrails do not start at beginning of bend - but in advance**
- **All water hazards protected.**
- **All bridge parapets are connected to guard rails, as shown belows;**

Ideal Connection between Guardrail & Bridge Parapet - Australia

Overlap Between Guardrail & Concrete Median on Indonesia Tollway

2.3 Local Roads

Problem

The signing to the local road system varies from excellent to missing and the local roads lack many items of street furniture essential for safety - particularly with the adjacent water hazards

High Standard Signing of Exit to Local Road

Local Road - Two Way - Lack of Guideposts or Guard Rail

Local Road - Lack of Delineation & Signs

Lack of Arrows & Signs for Return to Highway

Exit to Local Road Unsigned & Hidden by Parked Trucks

Exit to Local Road Still Hidden & Blocked

Exit to Local Road Unsigned

Exposed End of Guard Rail & Poor Signing, Circled (see below)

Poor Signing & Inadequate Delineation or Protection at Water & Below

Unprotected Water Hazard, Exposed End of Guardrail & Lack of Signs

Recommendations Local Roads

- **Carry out review of exits and local roads.**
- **Improve the directions signs and add reminders.**
- **Increase numbers guideposts and lengths of guardrail at waterside.**
- **Protect exposed ends of guardrail.**

APPENDIX A: References

1. UK Design Manual for Roads & Bridges, Road Safety Audit, HD 19/03, 2003
2. AUSTROADS Road Safety Audit Guidelines, Second Edition, 2002,
3. ADB Road Safety Audit for Road Projects, an Operational Toolkit, 2003
4. Road Safety Audit Guidelines for Dubai, RTA 2008
5. Works Requirements for Semarang Northern Relief Road
6. Pedoman Audit Keselamatan Jalan (PD T-17-2005-B) Puslitbang PU Prasarana Transportasi
7. Road safety Audit Guidelines (Austroads Standards) Second edition 2002
8. Indonesian Road Design Manual 2002
9. Technical Guidelines for Bus stop and Bus Lane, Directorate Transportation and Highways
10. Technical Guidelines for Safety Structure for Road Side No: 013 / S / BNKT / 1990 Bina Marga
11. Technical Guidelines for Median. Directorate General of Bina Marga 014/BNKT/1990
12. Technical Guidelines for Pedestrian at Cities region SK.43/AJ 007/DRJD/1997
13. Technical Guidelines for Landscaping in Urbanized area No.03/T/BNKT/1992
14. Technical Guidelines for maintenance the plant on the roads 009/T/BT/1995