Interim Report on the Development of Road Safety Infrastructure Facility Design Standard for the Asian Highway Network
Contents

- Background and Objectives
- Basis of the Work
- Scope of the Design Standard
- Development of Contents
Overview

• Formulation of a design standard with both mandatory requirements and recommendations
• Asian Highway Network member countries shall make every effort to comply with the design standard within reasonable timeframe

Applications

• Online highway improvement or upgrading projects
• New bypass projects
• New addition of roads to the Asian Highway Network
• Dedicated road safety improvement projects
• Routine maintenance activities
Objectives of the Design Standard

Vision Zero – Zero Death or Serious Injuries

Best performing countries

Three-Star Rating

Current Situation

Long Term
Diversity of Asian Highway Routes
Diversity of Asian Highway Routes
Current Status of the Network

- Development towards more Primary, Class I and Class II roads
- Class III roads and below will continue to exist for some time

<table>
<thead>
<tr>
<th></th>
<th>Primary</th>
<th>Class I</th>
<th>Class 2</th>
<th>Class 3</th>
<th>&lt; Class 3</th>
<th>Others</th>
<th>Total</th>
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</thead>
<tbody>
<tr>
<td>Mileage (km)</td>
<td>15,649</td>
<td>28,055</td>
<td>47,592</td>
<td>27,311</td>
<td>10,092</td>
<td>1203</td>
<td>129,902</td>
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<td>Mileage %</td>
<td>12.1%</td>
<td>21.6%</td>
<td>36.6%</td>
<td>21.0%</td>
<td>7.8%</td>
<td>0.9%</td>
<td>100%</td>
</tr>
</tbody>
</table>

- Class I roads have the highest fatality rate by km
- Class II/III roads have the highest fatality rate by veh–km

<table>
<thead>
<tr>
<th>Road Type</th>
<th>No. of Countries</th>
<th>Length (km)</th>
<th>Fatalities</th>
<th>Fatality Rate per km</th>
<th>Fatality Rate per billion veh-km</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Average</td>
<td>Range</td>
</tr>
<tr>
<td>Primary</td>
<td>8</td>
<td>4975</td>
<td>676</td>
<td>0.135</td>
<td>0.03-0.32</td>
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<tr>
<td>Class 1</td>
<td>14</td>
<td>15635</td>
<td>4159</td>
<td>0.266</td>
<td>0.09-1.63</td>
</tr>
<tr>
<td>Class 2</td>
<td>16</td>
<td>12263</td>
<td>1427</td>
<td>0.116</td>
<td>0.005-0.79</td>
</tr>
<tr>
<td>Class 3</td>
<td>11</td>
<td>6765</td>
<td>793</td>
<td>0.117</td>
<td>0.03-1.35</td>
</tr>
<tr>
<td>All Roads</td>
<td></td>
<td>39638</td>
<td>7055</td>
<td>0.178</td>
<td></td>
</tr>
</tbody>
</table>
Contents

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Work Flow

Intergovernmental Agreement on The Asian Highway Network

RIFs Output from iRAP

Information from AH Participating Countries (Bangladesh, China, India, Korea, Thailand)

Key References
- AASHTO/FHWA
- Korean Standard

International References
- UNECE–TERN
- Europe/Australia etc
- International organizations

Output by Korea Expressway Corporation (KEC)

Integration by Consultant in collaboration with KEC

Design Standard
International References

Selection Criteria

- Well-performing countries
- Pioneering design concepts and practices
- Design standards accessible

Fatalities per 100,000 Population

Asian Highway Network member countries

mainly 10 - 25

International reference countries

< 5

- US
- Singapore
- Japan
- Norway
- Netherlands
- Switzerland
- United Kingdom
- Sweden
**International References**

**United States**
- AASHTO Standards
- Forgiving Roadside
- MUTCD

**Germany**
- New Rural Road Design Standard

**Netherlands**
- Sustainable Safety
- Self-explaining Roads
- Traffic calming
- Bicycle infrastructures

**Norway**
- Vision Zero
- Mountain roads

**Sweden**
- Vision Zero
- 2+1 Roads

**United Kingdom**
- Aggressive research
- Elaborate design standard
- Innovations

**France**
- Expressways
- Mountain roads
- Intersections/Roundabouts

**Australia**
- Vigorous developments
- Abundant research
Trans European Road Network (TERN)
Trans-European Motorway (TEM)

International E-Roads
- Contiguity/Overlap with Asian Highways
- Road design standards for TERN, TEM and tunnels
UNECE Design Standards

ECONOMIC COMMISSION FOR EUROPE
INLAND TRANSPORT COMMITTEE
Working Party on Road Transport

EUROPEAN AGREEMENT ON MAIN INTERNATIONAL TRAFFIC ARTERIES (AGR)

TEM STANDARDS AND RECOMMENDED PRACTICE
Third Edition
February 2002

DIRECTIVE 2004/54/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL
of 29 April 2004

on minimum safety requirements for tunnels in the
Trans-European Road Network
Contents

• Background and Objectives

• Basis of the Work

• **Scope of the Design Standard**

• Development of Contents
Proposed Design Standard

INTEGOVERNMENTAL AGREEMENT ON THE ASIAN HIGHWAY NETWORK

- Annex I
  ASIAN HIGHWAY NETWORK

- Annex II
  ASIAN HIGHWAY CLASSIFICATION AND DESIGN STANDARDS

- Annex III
  IDENTIFICATION AND SIGNAGE OF THE ASIAN HIGHWAY NETWORK

- Annex IV
  ASIAN HIGHWAY ROAD SAFETY INFRASTRUCTURE STANDARDS

APPENDIX 1
RIF DESIGN GUIDELINE

Mandatory

Recommendations
Considerations

- Long term vision Vs Short term issues
- Feasible across different countries
- Compatibility with national standards/practices
- Harmonization of practices
- Flexibility with alternative solutions
- Amenable to updating

- Subtle use of wordings
  - “shall” (mandatory)
  - “should” (highly recommended)
  - “It is advisable to” (recommended)
  - “may” (optional depending on circumstances)
# Road Infrastructure Facilities (RIFs) selected by iRAP

<table>
<thead>
<tr>
<th>A–1</th>
<th>Line marking</th>
<th>E–1</th>
<th>Protected turn lane</th>
</tr>
</thead>
<tbody>
<tr>
<td>A–2</td>
<td>Chevron mark</td>
<td>E–2</td>
<td>Intersection Channelization</td>
</tr>
<tr>
<td>A–3</td>
<td>Raised pavement marker</td>
<td>E–3</td>
<td>Roundabout</td>
</tr>
<tr>
<td>A–4</td>
<td>Flexible delineation posts</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B–1</td>
<td>Roadside barrier</td>
<td>F–1</td>
<td>Speed hump</td>
</tr>
<tr>
<td>B–2</td>
<td>Median barrier</td>
<td>F–2</td>
<td>Visual Traffic Calming</td>
</tr>
<tr>
<td>B–4</td>
<td>Central Hatching</td>
<td>F–3</td>
<td>Automatic Regulation Cameras</td>
</tr>
<tr>
<td>B–5</td>
<td>Crash cushion with channelization</td>
<td>G–1</td>
<td>Bicycle Lane</td>
</tr>
<tr>
<td>B–6</td>
<td>Safety barrier end treatment</td>
<td>G–2</td>
<td>Exclusive Motorcycle Lanes</td>
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<tr>
<td>B–7</td>
<td>Clear Zones</td>
<td>H–2</td>
<td>Lighting</td>
</tr>
<tr>
<td>C–2</td>
<td>Centreline/Edge line Rumble Strip</td>
<td>H–7</td>
<td>Sight distance</td>
</tr>
<tr>
<td>D–1</td>
<td>Pedestrian crossings</td>
<td></td>
<td></td>
</tr>
<tr>
<td>D–2</td>
<td>Sidewalk (footpath)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>D–3</td>
<td>Pedestrian Fences</td>
<td></td>
<td></td>
</tr>
<tr>
<td>D–4</td>
<td>Pedestrian Refuge Island</td>
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<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Anti–glare Facilities</td>
</tr>
</tbody>
</table>
Potential Road Safety Topics for Inclusion

- Integration into the design standard is recommended

Road Network Development
Road Infrastructures
- Overtaking Strategy
- Parking Areas, Service Areas, Rest Areas
- Long steep grades
- Climbing lanes
- Service roads
- Wrong–way driving
- Wildlife facilities
- Noise abatement Facilities

Tunnels

Intersections
- Grade-separated Interchanges
- U–turn facilities
- At grade railway crossings

Road Signage
- Traffic Signs
- Directional signing
- Asian Highway signing

Speed Limits
Road Network Development Interface Issues

- Multi-lane roads onto existing alignment
- Class 1
- Class 2

- Online improvements
  - Class 2
  - Class 3

- Temporary termination via interchange

- Temporary termination onto existing roads

- Multi-lane roads onto existing alignment
  - Class 1
  - Class 2

- Online geometry onto existing alignment
  - Class 2
  - Class 3

- Online improvements
  - Class 1
  - Class 2
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PREFACE

I. GENERAL REQUIREMENTS
1. Design Speeds and Speed Limits
2. Road Types
3. Change of Road Category or Design Speeds
4. Road Safety Infrastructure Facilities

II. ROAD INFRASTRUCTURE DESIGN
1. Road Infrastructure Design
2. Alignments
3. Cross-sections
4. Steep Gradients
5. Change in Cross-sections
6. Parking Areas
7. Toll Plazas, Ports and Border Areas
8. Delineation
9. Intersections
10. Road Signage
11. Urbanized Sections, Pedestrians and Slow Traffic
12. Roadside Safety
13. Enforcement Facilities

III. ROAD CLASSES SPECIFIC REQUIREMENTS
1. Primary Roads
2. Class I Roads
3. Class II Roads
4. Class III Roads
5. Urban Roads

IV. ROAD NETWORK DEVELOPMENT
1. Phased Development
2. Network for Pedestrians and Slow Traffic
3. Re-use of Old Roads
4. Interim Improvements

APPENDIX 1 DESIGN MANUAL
Roadside Safety and RIFs

- Rock Slope (aggressive) Guarded by Safety Barrier
- Median Safety Barrier
- Shoulder
- Passively Safe Sign
- Clear Zone

Safety Zone comprising Shoulder and Clear Zone

Google Street View
12. Roadside Safety

Roadside areas of Asian Highway routes covering mainlines, immediate connections, interchanges and intersections shall be designed in accordance with the “Forgiving Roadside” principle to enable drivers to regain control upon deviating from their travel paths and to limit the consequences of an errant vehicle crashing onto the roadside.

A forgiving roadside consists of the following elements:

- Creation and maintenance of Clear Zones
- Management of Aggressive Roadside Features
- Deployment and maintenance of Safety Barriers

Clear Zones

Clear zones are roadside areas outside the normal travel lanes including paved shoulders, unpaved shoulders and side slopes. Clear zones shall be free of aggressive roadside features susceptible to:

- penetrating or abruptly stopping an errant vehicle
- destabilizing an errant vehicle leading to rollover or rollover
- collapsing or becoming projectiles leading to adverse secondary consequences

Any signs or objects within the clear zone shall be passively safe. The extent of the clear zone shall take into account the likely trajectory of an errant vehicle.

Where clear zones cannot be provided, a safety barrier of acceptable performance shall be provided to contain an errant vehicle from leaving the road and to redirect it back onto its travel path.
Traffic Calming for Towns and Villages

Major village
Market town

Gateway Sign
Transition
50 (40)
60 (70)
80 (70)

Small villages
Isolated houses
Enhancement of safety level

Traffic Calming with Speed Management
RIF Design Manual

• Definition and Functions WHAT & WHY

• Provision Criteria WHERE & WHEN
  • Locations
  • Conditions for application

• Technical Requirements HOW
  • Layout, Dimensions
  • Capacity, Performance, testing standard
  • Construction, operation, maintenance
  • Precautions

• Targeting at critical issues and common concerns
RIFs are interdependent of each other

- Priority intersections on Class I roads involve median barriers, protected turn lane, side road channelization island, visibility, end treatments, signing/markings, speed limit etc.
RIF: Chevron Marks

- Within the context of a bend signing system

$\Delta V = \leq 8\text{km/h}$

$8\text{km/h} < \Delta V \leq 16\text{km/h}$

$16\text{km/h} < \Delta V \leq 40\text{km/h}$

$\Delta V > 40\text{km/h}$

If poor visibility around bend

Enhance measures exceptionally according to circumstances

Source: CEREMA, France
Provision Criteria

- Sharp bends which
  - requires approach traffic to reduce speed substantially
  - are not conspicuous due to an open background
  - are not clear due to presence of intersections or tangential features
  - have poor visibility

Technical Requirements

- Sign height between 600mm and 900mm
- Facing drivers at right angle
- Mounting height ~ 1m–1.5m, higher for crests
- Installation intervals
- Passive safety
RIF: Protected Turn Lanes (Hatched Markings)

- Reduces risk of rear–front collisions
- Encourages more cautious maneuvers
RIF: Protected Turn Lanes (Hatched Markings)

Provision Criteria
- Crossroad and T-intersections with turning traffic >300 vpd

Technical Requirements
- Symmetrical or asymmetrical layout
- Turning lane between 3.0m and 5.0m
- Through lane between 3.0m and 3.5m
- Hard shoulder >1.75m (1.5m min) if used by pedestrians and slow traffic
- Geometry based on approach taper, diverge taper, deceleration length and queuing length
- Possible enhanced delineations
Priority Intersections

- Need to regulate types of intersections permitted
- Strict requirements for Class I roads

Source: CEREMA, France
4.8.7 Visibility at Roundabouts

1. Drivers approaching a roundabout should be able to identify the sign on the central island together with the give-way signs and markings at least 150m ahead. They should also be able to see any pedestrian crossings including the waiting area on the footpath.

2. At the immediate approach to a roundabout, drivers should be able to see one-quarter of the roundabout circulatory carriageway to the left. In addition, circulatory visibility should be provided over a width of 2.5m along the edge of the central island. These inter-visibility areas should not be raised more than 500mm in height including plantings.
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