Development of the Technical Standard on the Road Safety Facility For the Asian Highway Networks

2016. 10. 03
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2. Concept
3. Technical standard (initial version)
4. Amendment
1. INTRODUCTION
1. INTRODUCTION

1) Research information

- **Purpose**: Develop the technical standard on i) **road safety facilities** and ii) **model ITS deployment** for the Asian Highway Network.

- **Timeframe**: March 2015 – December 2017 (3 years)

- **Progress**
  - 2015. 03 : Research kick-off
  - 2015. 10 : 6th AH working group meeting and joint seminar
  - 2015. 12 : Survey for reviewing present condition in AH networks
  - 2016. 06 : KEC–UNESCAP joint seminar
  - 2016. 10 : 2nd regional seminar for experts from participating countries
1. INTRODUCTION

2) Progress in road safety facility part

- Presentation in COEX to share (2015.10):
  - Research framework
  - Methodology
  - Procedure

- Survey sheet design to investigate (2015.12):
  - Presence of RSF
  - Presence of manual/guideline on RSF
  - Effectiveness of RSF

- Submission the first draft version of technical standard on RSF by reviewing (2016.02):
  - International manuals/guideline such as AASHTO
  - Domestic manuals/guideline
  - Technical report from international expert

- Technical standard (Oct, 2016) includes
  - Mandatory standard (ANNEX IV)
  - Specific guidelines for 23 facilities

- Hold technical consulting meetings with
  - Seoul national university
  - University of Seoul
  - Hanyang university
  - King Saud university
  - Korea transportation institute (KOTI)
  - Korea road traffic authority (Koroad)
  - International consultanats
2. CONCEPT
2. CONCEPT

1) Intergovernmental agreement in 2005

INTERGOVERNMENTAL AGREEMENT ON THE ASIAN HIGHWAY NETWORK
Annex II

III. DESIGN STANDARDS OF ASIAN HIGHWAY ROUTES

10. Road safety

“While developing the Asian Highway network, Parties shall give full consideration to issues of road safety.”

“Technical Standard on Road Safety Facility”
2. CONCEPT

2) Definition of technical standard

The technical standard for road safety facility is defined by the minimum requirements to improve road safety and the detailed methods to satisfy them for 32 countries that signed the intergovernmental agreement.
3) Methodology ① Survey

1. Is the facility present on the Asian Highway?
2. If the facility is present, how effective is it?
3. If the facility is not present, is there any specific reasons that it has not been used?
4. Are there standards, guidelines or manuals that relate to the use of the facility in your country?
2. CONCEPT

3) Methodology ② Selection of road safety facilities

<table>
<thead>
<tr>
<th>A. Mandatory facilities</th>
<th>B. Median and roadside barrier</th>
<th>C. Delineation</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Line markings</td>
<td>• Median barrier</td>
<td>• Delineator</td>
</tr>
<tr>
<td>• Sight distance</td>
<td>• Roadside barrier</td>
<td>• Chevron marker</td>
</tr>
<tr>
<td>• Lighting</td>
<td>• End treatment</td>
<td>• Raised pavement marker</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Flexible delineation post</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>D. Pedestrian</th>
<th>E. Speed control and regulation</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Pedestrian crossings</td>
<td>• Automatic regulation camera</td>
</tr>
<tr>
<td>• Sidewalk (footpath)</td>
<td>• Speed hump</td>
</tr>
<tr>
<td>• Pedestrian fences</td>
<td>• Visual traffic calming</td>
</tr>
<tr>
<td>• Pedestrian refuge island</td>
<td></td>
</tr>
<tr>
<td>• Bicycle lane</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>F. Intersection</th>
<th>H. Others</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Protected turn lane</td>
<td>• Crash cushion</td>
</tr>
<tr>
<td>• Intersection channelization</td>
<td>• Rumble strips</td>
</tr>
<tr>
<td></td>
<td>• Central hatching</td>
</tr>
</tbody>
</table>
2. CONCEPT

3) Methodology ③ Investigation of existing guideline/manual

- Roadside design guide (AASHTO, 2011)
- Roadway delineation practices handbook (Federal Highway Administration, FHWA)
- A policy on geometric design of highways and streets (AASHTO, 2001)
- NCRHP Report (Transportation research board, TRB)
- Guidelines for traffic calming (City of Sparks in USA, 2007)
- Official homepage for iRAP, AASHTO, FHWA, ITE rid
- Guidelines on the installation and maintenance of a road safety facility (Ministry of Land, Infrastructure and Transport in Korea, 2014)
- Rules for standard on roadway facility and structure (Ministry of Land, Infrastructure and Transport in Korea, 2013)
- Design guideline for intersection (Ministry of Land, Infrastructure and Transport in Korea, 2004)
- Design specification for highway alignment (JTG D20-2006) (China, 2006)
- Specification for design of highway safety facilities (JGT D81-2006 in China)
- Road traffic signs and marking (GB5798-2006 in China)
- Specification for layout of highway traffic signs and markings (JTG D82-2009 in China)
- Geometric design standard manual of RHD (Bangladesh, 2005)
- Report from national expert in China, Thailand, and Bangladesh
- Guideline, manuals and recommendation from Indian roads congress
2. CONCEPT

3) Methodology ④ Technical standard development

- Definition
- Function
- Type and safety characteristics
- Well-known case
- Installation criteria
- Other consideration

- Initial version
- Coordination process
- Final version

- Consistent
- Not available
- Coordination required
- Inconsistent
2. CONCEPT

3) Methodology ⑤ Coordination process

Cited from “Roadside design guide (AASHTO, 2011)”

- Flexible type barrier (e.g. cable barrier) : 762mm
- Semi-rigid type barrier (e.g. W-beam barrier) : 737~787mm
- Rigid type barrier (e.g. concrete barrier) : 737mm

: Consistent


The height from road surface to top of barrier should be 70~100cm. If over 100cm height barriers are needed, the structure of barriers shall prevent passengers’ head on errant vehicle from directly collide with barriers.
2. CONCEPT

3) Methodology ⑤ Coordination process

Cited from “Guidelines on the installation and maintenance of a road safety facility (Korea, 2014)”

Intervals for chevron marker depending on radii of curve

<table>
<thead>
<tr>
<th></th>
<th></th>
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<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Interval (m)</td>
<td>8</td>
<td>12</td>
<td>15</td>
<td>20</td>
<td>22</td>
<td>25</td>
<td>30</td>
<td>35</td>
<td>38</td>
<td>45</td>
</tr>
</tbody>
</table>

: Coordination required

Cited from “National expert report from Thailand”

Intervals for chevron marker depending on radii of curve

<table>
<thead>
<tr>
<th>Radii Curve (m)</th>
<th>Less Than 75</th>
<th>75-99</th>
<th>100-149</th>
<th>150-199</th>
<th>200-299</th>
<th>300-499</th>
<th>500-1000</th>
<th>More than 1000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interval (m)</td>
<td>10</td>
<td>15</td>
<td>20</td>
<td>25</td>
<td>37.5</td>
<td>50</td>
<td>75</td>
<td>-</td>
</tr>
</tbody>
</table>
2. CONCEPT

3) Methodology ⑤ Coordination process

Traffic keeps to the left in:

- Japan
- India
- Thailand
- Bangladesh

Cited from "Specification for Design of Highway Safety Facilities (China, 2006)"

If the highway is separated cross-section, the road barriers shall be deployed on the left side; if the elevation difference of incoming and outcome directions is larger than 2m, the roadside barrier should be deployed on the higher elevation road base.
2. CONCEPT

3) Methodology ⑥ Documentation

- Consistency
- Coordination
- Inconsistency
- Not available

TECHNICAL STANDARD

- Minimum requirement
- Specific guidelines for 23 facilities
3. TECHNICAL STANDARD
3. TECHNICAL STANDARD

1) Approach

INTERGOVERNMENTAL AGREEMENT ON THE ASIAN HIGHWAY NETWORK

Annex II

ASIAN HIGHWAY CLASSIFICATION AND DESIGN STANDARDS

III. DESIGN STANDARDS OF ASIAN HIGHWAY ROUTES

10. Road safety

While developing the Asian Highway network, Parties shall give full consideration to issues of road safety.

Annex IV

TECHNICAL STANDARD ON ROAD SAFETY FACILITY FOR THE ASIAN HIGHWAYS

Attached document

SPECIFIC GUIDELINES FOR ROAD SAFETY FACILITIES
2) Scope

- This document has been prepared for the purpose of improving the level of quality of road infrastructures, and focuses on improving roads and environmental factors, and minimizing human and vehicle factors which cause accidents.

3. TECHNICAL STANDARD

2) Scope

- As the method for improving environmental factors, following three steps can be reviewed. And this document **mainly describes the installation and management of road safety facilities**

| I. Planning and construction of roads meeting design standards | • Compliance of minimum radii of curve  
• Compliance of minimum gradient  
• Compliance of minimum lane width, etc. |
| --- | --- |
| II. Installation and management of road safety facilities | • Installation of median barrier  
• Installation of crash cushion  
• Installation of delineation facilities, etc. |
| III. Performance evaluation of road safety facilities | • Evaluation of crash-worthiness  
- Structural stability, passenger safety, etc.  
• Evaluation of reflectivity of facilities, etc. |
3. TECHNICAL STANDARD

3) Application

- Installation of road safety facilities are utilized in two stages

  A) **Planning stage**: Installations are performed to supplement physical limitations of roads when the road design standards are not fulfilled for inevitable reasons

  B) **In-service stage**: Installations are performed to remove or minimize safety hazardous factors which can still exist even though the road design standards have been fulfilled
3. TECHNICAL STANDARD

4) Minimum requirement

A) For roads with vehicle traffics, **line marking** on road surface shall be installed in principle.

<table>
<thead>
<tr>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Double</td>
<td>maximum or special restriction</td>
</tr>
<tr>
<td>Solid</td>
<td>discourage or prohibit</td>
</tr>
<tr>
<td>Broken</td>
<td>permissive condition</td>
</tr>
<tr>
<td>Dotted</td>
<td>provide guidance</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Color</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>White</td>
<td>the separation of traffic flow in the same direction</td>
</tr>
<tr>
<td>Yellow</td>
<td>The separation of traffic flow in the opposite direction</td>
</tr>
<tr>
<td>Blue</td>
<td>the supplement for white markings such as parking space for person with disabilities or HOV lane</td>
</tr>
</tbody>
</table>

Please see the full document for further information.
3. TECHNICAL STANDARD

4) Minimum requirement

B) Roadside environments shall be renovated to secure the **sight distance** of drivers.

<table>
<thead>
<tr>
<th>Design speed (km/h)</th>
<th>30</th>
<th>40</th>
<th>50</th>
<th>60</th>
<th>70</th>
<th>80</th>
<th>90</th>
<th>100</th>
<th>110</th>
<th>120</th>
<th>130</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stopping sight distance (m)</td>
<td>35</td>
<td>50</td>
<td>65</td>
<td>85</td>
<td>105</td>
<td>130</td>
<td>160</td>
<td>185</td>
<td>220</td>
<td>250</td>
<td>285</td>
</tr>
<tr>
<td>Overtaking sight distance (m)</td>
<td>200</td>
<td>270</td>
<td>345</td>
<td>410</td>
<td>485</td>
<td>540</td>
<td>615</td>
<td>670</td>
<td>730</td>
<td>775</td>
<td>815</td>
</tr>
</tbody>
</table>

※ Overtaking sight distance is applied to only two-way two-lane road (AH class II, III)
C) Lighting facilities shall be installed to secure safe sight distance in night time, improve driving convenience and increase pedestrian safety.

| Area | -Within built-in area including towns, shopping malls, and school zones
|      | -Within service area as well as parking area |
| Line | -Road sections with heavy traffic at night time
|      | -Road sections with regular pedestrian or slow traffic at night time
|      | -Through tunnels, bridges and immediate approaches |
| Spot | -At major intersections, interchanges, and pedestrian crossings with heavy traffic at night time
|      | -At toll-plazas, dry ports, and immigration points |
3. TECHNICAL STANDARD

4) Minimum requirement

D) Median barrier shall be installed to prevent head on collision on a road with 4 or more lanes.

• For motorways, highways and expressways with speed more than 80km/h, it is recommended to install a rigid type with concrete material or a semi-rigid type with two-side W-beams.

• Basically, the height of median barrier from road surface to top of barrier should be 70-100cm. However, height may be expanded to minimize the glaring by the light from opposite direction.
E) **Roadside barrier** shall be installed where a clear zone is not available. Especially, for sharply curved sections or mountainous/steep sections along the AH networks, installation of roadside barrier is highly recommended to prevent run-off and falling accident.

- It is highly recommended to install a rigid type of roadside barrier on a bridge section, and the height of roadside barrier may be expanded more than 100cm to prevent falling accident.

- Roadside barrier may be installed to separate vehicle roadways and sidewalk (footpath) to secure pedestrian safety.
3. TECHNICAL STANDARD

4) Minimum requirement

E) To minimize the impact (severity) of accident between a vehicle and barrier end terminals, **safety end treatment** shall be equipped.

- The number of dangerous end terminals should first of all be reduced to a minimum

- Flare type and anchorage type of end treatment is recommended for all kinds of road in AH networks. Especially, for the high speed road more than 80km/h, tangent terminal type and crash cushion type of end treatment may have a higher safety performance than others.
3. TECHNICAL STANDARD

4) Minimum requirement

G) **Delineation facility** shall be installed to inform the geometric condition for upcoming roadway and to prevent the vehicle to infrastructure accident.

- **Chevron marker** should have a height of the plate within 60-90cm, and large plate (height of 90cm) may be deployed in primary/class I road.

- Basically, the height if **raised pavement** marker from road surface to top of marker should be less than 30mm, however, height may be reduced less than 25mm with consideration to motorcycle traffic.

- The height of **flexible delineation post** should be less than 130cm
  - Primary, class I road with speed 70km/h or above : 70-130cm
  - Class II, III road with speed 70km/h or below : 40-70cm
H) For roads, where vehicles and pedestrians are mixed in traffic and there is high pedestrian traffic, pedestrian safety facilities (sidewalk, pedestrian crossing, fences, and refuge islands) shall be installed.

• The minimum sidewalk width of 2.0m is recommended with consideration to mobility of the handicapped of such as pedestrian on wheelchair, and the height of kerb should be 10-20cm from road surface.

• A grade separated crossing facility such as over-bridge, underpass shall be installed in primary road. For other roads exceeding 60km/h, it is recommended to install a grade separated/signalized crossing facilities.

Please see the full document for further information.
3. TECHNICAL STANDARD

4) Minimum requirement

I) Installation of a speed control and regulation facility in the section prone to speeding is recommended to prevent crashes caused by speeding or careless driving.

• Installation of **automatic regulation cameras** on the road with design speed of 50km/h or higher

• Installation of a **speed hump**, speed bump, speed table, and application of a **visual traffic calming technique** on the road with design speed of 30km/h or lower considering land-use type (school zone, silver zone, shopping mall and residential area, tourist area, etc).

Please see the full document for further information
4) Minimum requirement

J) In case intersections are complex or have multiple legs, channelization facilities shall be installed to avoid confusion of drivers and separate traffic by direction.

• For effective channelization, traffic island, line marking and traffic signs can be utilized.

• In case that in intersections the traffic making turns interrupts the traffic moving straight ahead, so that road capacity is reduced or safety issues occur, protected turn lanes for the traffic making turns may be installed additionally.

Please see the full document for further information.
3. TECHNICAL STANDARD

4) Minimum requirement

K) **Crash cushion** shall be installed at the gore areas on the primary and class I road with fully controlled access and design speed of 80km/h to mitigate the crash severity and to reduce fatality at the time of an accident.

- It can also be installed ahead of an obstacle (tollgate, guide post, etc.) that can interrupt the traffic flow.

- Crash cushion may also be appropriate for lower speed limits or other high risk situations where no other solution are practical.
3. TECHNICAL STANDARD

4) Minimum requirement

L) Installation of a **rumble strips** is recommended for road with speed limit of 80km/h or above to prevent run-off due to drowsing or careless driving.

• Installation of edge line rumble strip at the sections, where the concentration of drivers can be reduced due to long straight sections

• Installation of centerline rumble strip if there is no median barrier or only central hatching is available

• In case two-wheeled vehicles and bicycles are mixed in the traffic flow, it is recommended not to use rumble strips and groovings.

Please see the full document for further information
4. AMENDMENT
4. AMENDMENT

1) Approach

- Mandatory standard
- Specific guidelines for 23 facilities

**TECHNICAL STANDARD**

- **Annex IV**
  - This part should be ratified by participating countries

- **Attached document (Specific guideline)**
  - This part can be supplemented by the best practices from participating countries
2) Process

Presentation for technical standard on road safety facilities (3th, OCT)

Annex IV (Mandatory standard) → Modification

Attached document (Specific guideline) → Update / supplementation

Circulation / feedback

Amendment
4. AMENDMENT

3) Amendment

Annex II

ASIAN HIGHWAY CLASSIFICATION AND DESIGN STANDARDS

I. GENERAL

The Asian Highway classification and design standards provide the minimum standards and guidelines for the construction, improvement and maintenance of Asian Highway routes. Parties shall make every possible effort to conform to these provisions both in constructing new routes and in upgrading and modernizing existing ones. These standards do not apply to built-up areas.¹

II. CLASSIFICATION OF ASIAN HIGHWAY ROUTES

III. DESIGN STANDARDS OF ASIAN HIGHWAY ROUTES

10. Road safety

While developing the Asian Highway network, Parties shall give full consideration to issues of road safety.
3) Amendment

Annex IV
TECHNICAL STANDARD ON ROAD SAFETY FACILITY FOR THE ASIAN HIGHWAYS

I. GENERAL

1. The countries participating in Asian Highway Network development shall sufficiently review the issue related to road safety.

II. TECHNICAL STANDARD ON ROAD SAFETY FACILITY

5. The roads included in the Asian Highway shall satisfy design standard suggested in inter governmental agreement annex II by priority. Installation of suitable road safety facilities can mitigate the impact of obstacles of road safety that cannot be resolved by the design standard and geometrical structure of the road.

A) For roads with vehicle traffics, line marking on road surface shall be installed in principle.
   • The installations should clearly deliver the intend of the marking to drivers through variations of types, colors and thickness of the line markings.
Thank you

Ducknyung Kim,
Ph.D. / Senior researcher
T. +82-54-811-4319
E. k999@ex.co.kr

Korea Expressway Corporation Research Institute