Policies and issues related to road safety along the Asian Highway network

Note by the secretariat

Summary

The present document contains an outline of policies and issues relating to the improvement of road safety along the Asian Highway routes. The Working Group on the Asian Highway is invited to review the present document and consider the following issues: (1) the harmonization of the design and specification of road infrastructure safety facilities for the Asian Highway network and consideration of the adoption of technical standards for road infrastructure safety facilities, to be annexed to the Intergovernmental Agreement on the Asian Highway Network; (2) road safety audits at different stages of road projects and the harmonization of audit procedures among the member countries; (3) the improvement of data collection procedures with regard to road crashes and the consideration of initiatives to reduce underreporting; (4) the deployment of appropriate intelligent transport systems services for improving road safety; and (5) addressing road safety holistically and the implementation of interventions involving multiple sectors. The Working Group may also wish to provide updates on the progress and status of priority initiatives for improving road safety along the Asian Highway.

I. Introduction

1. Road safety is a global concern and is a sustainable development issue that needs greater attention. More than 1.2 million people die and up to 50 million people incur non-fatal injuries annually as a result of road crashes. It is a human-made problem and a leading cause of preventable and predictable deaths. The World Health Organization showed that among the top 10 causes of death, including suicide, HIV and AIDS, homicide, maternal conditions and diseases, in 2013, road traffic injury was the ninth leading cause of death across all age groups globally. Moreover, if countries are not successful in taking adequate measures to reduce road crashes, it will become the seventh leading cause of death by 2030.1 In the Asia-Pacific region, road crashes cause human causalities every minute, and on average, every two minutes three people are killed.

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2. Road traffic fatalities and injuries place a significant burden on the national economies of the Asian Highway member countries. In some developing countries, the problem is severe and economic loss is as high as 6 per cent of the gross domestic product (GDP). In high-income countries, although the economic loss is less than that in developing countries, the social impact is still considerable.

3. The international community has adopted a number of initiatives to address road safety. The Brasilia Declaration on Road Safety is the most recent, adopted in November 2015; it includes commitments to halve road traffic deaths by the end of the decade and to a holistic approach to road safety involving multiple sectors.

4. Infrastructure design plays an important role in the various factors that contribute to road crashes. Road engineering and design can affect the severity of the crashes. Annex II to the Intergovernmental Agreement on the Asian Highway Network, on Asian Highway classification and design standards, provides the minimum standards and guidelines for the construction, improvement and maintenance of Asian Highway routes. However, it does not provide adequate guidance on road safety and road infrastructure safety facilities.

5. To address the above, the secretariat, with financial and technical support from the Korea Expressway Corporation in the Republic of Korea, has been conducting a study since 2015 on the development of road infrastructure safety facility standards for the Asian Highway network. The details of the study are included in section VI.A of the present document. The study includes a proposal for minimum design standards for road infrastructure safety facilities that could be annexed to the Intergovernmental Agreement on the Asian Highway Network, as well as related design guidelines for consideration by the Asian Highway member countries.

II. Road safety – a development challenge

6. Globally, an estimated 3 per cent of GDP is lost due to road traffic crashes. The estimated cost of road crashes to low-income and lower-middle income countries as classified by the World Bank is $225 billion a year. In some of the developing countries, the estimated GDP losses are as high as 6 per cent (Islamic Republic of Iran). In high-income countries, although the economic loss is as low as 1 per cent of GDP, the social impact is considerable. A study in the Republic of Korea showed that many victims of road crashes experienced job losses after a road crash (70.7 per cent of the disabled and 27.6 percent of the non-disabled victims). Another study, in Bangladesh, showed that most bereaved households went into debt, and one third of households had to sell an asset after a road fatality. Moreover, road crashes have a serious flow-on effect on hospital systems, especially in developing countries. For example, at the Thai Binh General Hospital in Viet Nam, more than half of patients admitted with injuries were road crash victims.

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7. The Asia-Pacific region accounted for 58 per cent of global road traffic deaths in 2013. Since 2010, there has been mixed progress in tackling road safety among member countries of the Economic and Social Commission for Asia and the Pacific (ESCAP). Road traffic fatalities dropped from 777,000 in 2010 to 733,000 in 2013, representing a reduction of 5.6 per cent (E/ESCAP/MCT(3)/9). Table 1 shows the changes in road crash fatalities in the ESCAP subregions between 2010 and 2013.

Table 1

<table>
<thead>
<tr>
<th>Subregion</th>
<th>Change in fatalities (Percentage)</th>
</tr>
</thead>
<tbody>
<tr>
<td>East and North-East Asia</td>
<td>Reduced by 5.53</td>
</tr>
<tr>
<td>South-East Asia</td>
<td>No change</td>
</tr>
<tr>
<td>South and South-West Asia</td>
<td>Reduced by 8.24</td>
</tr>
<tr>
<td>North and Central Asia</td>
<td>Increased by 2.94</td>
</tr>
<tr>
<td>Pacific island countries</td>
<td>Increased by 4.55</td>
</tr>
</tbody>
</table>


8. The average road traffic fatality rate for the Asian Highway member countries in 2013 was 16.95 fatalities per 100,000 inhabitants. For 2010–2013, 16 Asian Highway member countries were successful in reducing road fatalities, while 14 were not. The total number of fatalities in 30 of the 32 Asian Highway member countries, excluding the Democratic People’s Republic of Korea and Turkmenistan, for which data could not be compared, dropped from 771,271 in 2010 to 729,418 in 2013, representing a 5.43 per cent reduction (see table 2).

9. Table 2 shows the details of the changes in road traffic fatalities in the Asian Highway member countries for 2010–2013. The World Health Organization’s estimates for road traffic fatalities and the fatality rates in the Asian Highway member countries are shown in figure I. Several factors resulted in increases in the number of fatalities in some member countries. For example, in Bhutan, 49 per cent of road fatalities involved passengers of four-wheeled cars and light vehicles, but the existing seat belt law could not be enforced adequately. In the Philippines, 53 per cent of the fatalities involved riders of motorized two- or three-wheelers, but the helmet wearing rate among all riders was only 51 per cent.¹
Table 2
Changes in the number of road traffic fatalities in the Asian Highway member countries, 2010–2013 (Percentage)

<table>
<thead>
<tr>
<th>Country</th>
<th>Decline</th>
<th>Change</th>
<th>Country</th>
<th>Increase</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Georgia</td>
<td>-24.96</td>
<td></td>
<td>Malaysia</td>
<td>0.62</td>
<td></td>
</tr>
<tr>
<td>Singapore</td>
<td>-23.94</td>
<td></td>
<td>Russian Federation</td>
<td>1.72</td>
<td></td>
</tr>
<tr>
<td>Afghanistan</td>
<td>-23.76</td>
<td></td>
<td>Viet Nam</td>
<td>3.55</td>
<td></td>
</tr>
<tr>
<td>Turkey</td>
<td>-23.65</td>
<td></td>
<td>Uzbekistan</td>
<td>4.28</td>
<td></td>
</tr>
<tr>
<td>Lao People’s Democratic Republic</td>
<td>-23.30</td>
<td></td>
<td>Cambodia</td>
<td>8.39</td>
<td></td>
</tr>
<tr>
<td>Azerbaijan</td>
<td>-21.55</td>
<td></td>
<td>Kazakhstan</td>
<td>13.35</td>
<td></td>
</tr>
<tr>
<td>Pakistan</td>
<td>-14.44</td>
<td></td>
<td>Kyrgyzstan</td>
<td>19.37</td>
<td></td>
</tr>
<tr>
<td>Republic of Korea</td>
<td>-12.57</td>
<td></td>
<td>Mongolia</td>
<td>21.59</td>
<td></td>
</tr>
<tr>
<td>India</td>
<td>-10.16</td>
<td></td>
<td>Philippines</td>
<td>22.12</td>
<td></td>
</tr>
<tr>
<td>Japan</td>
<td>-9.87</td>
<td></td>
<td>Bangladesh</td>
<td>23.29</td>
<td></td>
</tr>
<tr>
<td>Indonesia</td>
<td>-9.79</td>
<td></td>
<td>Tajikistan</td>
<td>24.04</td>
<td></td>
</tr>
<tr>
<td>Thailand</td>
<td>-7.89</td>
<td></td>
<td>Sri Lanka</td>
<td>29.33</td>
<td></td>
</tr>
<tr>
<td>China</td>
<td>-5.30</td>
<td></td>
<td>Myanmar</td>
<td>50.61</td>
<td></td>
</tr>
<tr>
<td>Armenia</td>
<td>-2.15</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nepal</td>
<td>-1.55</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Iran (Islamic Republic of)</td>
<td>-1.30</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Average</strong></td>
<td></td>
<td><strong>-5.43</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Figure I
Estimated road traffic fatalities and fatality rates in the Asian Highway member countries, 2013


Note: Data for the Democratic People’s Republic of Korea was not available.

III. Road safety initiatives of the United Nations system

10. The entities of the United Nations system have a number of road safety initiatives. The World Report on Road Traffic Injury Prevention, launched in 2004, contained an invitation to the regional commissions to take a leading role on road safety issues.

11. Moscow Declaration on road safety and the Decade of Action for Road Safety 2011–2020. The first Global Ministerial Conference on Road Safety, which was held on 19 and 20 November 2009 with the title “Time for Action”, adopted the Moscow Declaration on road safety, in which the General Assembly was invited to proclaim 2011–2020 the Decade of Action for Road Safety with the goal of stabilizing and then reducing the forecast level of global road deaths by 2020.

12. Brasilia Declaration on Road Safety and ways to halve road traffic deaths by the end of the decade. The Second Global High-level Conference on Road Safety, which was held on 18 and 19 November 2015 with the title “Time for Results”, adopted the Brasilia Declaration on Road Safety, in which the participants affirmed their willingness to meet the Sustainable Development Goal target to halve road traffic deaths by 2020. In the Declaration, a holistic approach involving multiple sectors was reiterated: (a) strengthening road safety management and improving legislation and enforcement, (b) promoting safer roads and the use of sustainable modes of transport, (c) protecting vulnerable road users, (d) developing and promoting the use of safer vehicles, (e) increasing

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awareness and building the capacity of road users, (f) improving post-crash response and rehabilitation services, and (g) strengthening cooperation and coordination towards global road safety.

13. **Road safety and the Sustainable Development Goals.** On 25 September 2015, the General Assembly adopted the 2030 Agenda for Sustainable Development. The 2030 Agenda contains 17 Sustainable Development Goals and 169 associated targets which are intended to balance the economic, social and environmental dimensions of sustainable development. Two targets relate to road safety: targets 3.6 and 11.2. Target 3.6, by 2020, halve the number of global deaths and injuries from road traffic accidents, is even more ambitious than the goal of the Decade of Action for Road Safety 2011–2020. Target 11.2 states: by 2030, provide access to safe, affordable, accessible and sustainable transport systems for all, improving road safety, notably by expanding public transport, with special attention to the needs of those in vulnerable situations, women, children, persons with disabilities and older persons.

IV. **Road safety on the Asian Highway**

14. Section III of annex II to the Intergovernmental Agreement on the Asian Highway Network requires the parties to give full consideration to issues of road safety while developing the Asian Highway network. At the third Ministerial Conference on Transport, held in Moscow from 5 to 9 December 2016, the transport ministers of ESCAP member countries adopted the updated Regional Road Safety Goals, Targets and Indicators for Asia and the Pacific 2016–2020 (E/ESCAP/MCT(3)/11, annex VI). Goal 7 addresses developing the Asian Highway network as a model of road safety. It has four targets: (a) reduce the total number of fatalities and road crashes on the Asian Highway network, (b) reduce the number of fatalities on all Asian Highway network segments to less than 100 per billion vehicle-kilometres, (c) increase resource allocation for measures related to road safety along the Asian Highway network, and (d) improve Asian Highway network segments to be forgiving to road users if a crash occurs.

V. **Road infrastructure and road safety**

15. Roadway and roadside design elements have an effect on crash risk as they directly affect how road users, including drivers and pedestrians, perceive the road environment. Roadway elements provide guidance to road users in their decision-making processes. In particular, the geometry of the road influences crash rates as well as the severity of the crash. According to the *Highway Safety Manual* of the American Association of State Highway and Transportation Officials, 33 per cent of all road crashes result from a combination of roadway factors and human factors. However, these proportions may vary depending on the environment. A study on Mumbai-Pune Expressway road crashes in India showed that the combination of human and infrastructure factors resulted in 22.5 per cent of all road crashes.7

16. Not only the geometric features of the road but also the existing road safety facilities influence road safety. When encountering unexpected road geometry, the driver may still be able to maintain normal driving, but if the driver

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keeps receiving additional information, the driver may fail to maintain normal
driving and cause a road crash. Negative road engineering factors include those
where a road defect directly triggers a crash and where some elements of the
road environment mislead users and thereby create human error. A study on the
effectiveness of shoulder widths found that the crash risk for a road with a
60-centimetre-wide shoulder on each side was 30 per cent higher than a road
with a 1.8-metre-wide shoulder. Another study on median width revealed that a
multilane highway with a 3-metre-wide median has a 4 per cent greater
probability of crashes than a highway with a 9-metre-wide median.

VI. Improving road safety along the Asian Highway

17. While many Asian Highway member countries are actively addressing
issues related to road safety, road crashes remain an unresolved problem and a
major threat to sustainable development. Important initiatives that need the
consideration of the member countries are reviewed in the following paragraphs.

A. Development of road infrastructure safety facility standards for the
Asian Highway network

18. The compatibility of standards for road transport has been a dormant
issue for many years because road vehicles are neither captive to their ground-
based infrastructure nor strongly dependent on roadside infrastructure. Several
issues have affected the current call for greater standardization in the realm of
road transport. These include the expansion of the region’s internal market, the
increase in short-distance cross-border trade between neighbouring countries,
improved road infrastructure, and growing affluence resulting in an
unprecedented rise in the number of privately owned vehicles. In addition, the
region is also experiencing emerging road tourism with either increased personal
cross-border travel by car for tourism purposes, such as between China and
Thailand, or a rise in the number of international tourists renting vehicles in their
destination countries, both of which raise the question of standards relating to
driving practices and road infrastructure safety facilities.

19. Differences in national standards for the design and construction of road
infrastructure and for vehicles’ permissible weight, dimensions and emissions
pose various challenges for international road transport. Countries in Asia have
been trying to harmonize standards related to international road traffic; however,
little success has been achieved and national standards continue to take
precedence in most countries. Since July 2017, the secretariat has been working
on the development of harmonized standards on weights, dimensions and
emissions of road vehicles to facilitate transport along the Asian Highway
network.

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8 Ishtiaque Ahmed, “Road infrastructure and road safety”, Transport and
Communications Bulletin for Asia and the Pacific: Designing Safer Roads, No. 83
(Bangkok, ESCAP, 2013). Available from

9 Charles V. Zegeer and others, “Safety effects of cross-section design for two-lane
roads”, Transportation Research Record, No. 1195 (1988). Available from

10 David L. Harkey and others, “Accident modification factors for traffic engineering and
ITS improvements”, NCHRP Report 617 (Washington, D.C., Transportation Research
20. Additionally, while the harmonization of road construction standards continues to be important, the secretariat has recognized that attention should also be given to above-the-ground installations, in particular road infrastructure safety facilities such as clear zones, speed-reduction devices and roadside safety features. Easing drivers’ vehicle operation and providing a safe driving environment require predictability of events. It is highly desirable that this predictability of events be uniform along the region’s road infrastructure and that standards be established to that effect. Since 2015, the secretariat has been collaborating with the Korea Expressway Corporation on a three-year project on the development of technical standards on road infrastructure safety facilities and model intelligent transport systems deployments for the Asian Highway network, which is scheduled to be completed in 2017.

21. As part of this project, the secretariat is conducting a study on the development of technical standards for road infrastructure safety facilities for the Asian Highway network. A survey was conducted to assess the prevalence, type and design of standards for road safety facilities in the Asian Highway member countries. It included questions about 36 road infrastructure safety facilities, for example median barriers, rumble strips and pedestrian refuge islands, which had been selected due to their existing and potential use in the region. Participants in the survey were asked to estimate the perceived effectiveness of the road infrastructure safety facilities in their countries (figure II).
Figure II

Perceived safety effectiveness of road infrastructure safety facilities

- Sight distance
- Emergency telephones
- Emergency escape ramp
- Roadside parking
- Variable message sign
- Lighting
- Reflection mirror
- Motorcycle-friendly safety barriers
- Non-exclusive motorcycle lane
- Exclusive motorcycle lane
- Bicycle lane
- Variable speed limit
- Automatic regulation camera
- Visual traffic calming
- Speed hump
- Roundabout
- Intersection channelization
- Protected turn lane (pocket lane for turning)
- Pedestrian refuge island
- Pedestrian fences
- Sidewalk (footpath)
- Pedestrian crossings
- Centerline/edgeline rumble strip
- Skid resistance (anti-skid pavement)
- Clear zones
- Safety barrier end treatment
- Crash cushion with channelization
- Central hatching (painted median)
- Slide to protect headlight from opposite direction
- Median barrier
- Roadside barrier
- Colored lanes
- Flexible delineation posts
- Raised pavement mark
- Chevron mark
- Line marking

- Very effective
- Effective
- Not effective
- Not known
22. By systematically inspecting a road’s infrastructure condition and road infrastructure safety facilities, it is possible to develop an understanding of the probability of road crashes on a road section. Inspections are especially useful when crash data is unavailable or unreliable. An objective measure of the likelihood of a crash occurring and its severity, which is known as star rating, was used in the study. A person’s risk of death or serious injury is highest on a one-star road and lowest on a five-star road. The analyses were conducted using the International Road Assessment Programme methodology. It includes a road safety software platform which allows a user to create and analyse interactive safety reports for road sections. The results of analyses for a sample of 6,725 km of Asian Highway network roads in seven member countries (Bangladesh, India, Indonesia, Malaysia, Nepal, the Philippines and Viet Nam) were compiled as a part of the study. They showed that 51 per cent of the roads were rated three stars or better for vehicle occupants. However, only 16 per cent of the roads were rated three stars or better for pedestrians (figure III).

Figure III
Star ratings for sample Asian Highway roads

<table>
<thead>
<tr>
<th>Vehicle occupants</th>
<th>Motorcyclists</th>
<th>Pedestrians</th>
<th>Bicyclists</th>
</tr>
</thead>
<tbody>
<tr>
<td>One star</td>
<td>Two stars</td>
<td>Three stars</td>
<td>Four stars</td>
</tr>
<tr>
<td>18%</td>
<td>27%</td>
<td>30%</td>
<td>30%</td>
</tr>
<tr>
<td>22%</td>
<td>20%</td>
<td>31%</td>
<td>54%</td>
</tr>
<tr>
<td>31%</td>
<td>19%</td>
<td>16%</td>
<td>12%</td>
</tr>
<tr>
<td>24%</td>
<td>19%</td>
<td>16%</td>
<td>12%</td>
</tr>
</tbody>
</table>

23. The study also found that annex II to the Intergovernmental Agreement on the Asian Highway Network covers a limited number of road infrastructure safety facilities. For example, table 7 in section III of annex II provides minimum transition curve lengths for different terrain conditions. The study included the suggestion that the Intergovernmental Agreement should provide guidance to member countries on promoting a coordinated approach to the development and adoption of standards for road infrastructure safety facilities. The study included a new draft annex on Asian Highway design standards for road safety and related design guidelines. The study included the recommendation that member countries consider adopting technical standards for road infrastructure safety facilities to improve road safety on the Asian Highway network.

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B. Road safety audits

24. There are two types of internationally recognized road engineering approaches to reducing road crashes. Since the twentieth century, the reactive approach has been popular; in this method, a high-risk location is recognized after many crashes have already occurred and fatalities, injuries and damages have already taken place. In contrast, the proactive approach is comparatively new and encompasses crash prevention and the adoption of corrective measures to the road infrastructure and environment before crashes can take place. One proactive intervention is the road safety audit. It is a formal examination of the crash potential and safety performance of a road.

25. The benefits of a road safety audit are numerous. Studies that attempted to quantify the benefits of road safety audits yielded significantly positive results. For example, a study of road safety audits for new road projects in Australia indicated that the benefit/cost ratio for 75 per cent of the projects was greater than 10 for detailed design stage audits. The note by the Secretary-General on improving global road safety included a recommendation to improve infrastructure by conducting road safety audits for all new road constructions (A/70/386).

26. Member countries each have their own guidelines with procedures for conducting road safety audits. A comparative review study found significant differences among national road safety audit guidelines, including for Bangladesh, India, Malaysia and Nepal. Moreover, each road safety audit guidelines document or manual has its own style and format. In a research note published in 2011, the World Bank identified five critical areas of the road safety audit system in China. Given national differences, the secretariat recommends that a model road safety audit manual/guideline for the Asian Highway network be developed, so that member countries can adopt and implement a harmonized audit procedure.

C. Crash data collection and underreporting of road crashes

27. An important parameter for road safety management is the collection and use of accurate data related to road crashes and severity levels. However, data on road crashes are not robust in many Asian Highway member countries. Data interpretation is a prerequisite for accurate diagnostics of infrastructure-related issues. However, data constraints and inaccurate data reporting systems prevent understanding of the real magnitude of the road safety problem. In China, police-reported data and death registration data showed different trends in road traffic fatality rates for 2002–2007. In Kandy District, Sri Lanka, the extent of underreporting was as high as 56 per cent, demonstrating that the real burden of road traffic crashes was underestimated.

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D. **Deployment of intelligent transport systems**

28. Intelligent transport systems are an important tool that can be utilized to improve road safety on the Asian Highway routes. They have different applications, including assistance to vulnerable road users, weather and road condition monitoring and information, incident detection and warning systems, collision warning systems, emergency vehicle priority, speed and traffic signal enforcement, hazardous load monitoring, evacuation route signing and priority signing. A study conducted in the Republic of Korea found that automatic crash information notification systems, which enable vehicles to automatically notify an emergency management centre in the event of a crash, reduced freeway fatalities by more than 11.8 per cent.\(^\text{16}\) An Asian Development Bank study conducted in China concluded that intelligent transport systems had great promise for the future and as technologies improve and become cheaper, these systems had the potential to make substantial improvements to road safety.\(^\text{17}\)

E. **Adoption of a holistic approach involving multiple sectors**

29. Multiple variables, including human factors, infrastructure factors and vehicular factors, may be involved in a road crash. Knowledge of the human factors can be used to reduce the probability and consequences of user errors by designing transport systems to take into account user characteristics and limitations. For example, the reaction time of an elderly driver is longer than that of a younger adult. Adverse mental and physical conditions, for example decreased performance caused by alcohol, drugs or fatigue, lead to driver failure. As explained in section V, roadway and roadside design elements, including road infrastructure safety facilities, influence crash risks. Additionally, safe vehicles are an important part of road safety as they play a critical role both in reducing the frequency and the severity of crashes.

30. The *Global Status Report on Road Safety 2015* indicates that many Asian Highway member countries have not been able to adopt the holistic approach. For example, in addressing vehicular factors, in 2013, only seven of the Asian Highway member countries adopted partial or complete minimum standards for vehicles. Moreover, in terms of post-crash care, 15 did not have an emergency room-based injury surveillance system in place.

31. In many of the Asian Highway member countries, road-safety infrastructure-related interventions are implemented as a component of an overall highway project and without adequate coordination with other sectors related to road safety. The secretariat recommends the implementation in the member countries of road safety projects involving multiple sectors which address the issues holistically.

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VII. Issues for consideration by the Working Group on the Asian Highway

32. The Working Group on the Asian Highway is invited to review the document and consider the following issues: (a) the harmonization of the design and specification of road infrastructure safety facilities for the Asian Highway network and consideration of the adoption of technical standards for road infrastructure safety facilities to be annexed to the Intergovernmental Agreement on the Asian Highway Network; (b) road safety audits at different stages of road projects and the harmonization of the audit procedures among the member countries; (c) the improvement of data collection procedures with regard to road crashes and the consideration of initiatives to reduce; (d) the deployment of intelligent transport systems services for improving road safety; and (e) addressing road safety holistically and the implementation of road safety projects involving multiple sectors. The Working Group may also wish to provide updates on the progress and status of priority initiatives for improving road safety along the Asian Highway.