PART II

NATIONAL TRAFFIC SAFETY FIVE YEAR ACTION PLAN

1 INTRODUCTION

The 5-year Action Program (2008-2012) is the first phase implementation period of the proposed traffic safety measures in the Master Plan. This first Action Program is critical in ensuring that smooth and successful implementation of the proposed measures and shall be the basis for implementation conditions of the succeeding Action Programs.

1.1 Basic Principles of the Five-Year Action Program

In order to meet the requirements of the Master Plan and the strategies presented in Subsection 3.2, Volume 3, Part I, the following basic principles are introduced:

Basic Principle No. 1: The "All-people" and "Comprehensiveness" perspectives as indicated in the existing government polices as well as the "4Es" and "Stakeholders" approaches should guide the planning and implementation of measures indicated in this Action Program. The importance of these perspectives and approaches are clear, particularly in the implementation of Resolution No. 32/2007/NQ-CP dated 29 June 2008. Thus, the active participation of the whole political system is one of most important conditions for the success of this Action Program.

Basic Principle No. 2: This Action Program should consider the forecasted special political and socio-economic features as well as the traffic safety conditions in the whole country until 2012. During this period, Vietnam is in transition to accelerate its economic development and overcome its being classified among countries within the "poor threshold" in the world map. One of the characteristics of this Action Program period is the anticipated continuously increasing growth rates of private vehicle ownership, and thus very high motorization rate, for both motorcycles and cars. Given the forecasted high growth percentage of the vehicles and drivers, a slower implementation of necessary countermeasures (e.g. enhanced drivers' licensing renewal system) will lead to more complex situations and implementation in the later years.

Basic Principle No. 3: The Action Program should be integrated with all related existing orientations, policies, plans of the Government, in particular, the approved "Scheme to Enhance the National Traffic Safety and Order until 2010", and other socio-economic development strategies/plans.

Basic Principle No. 4: Among the various proposed measures from the Master Plan, those that are considered "of critical impact" or those measures whose implementation will result in significant impact in Vietnam's general traffic safety situation as well as to other proposed measures should be clarified and should receive high priority. Such measures can be recognized as those which result in the: (i) improvement of capacities of traffic safety related agencies; (ii) enhancement of institutional framework for traffic safety; and (iii) development of traffic culture, among others.

Basic Principle No. 5: The selected measures should be ensured under a strong leadership and with adequate financial and human resources.

1.2 Lessons from International Experiences in Formulation of the Action Program

Based on the following international experiences[1], many important activities in road safety cannot be undertaken effectively unless some basic systems are already in place and operational, at least at a minimum level. The main prerequisites for effective work in road safety in a country are set out below, with the first two as the most urgent. Depending on the resources available, other important improvements (such as improvements on hazardous work location) can also be included.

(1) Traffic Accident Database System

A very essential and of utmost priority is the establishment of an effective Traffic Accident Database System which will allow the nationwide collection of traffic accident data which will be centrally stored in a secure location, and with the data accessible to concerned agencies for analysis whenever and wherever necessary to be able to systematically develop and formulate traffic safety countermeasures and interventions. All compiled data/statistics and conducted analyses have to be widely disseminated to enable all other concerned agencies to fully participate in addressing problems related to traffic safety in the country.

(2) National Road Safety Council (similar to NTSC) and Coordinating Mechanism

While it is necessary for NTSC to be very independent, at the same time, it should also be a very effective coordinating mechanism among representatives of the most important organizations responsible for road safety. This may be made possible through a National Road Safety Council which has its own secretariat and has adequate funding and technical resources to ensure implementation of agreed measures based on decisions issued by the government.

(3) Demonstration Projects

In each section where improvements are to be undertaken, an opportunity to implement “demonstration” projects should always be taken to provide relevant experiences to concerned staff of key agencies and to establish procedures and practices towards road safety improvement. For example, the development of a Safety Audit System could initially involve the development of safety audit guidelines for use in safety checking of proposed new road schemes and their application, under the supervision of a road safety specialist, on two or three schemes by local traffic engineers for them to gain practical experience in identifying potential safety problems. In the same manner, the development of access and development control guidelines will benefit from the development of draft guidelines and then their application on two or three occasions by local traffic engineers under the supervision of the road safety specialist.

The first 5-year action program should seek to consolidate and improve road safety activities in each of the sectors affecting road safety. It should identify priorities and required indicative costs to make the necessary improvements in each sector. It should package the proposed improvements in such a way as to facilitate funding from external development banks and other aid agencies. It should identify the types of activities and interventions which can be financed through such agencies and those which will have to be funded by the central government or concerned agency.

[1]Source: UN ESCAP Road Safety Action Plans and Programmes, Bangkok, 2000

2 OBJECTIVES OF THE FIVE-YEAR ACTION PROGRAM

Based on the basic principles discussed in Chapter 1 of this Action Program and in the Master Plan volume, as well as analysis made on traffic situation in Vietnam in Volume 2 of this report, this chapter will present an outlook of the road traffic accident in Vietnam at present and in the coming years and outline a background to set up the objectives and targets of this 5-year Action Program for the period 2008-2012. To realize these objectives and targets, adequate sectoral action program development policies should be clarified.

2.1 Outlook of the Road Traffic Accident in Vietnam

This section discusses on the state of road traffic accidents at the beginning of this 5-year action program period 2008-2012 and prospects in the coming years. The most significant development on traffic safety in the whole country is the positive impact of Resolution No. 32/2007/NQ-CP dated 29 June 2007 issued by the Government.

1) Present Status: Decreasing but still High Rate of Traffic Accident

It is remarkable that with the implementation of Resolution No. 32/2007, the traffic safety situation is improved as exemplified by the decreasing rate in the number of traffic accident, particularly the remarkable decrease in the number of serious and extremely serious accidents.

Several years ago, on 19 December 2002, the Government has issued Resolution No. 13/2002/NQ-CP on measures to reduce the growing number of traffic accidents and incidence of traffic congestions. Soon after, the Central Party Secretariat has issued Directive No. 22-CT-TW on 24 February 2003 on the improvement of the Party's leadership to ensure traffic order and safety. Based on these important events, from 2002 until 2005, the objective to curb traffic accident seems feasible and within reach.

From 2006, however, the number of traffic accidents increased, sometimes even higher than that of the past. The number of fatalities in 2006 increased by about 1,000 deaths (around 10%) and by end of May 2007, a total of 6,660 traffic accidents were recorded nationwide, with 5,859 fatalities and 4,977 injuries, an increase of 23 accidents, 370 fatalities and 93 injuries compared with that of the period of the preceding year. The road traffic accidents in particular and the traffic order and safety situation in general have become more complex and seemed to be in chaos.

During the first half of 2007, with instructions from NTSC, the traffic police force increased its patrol and control activities, improved traffic accident treatment and investigation and enhanced cooperation in propaganda and education. However, the number of traffic accidents still drastically increased.

This scenario of increased rate of traffic accidents and apparent lack for regulatory environment has initiated the NTSC, MOT, MOPS, and other concerned ministries to work together to determine the causes of this increasing traffic safety risks and formulate effective measures to finally find a solution to this perennial social problem. And thus Resolution No. 32/2007/NQ-CP was issued as a step towards achieving the successful implementation of a comprehensive traffic safety program with the

participation of the entire political system.

The drastic implementation of this Resolution No. 32 has very positive impact towards traffic safety. One of the most remarkable results is the very high percentage (almost 100%) of helmet use among motorcycle riders on the road. Even with no improvements on road infrastructure, traffic accidents in the last months of 2007 and first months of 2008 were reduced in all three aspects: total number of accidents, fatalities and injuries, as follows:

- In 2007 there were 14,218 road traffic accidents with 12,857 fatalities and 10,631 injuries. Compared with 2006 figures, there was a reduction in the number of accidents (100 accidents or 0.07%) and injuries (by 299 or 2.7%) but an increase in the number of fatalities (667 deaths or 5.5%).
- During the first seven months of 2008, compared with figures during the same period in 2007, there was a reduction in the number of traffic accidents (1,368 or -15.44%), fatalities (1,115 or -14.01%) and injuries *(1,957 or -28.53%).

2) Future Scenario: High Risks of Road Traffic Accidents and More Complex Traffic Safety Conditions

Resolution No.32/2007/NQ-CP is basically an urgent measure to address the present traffic accident situation. While some of its measures may have value in the future, it is also necessary to determine other additional measures appropriate for the anticipated more complex development of traffic accidents and situations in the coming years by conducting an evaluation of risks of road traffic accidents. In other words, although this Resolution has given positive impacts on the traffic safety situation in general, the road traffic accident situation in the whole country is still at high risk.

It is anticipated that in the coming years, the country's economic development will continue and the economic and the living standards of the people will still improve. This will expectedly result also in the very high increase in motorization rate which, in turn, can lead to high risk of traffic accidents. As discussed in Chapter 9 of Volume 2 of this report, while the long-term forecast (until 2020) may indicate a high annual average growth rate in the number of vehicles (7.1%), the short-term scenario poses a much higher growth rate. In 2007, the number of newly registered vehicles was over 130,000 cars (an increase by 12.8%) and 3 million motorcycles (an increase by 16.4%). And if there are no effective measures immediately adopted, this annual growth rate of 12-16% will continue during the 5-year Action Program period of this Master Plan.

Another critical issue is the capacity of the infrastructure which is at present lagging in terms of meeting the travel demand. Even if the Government gives priority in the upgrading and development of the road system in the whole country, it however requires considerable resources, particularly huge amount of funds, so that infrastructure growth rate will be in accordance with the demand brought about by high motorization growth rate. On the other hand, the percentage of land available for transport is very limited: only 6.4% in Hanoi and 6.7% in Ho Chi Minh City as compared with about 22-25% in major cities of other countries.

Adding to these problems in disparity of growth rates of vehicles and infrastructure, the traffic safety and order is also affected by other more complex factors that are related to the traffic participants. The level of traffic safety awareness in general of most road users seems very low and thus not ready to meet the requirements of a modern traffic society. In addition, in the coming years, the country's relatively lax policies on Residence Law and International Integration are also expected to contribute to the further increase in motorization in the country.

2.2 Action Program Objectives and Targets

The abovementioned overview on traffic safety during this 5-year period presents the clear challenges to this 5-year Action Program. The following discussion presents the Rationale, Objectives and Target of this Action Program. In general, these are expectedly in concurrence with those in the approved "Scheme to the Improvement of the National Traffic Safety and Order until 2010".

1) General Objectives and Rationale

- This Action Program is formulated first of all to guarantee that the transport systems are operating comprehensively and smoothly for the purpose of social economic development while ensuring national defense, security and international economic integration. In addition, this Action Program aims to establish and maintain the social orders in the transport fields, ensuring the safety of road users and vehicles.
- It also aims to make all stakeholders realize that to be able to maintain traffic safety and order, everybody should take responsibility and not only expect the State agencies concerned and the road users.
- The Ministries, agencies, local authorities, social political organizations can do its part by proposing comprehensive measures to mitigate traffic accidents.
- Comprehensive measures must be formulated for long-term implementation. Then implementation should be started gradually, continuously, decisively, and patiently to achieve significant and lasting achievements and ensure a sustainable traffic safety and order.

2) Specific Objectives of the Action Program

- To deploy a system of basic measures to dominate effectively and sustainably the traffic accidents and as a first-step, to reduce these accidents.
- To form favorable conditions to reduce continuously the losses by traffic accidents, both in human and material resources, in the next 5-year planning period.
- To improve the knowledge, creating self-awareness of law implementation for road users, particularly for vehicle conductors.
- To enhance the management activities of transport mode quality.
- To strengthen the capacity for the legal enforcement forces of traffic safety order.
- To address the factors causing safety losses in transport infrastructures.
- To complete the activities of transport organization, system of legal documents of

traffic safety order.

- To continue completing the mechanism, management organization for traffic safety from the central to local level.

3) Targets

The abovementioned Scheme is aimed at “reducing the number of fatalities caused by traffic accidents from 5% down to 7%, number of fatalities per 10,000 road motorized vehicles decreasing from 6.5 down to 4.5 by the year 2010”.

The Master Plan has set up the Goal and Numeric Targets (Chapter 3, Volume 3, Part 1) as follows:

(i) To reduce the number of fatalities into half (based on 2007 figures) or to reduce fatality rate per 100,000 population into less than 6.4%.

(ii) To strengthen the capability and functions of the organizations involved in road traffic safety and to develop new organizations and rules/regulations necessary to ensure sustainability of traffic safety measures.

For the Action Program, the targets are based on the general targets of the Master Plan, as follows:

(i) Majority of road users (at least the same percentage of motorcycle users wearing helmet on the road, which is about 90%) have formed the inherent habit of respecting all traffic rules.

(ii) A reduction of 5.2 - 6% in traffic accidents per year against previous year, in terms of the absolute number of fatalities.

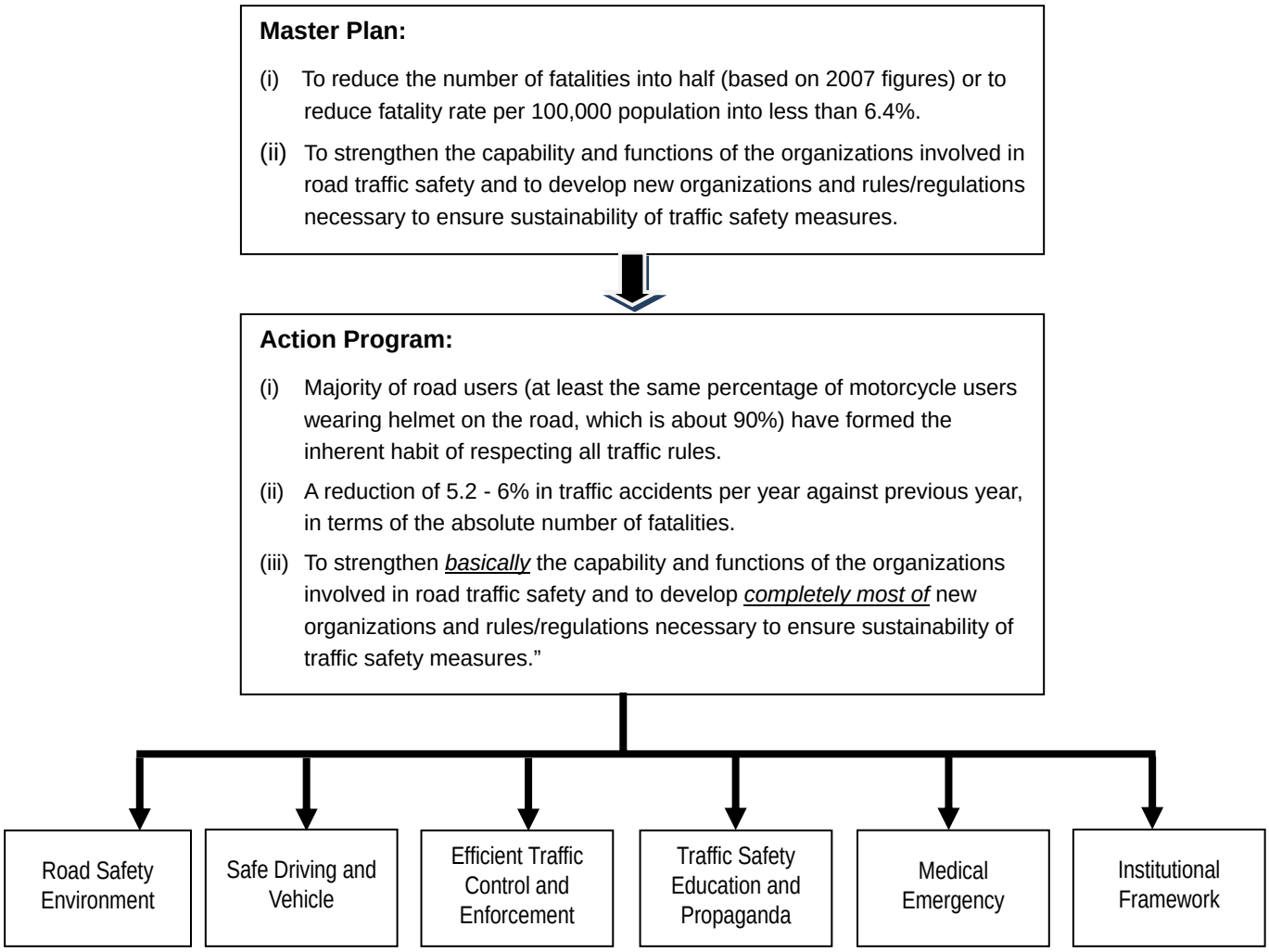
(iii) To strengthen *basically* the capability and functions of the organizations involved in road traffic safety and to develop *completely most of* new organizations and rules/regulations necessary to ensure sustainability of traffic safety measures.

2.3 Sectoral Action Program Development Policy

In the succeeding chapters, Action Program for each of the respective sectors and for institutional frameworks will be presented. As indicated in Figure.2.3.1, concrete targets will be determined based on common targets of this Action Program for each sector. The sectoral targets are examined based on the research data in other countries. Engineering sector shall play a major role accounting for 60% of the expected impact while enforcement, education and emergency shall account for 20%, 10%, and 10% of expected impacts, respectively.

To reach these special targets, selected activities are proposed together with implementation and investment plan. While each Sector Action Program should meet particular requirements of their respective sectors, each Sector Action Program should also be in coordination with the other sector plans to ensure a cohesive and comprehensive Traffic Safety Action Program.

Figure 2.3.1 Targets from Master Plan to Action Program and Sectoral Plans



Sectoral Targets

Sector	Share of Impact (Target)	Priority Program (Focus Areas)
Engineering	60% (15%)	■ 50% of the blacks spots on NH eliminated ■ Reduce 30% of M/C accident (fatality) on NH ■ Reduce 15% of Pedestrian and Bicycle on NH ■ Reduce 15% of Pedestrian and Bicycle in the urban areas
Enforcement	20% (5%)	■ Strict enforcement for flagrant law violations ■ Modernization of enforcement equipment
Education	10% (2.5%)	■ Traffic Culture development (community) ■ Improvement of school education institution
Emergency	10% (2.5%)	■ Reduction by 2.5% in the No. of fatalities in hospital ■ Disseminate pre-hospital care and 115 system
License, Inspection	-	■ Preparatory works for new license and vehicle registration system for both of M/C and Car
Institution	-	■ NTSC administrative enhancement ■ Traffic Safety Foundation ■ Human resource development

Source: JICA Study Team

3 ROAD TRANSPORT INFRASTRUCTURE DEVELOPMENT PLAN

3.1 Outline of the Engineering Action Program

1) Target Indicator to Reduce Accident

As mentioned in the Master Plan, the following are the set target indicators for the reduction of traffic accidents:

- Fatalities rate per 100,000 population less than 6.4 %, and
- Fatalities rate per 100,000 vehicles less than 1.2 – 1.8 %.

In order to achieve the above indicator, fatality rate per year should be approximately reduced by 5% compared to that of the previous year, with the total number of fatalities lowered to 10,000 in 2013 from 12,800 fatalities in 2007 (Table 3.1.1).

Table 3.1.1 Target Reduction in Traffic Accident by 2013 during the Action Program Period

Year	Number of Accidents			Population (000)	Number of Vehicle (000)		Fatality Rate	
	Accident	Fatality	Injured		Car	Motorbike	/100,00 person	/10,000 vehicle
2005	14,711	11,535	12,013	83,119	891	16,087	13.9	6.79
2006	14,727	12,757	11,288	84,156	973	18,616	15.1	6.51
2007	13,985	12,800	10,266	85,200	1,107	21,721	15.0	5.61
		- 5% / year ↓		+ 1% / year ↓	↓ + 10% / year ↓		↓	↓
2013	-	10,000	-	89,546	1,783	34,982	11.2	2.72

Source: Accident Data from MOPS.

Approximately 50% of traffic accident in Vietnam occurs on the national road, followed by 20% on the urban roads which are expected to increase with the rapid increase in urbanization and motorization. Thus, focus should be given on developing traffic accident measures for national and urban roads. Implementation of the Master Plan shall begin with the development of a 5-year action program, as follows:

(i) National Road

- Number of black spots in 2012 on national highway network will be reduced by 50% as compared to year 2007.
- Number of fatalities in 2012 caused by motorcycle accidents on national highway network will be reduced by 30% compared to year 2007.
- Number of accidents in 2012 involving pedestrians and bicycle users on national highway network will be reduced by 15% as compared to year 2007.

(ii) Urban Road

- Number of accidents in 2012 on urban roads will be reduced by 15% as compared to year 2007.

2) Outline of Contents of Action Program

An action program for road infrastructure traffic safety development is formulated to achieve the above target accident reduction not only through physical infrastructure

improvement but as well as institutional scheme, design guideline development, and capacity development program. Table 3.1.2 presents the outline of the 5-year action program in the road transport infrastructure development sector.

Table 3.1.2 Summary of Action Program for Road Infrastructure Development

Program	Program Components
1. Black Spot Improvement	1) Establishment of practical criteria to identify black spot. 2) Conduct of capacity development program for black spot management under WB and JBIC Traffic Safety Project. 3) Formulation of trainer training framework for engineers of RRMU and PDOT
2. Traffic Safety Audit System Development	1) Establishment of an executive guideline (Pre-F/S, F/S, D/D and operation stage) to coordinate with a technical assistance program under WB Traffic Safety Project. 2) Conduct of capacity development program on pilot traffic safety audit under WB Traffic Safety Project.
3. Traffic Safety Corridor Development	1) Formulation of a prioritized process to implement traffic safety corridor restoration from aspects of accident severity, traffic condition and roadside condition. 2) Establishment of database system to back-up implementation. 3) Establishment of institutional/legal framework of enforcing illegal dwellers and public consultation system for smooth implementation. 4) Preparation of amendment / supplement of legal provision to accelerate prioritized section.
4. Highway Traffic Safety Facility Enhancement	1) Implementation of physical infrastructure improvement project on national highway to include: - Intersection improvement in accordance with (to be specified) design standards. - Lane separation by vehicle type in accordance with (to be specified) design standards. - Upgrading of safety facility on railway crossing. - Strengthening of countermeasure for night-time accident on high-traffic and high-risk sections. 2) Establishment of practical and technical criteria to support the programs: - Technical design standards to clarify level of intersection improvement; geometrical improvement, installation of signal system and grade-separation improvement, depending on traffic conditions. - Design criteria for provision of lane separation by vehicle type to be considered a traffic rule on lane separation in accordance with traffic conditions.
5. Vulnerable Road User Accident Prevention	1) Implementation of physical infrastructure improvement project on national highway in cooperation with people at the local levels: - Provision of pedestrian path and bicycle path at necessary road sections based on to be specified design criteria. - Installation of pedestrian crossing facility at necessary road sections based on to be specified design criteria. 2) Establishment of technical criteria to install or provide the above pedestrian/bicycle safety facility in accordance with traffic condition. 3) Formulation of education program or campaign program to support the above infrastructure measures.

Program	Program Components
6. Expressway Safety Development	1) Establishment of responsible and supervising department in MOT. 2) Establishment of traffic regulation/rule and operation rule of expressway. 3) Formulation of a traffic operation/management standard and a technical standard of traffic safety facility/device by MOT. 4) Establishment of traffic safety assurance framework on expressway project or operation with the use of traffic safety audit system.
7. Road Work Traffic Safety Development	1) Establishment of a road construction work traffic safety guideline to be utilized for traffic safety audit during construction stage. 2) Implementation of a pilot performance-based maintenance project on selected section which has high risk of accident, and then establishing a performance standard/requirement for maintenance work, to realize proper maintenance system on major national highway. 3) Installation of vehicle weight station to mitigate accident related to overloading vehicles.
8. Traffic Safety Monitoring and Maintenance	1) Establishment of a traffic safety benefits evaluation guideline to include damage loss circulation method. 2) Formulation of traffic safety monitoring/evaluation framework after conduct of physical infrastructural measure.
9. Urban Road and Urban Bypass Traffic Safety Development	1) Improvement and upgrading of safety measures on intersection to include ensure safe pedestrian road crossing. 2) Formulation of phasing manual and technical guideline for signal control system to strengthen capacity of traffic control by traffic management authority (traffic police) as well as road management authority (TUPWS/PDOT/VRA), aimed to upgrade signal control system toward line control and area-wide control. 3) Establishment of trainer training system for capacity development on signal control. 4) Promotion of the following road infrastructure improvements related to overtaking/changing lane accident: - Installation of portable centre median facility on route or section of high frequency for overtaking accident. - Provision of bicycle path to mitigate accident risk due to mix traffic and implementation of a safety campaign. - Introduction of bus priority lane system on peak hour to mitigate accident risk due to mix traffic. - Development of urban planning and institutional framework to create parking space, in order to reduce on-street and sidewalk parking of motorcycles. 5) Conduct of urban bypass planning integrated with assurance of traffic safety corridor and traffic safety audit to introduce traffic impact assessment scheme.
10. Human Resource Development	1) Formulation of a technical guidebook for black spot treatment practice to support road management agency and design engineer. 2) Formulation of a technical manual on traffic safety audit to support design works by the engineer and practice by auditor.

Source: JICA Study Team

3.2 Black Spot Improvement

1) Targets

The following are the targets for the black spot improvement plan during the 5-year action program period:

- Formulation of cooperative mechanism between traffic police and road management authority.
- Establishment of practical criteria that can objectively identify position/location of black spot.
- Capacity building for VRA on black spot management by utilizing capacity development scheme under WB/JBIC Traffic Safety Project. VRA will then be encouraged to transfer technical skills at the local levels.

2) Program Components

(i) Establishment of a Cooperative Mechanism between Traffic Police and Road Management Authority

Information sharing of traffic accident records by Traffic Police should be an essential requirement for road management authorities to effectively implement black spot improvement through appropriate traffic safety measures. Thus, disclosure scheme of traffic accident records should be prioritized in the proposed black spot improvement system.

In the current road safety management, the traffic police only perform enforcement activities in the traffic management/safety facilities, which are installed by VRA/TUPWS/PDOT. However, since the traffic police are responsible in handling traffic accidents onsite, where most of the information can be collected, it is reasonable and necessary to give the traffic police authority and responsibility in traffic management planning and installation of traffic safety facilities.

The following actions are proposed to enhance cooperative mechanism between traffic police and road management authority:

- MOT and MOPS will enter into an accident record disclosure agreement by the end of 2008. Data format, timing of disclosure, information style, etc. shall be specified in the agreement.
- Disclosure of traffic accident records on national highways to VRA/RRMU will start in the beginning of 2009.
- Disclosure of traffic accident records on provincial roads to PDOT/TUPWS will begin in mid-2009.
- Traffic Accident Database System under VRSP-1 financed by World Bank will be formulated in accordance with accident record disclosure agreement between MOT and MOPS.
- Authority and responsibility with regards the planning, installation, operation, and maintenance for traffic management/safety facilities will be redefined between MOT and MOPS by the end of 2012.

(ii) Formulation of Practical Criteria for Black Spot Identification

The biggest challenge to black spot improvement is the unclear definition of black spot position, section and intersection. According to the review conducted on black spot improvement by VRA/RRMU in the Decision No.13/2005/QD-BGTVT, the black spot identification varies considerably from department to department or from person to person due to lack of information on accident records and vague criteria of black spot location.

This program component is therefore aimed at formulating the criteria for black spot identification with priority on implementing unified identification process among different concerned departments:

- VRA will collect information/data on black spot identification based on black spot identification procedures in the past years. RRMU will then review criteria used on black spot identification conducted in the past until end of 2008 which will then become the basis in determining issues on black spot identification process.
- VRA will be the lead agency in the formulation of practical technical criteria for black spot identification by the end of 2009. Various technical parameters such as road classification, traffic volume, facility and road conditions, speed regulation, etc. should be taken into consideration in the definition of black spot position, section.
- Technology & Science Dept. of MOT will organize the preparatory working group in charge of updating the criteria in coordination with related research institutes and submit these criteria to MOT for approval.
- Since VRSP-1 by World Bank as well as Traffic Safety Improvement Project by JBIC includes black spot analysis on the project route which shall utilize foreign consultants, TSMPU should coordinate with these programs in the formulation of black spot technical criteria.

(iii) Strengthening VRA Capacity on Black Spot Management

In order to establish itself as the authority and champion of black spot engineering management of the road network system, the capacity of responsible unit in VRA should be strengthened.

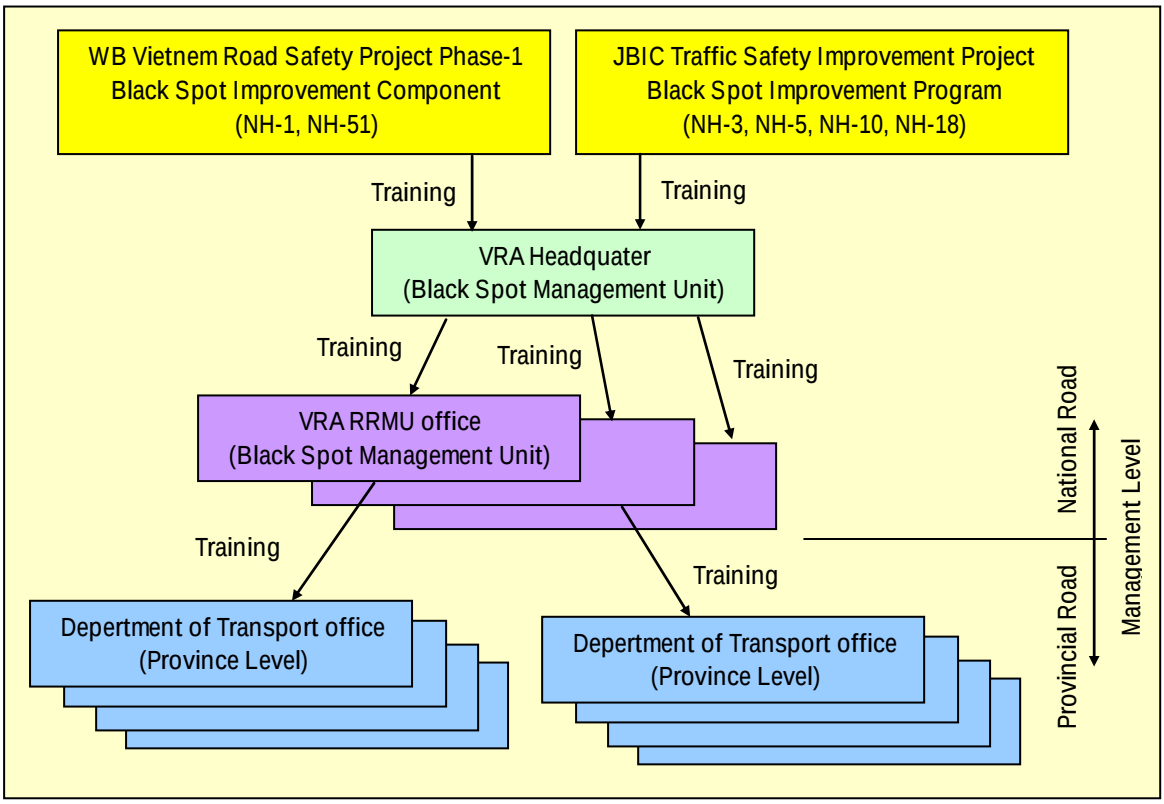
In the next 5 years, through the WB and JBIC's respective traffic safety projects capacity development programs (Figure 3.2.1), VRA staff will be trained on black spot management. This program subcomponent therefore proposes that an effective downstream training be implemented to strengthen concerned agencies at the provincial level.

- VRA will establish a responsible unit for black spot improvement within 2008. The black spot improvement component in WB VRSP-1 and the engineering component in JBIC traffic safety project also required the establishment of such responsible unit in VRA.
- VRA will undertake the black spot improvement project by WB and JBIC and then the capacity development programs will be implemented in both projects coordinated by TSPMU. At the outset, coordination with WB and JBIC capacity

development programs should be established to ensure that program contents include the trainers' training scheme wherein VRA may conduct training for RRMU and Provincial engineers.

- Parallel with capacity development programs by WB and JBIC, VRA will review past black spot improvement practices by REMU and then conduct evaluation of improvement results until the end of 2009. Method and format of evaluation may be revised to incorporate black spot improvement programs of WB/JBIC Project.
- RRMU will establish a responsible unit for black spot improvement within the end of 2009.
- Responsible unit in VRA will conduct training to RRMU engineers in 2010. RRMU engineers will then be expected to incorporate knowledge and skills in their implementation of black spot improvement.
- Responsible unit in RRMU will conduct training for engineers of Provincial Department of Transport (PDOT) in 2011 and support PDOT during the analysis/planning stage up to evaluation stage of the black spot improvement implementation which will be undertaken by PDOT.

Figure 3.2.1 Hierarchical Trainers Training for Black Spot Improvement



Source: JICA Study Team

3) Implementation Plan

Table 3.2.1 shows the schedule of implementation of black spot improvement program components in the next five years.

Table 3.2.1 Implementation Schedule of Black Spot Improvement Program

Program Components	Year					
	2008	2009	2010	2011	2012	2013
[Implementing Black Spot Improvement on National Highway by VRA]						
Establishment of a Cooperative Mechanism between Traffic Police and Road Management Authority						
1) Preparation of agreement on traffic accident record disclosure between MOPS and MOT.	▲					
2) Commencement of traffic accident record disclosure between VRA/RRMU and Provincial/City Traffic Police for National.	▲	→				
3) Commencement of traffic accident record disclosure between PDOT/TUPWS and Provincial/City Traffic Police.		▲	→			
4) Establishment of Traffic Accident Database System by WB VRSP-1						
5) Promotion of black spot improvement coordination between road management authority and traffic police						
Formulation of Practical Criteria for Black Spot Identification						
1) Review of present black spot identification criteria						
2) Implementation of black spot improvement pilot project including training/capacity development for engineers						
- Black spot improvement (NH-1,51) under WB VRSP-1						
- JBIC Traffic Safety Improvement Project (NH-3, 5, 10, 18)						
3) Formulation of practical criteria			▲			
Strengthening VRA Capacity on Black Spot Management						
1) Developing human resource/techniques/expertise exchange system related to black spot improvement						
- Establishment of responsible unit for black spot improvement in VRA	▲					
- Review and analysis of past black spot practices						
- Training of VRA engineers under the JBIC/WB Project						
- Establishment of responsible unit for black spot improvement in RRMU offices			▲			
- Training of RRMU engineers by VRA						
2) Promotion of black spot improvement implementation at the level of the local governments						
- Training of PDOT engineers by VRA RRMU						
- Black spot improvement of provincial roads by PDOT						

Source: JICA Study Team

3.3 Traffic Safety Audit System Development

1) Targets

Traffic Safety Audit (TSA) system is regulated by MOT Decision No.23/2007/QD-BGTVT. However, since there are still no clear implementing guidelines such as executive structure, scheduling, evaluation item, and criteria, this audit system is still not being implemented at present.

This TSA development program is therefore aimed at establishing executive guidelines for implementation of the TSA on national highways in the next five years.

- Preparation/formulation of executive guidelines and criteria to evaluate traffic safety in each project implementation phase by MOT.
- Formulation of safety audit implementation plan on national highway to complement with black spot improvement scheme and for implementation by VRA.
- Strengthening capacity for implementation of safety audit to conduct capacity development program in WB VRSP-1.

2) Program Components

(i) Revision of TSA Guideline

(1) Perspectives on the Executive TSA Guideline

The Study Team recommends that the revised TSA guideline should be harmonized with the existing technical review system by external consultant or person and black spot improvement implementation system mentioned in preceding subsection on Black Spot Improvement Plan, as follows;

- On pre-feasibility study (Pre-F/S), F/S and detailed design (D/D) stages, TSA is executed to collaborate with Pre-F/S, F/S or D/D review to be conducted by the external consultant and persons.
- During operational stage, TSA is executed to be an extension of the black spot improvement implementation.

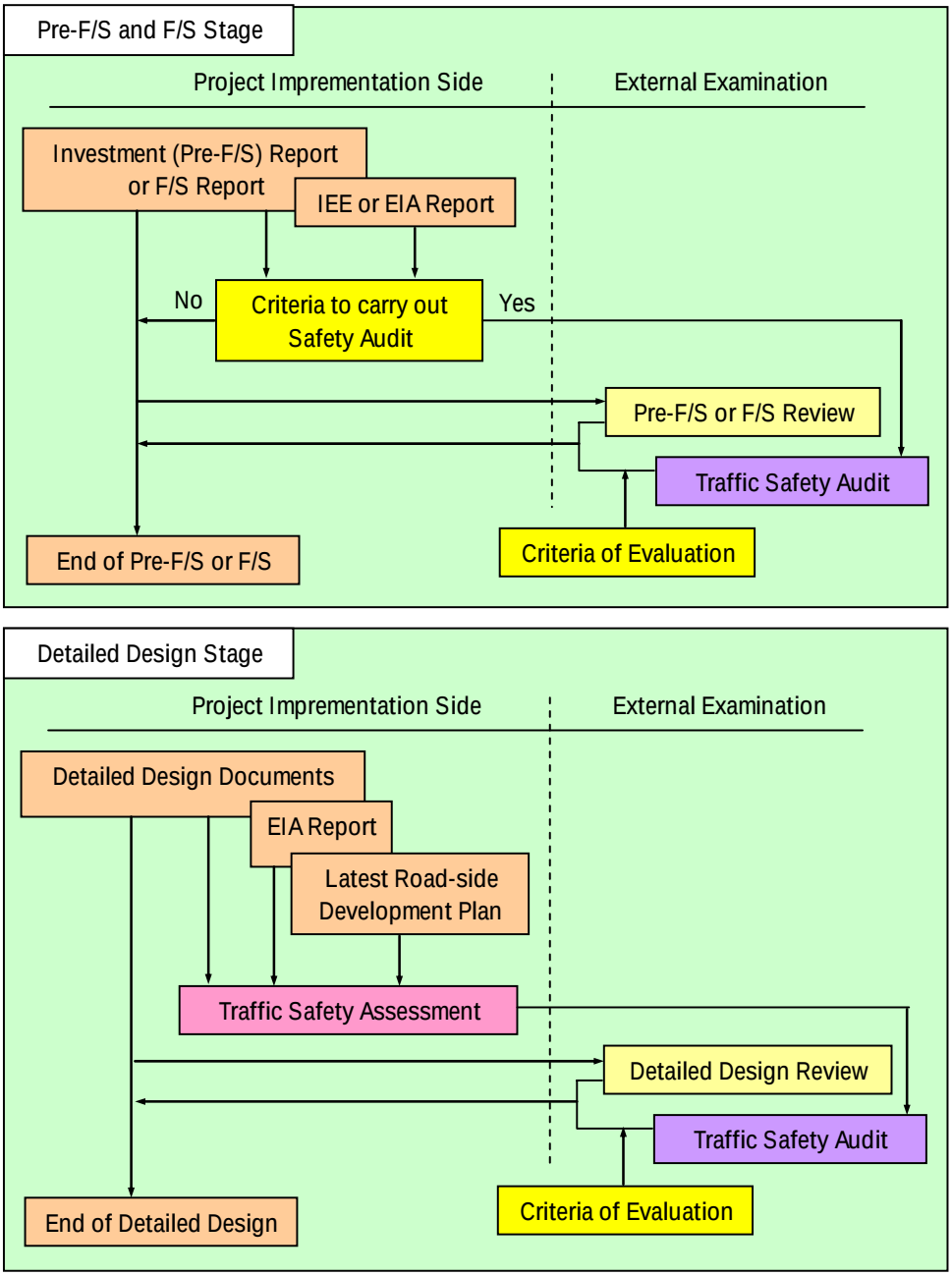
(2) Executing Process of TSA

(a) Pre-F/S, F/S and D/D Stage

The results of Pre-F/S, F/S and D/D of above road rehabilitation/ upgrade/new road construction project usually carry out a technical review conducted by an external agency. The Study Team is recommending that TSA be conducted parallel with the process of the said external review as shown in Figure 3.3.1. The following points should be taken into consideration in the revised guideline formulation:

- In Pre-F/S or F/S stage, that which is able to carry out TSA will be regulated. The said criteria is recommended to be configured with traffic demand forecast, road classification, traffic safety assessment in Initial Environment Examination (IEE) or Environmental Impact Assessment (EIA), and so on.
- In the D/D Stage, the Study Team recommends that the project implementing agency should be obligated to conduct the traffic safety assessment based on the design output and EIA study, and to take the latest roadside development plan into consideration.
- The standard item and criteria to evaluate traffic safety assessment by project implementing agency are given to the external safety auditor.

Figure 3.3.1 Proposed Executive Procedure of TSA during Pre-F/S, F/S, D/D Stage



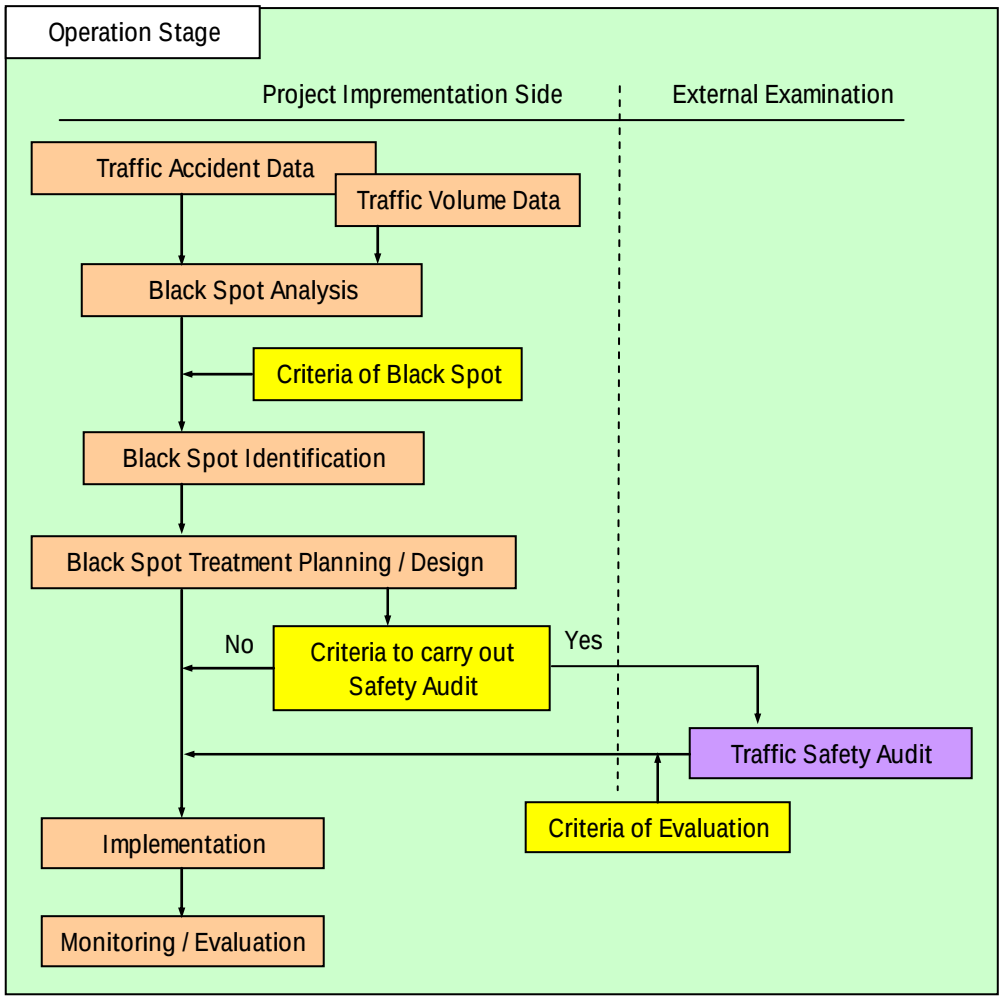
Source: JICA Study Team

(b) Operation Sage

The Study Team recommends that TSA during operation stage should be executed as part of routine procedure in the black spot treatment as shown in Figure 3.3.2.

- Whether the external audit is organized or not should be assessed from the regulated criteria that may be indicated such as severity of traffic accident, work scale of black spot treatment.
- The standard item and criteria are also given to the external safety auditor. In TSA, a series of process from black spot analysis to black spot treatment design is apprised by the auditor.

Figure 3.3.2 Proposed Executive Procedure of TSA during Operation Stage



Source: JICA Study Team

(3) Responsible Agency

MOT will have the responsibility in preparing and issuing the executive TSA guideline. However, VRA will fully cooperate with MOT in the exanimation of guideline during operation stage since the said examination should be collaborated to formulate the technical guideline of black spot improvement as mentioned earlier in Practical Technical Guideline Formulation subsection.

The revised guideline of TSA will be issued by the end of 2009 by the MOT.

(4) Suggestion on Black Spot Analysis and Identification

Several methods, which are to analyze available accident data and to identify black spots, have long been used to detect road safety deficiencies. Table 3.1.1 presents the representative evaluation indexes of simple criteria, from which are analyzed the data on the number of accidents, traffic volume and economic losses. The Study Team recommends introducing the objective index as given in Table 3.3.1 should be introduced in the black spot analysis and the criteria of black spot identification.

Table 3.3.1 Evaluation Index for Accident Data

Index	Outline
Accident Frequency	$f_{ip} = \frac{\sum f_j}{n}$ f ip = average accident frequency f j = accident frequency at site j of a reference population n = number of sites [Advantages] - simplicity of the criterion; - sites with high accident frequency are necessarily detected. [Disadvantages] - basis towards high traffic volume sites; - does not take into account accident severity; - does not take into account the random nature of accidents.
Accident Rate	$R_j = \frac{f_i \times 10^6}{362.25 \times PL_j Q_j}$ R j = average rate of site j (acc./Mveh-km) f j = accident frequency at site j P = period of analysis (years) L j = section's length of site j (km) Q j = average annual daily traffic of site j (AADT) [Advantages] - take into account traffic exposure; - is the most widely used identification criterion, which facilities comparison. [Disadvantages] - traffic volume must be known at each site; - does not take into account the random nature of accidents; - bias toward low-traffic roads (a random variation of a few accident per period will significantly modify the accident rate volume at such sites); - does not take into account accident severity; - assumes a linear relationship between traffic volume and accidents; this may be a source of error.
Critical Accident Rate	$R_{cj} = R_{rp} + K\sqrt{\frac{R_{rp} \times 10^6}{365.25 \times PL_j Q_j} + \frac{1 \times 10^6}{730.5 \times PL_j Q_j}}$ Rc j = critical accident rate at site j (acc./Mveh-km) Rr p = average accident rate at similar sites (acc./Mveh-km) K = statistical constant P = period of analysis (years) L j = section's length of site j (km) Q j = average annual daily traffic of site j (AADT) [Advantages] - take into account the random nature of accidents; - take into account traffic exposure. [Disadvantages] - complexity of the method; - does not take into account accident severity; - assumes a linear relationship between traffic volume and accidents; this may be a source of error.
Equivalent Property Damage Only	$EPDO_j = \sum w_i \times f_{ij}$ EPDO j = equivalent property damage only index at site j W i = weighting factor for an accident severity i f ij = frequency of a severity i accident at site j

Index	Outline
Index (EPDO Index)	[Advantages] - take into account accident severity; - simplicity of the criterion. [Disadvantages] - does not take into account traffic exposure; - take into account the random nature of accidents; - bias towards high-speed sites such as rural roads.
Relative Severity Index (RSI)	$RSI_j = \sum f_{ij} \times Ci$ RSI j = relative severity index at site j f ij = frequency of a type i accident at site j C i = average cost of a type i accident [Advantages] - take into account accident severity; - reduce the influence of exogenous variables having an impact on accident severity. [Disadvantages] - the development of the cost grid may be complex; - does not take into account traffic exposure; - does not take into account the random nature of accidents; - bias towards high-speed sites such as rural roads.
Accident Prediction Models	$P.I._j = f_j - f_{pj}$ P.I. j = potential for improvement at site j f j = accident frequency at site j f pj = estimated accident frequency at site j [Advantages] - improves the accuracy of the estimated potential for improvement. [Disadvantages] - relatively complex; - does not take into account the random nature of accidents; - bias towards high-speed sites such as rural roads.
Empirical Bayesian Methods	$P.I._j = f_{EBj} - f_{pj}$ P.I. j = potential for improvement at site j f EBj = EB adjusted accident frequency at site j f pj = estimated accident frequency at site j $f_{EBj} = f_j + \frac{f_{rp}}{s^2}(f_{rp} - f_i)$ f j = accident frequency at site j f rp = average accident frequency (reference population) = $\frac{\sum f_j}{n}$ n = number of sites (reference population) s^2 = average accident frequency (reference population) = $\frac{\sum (f_j - f_{rp})^2}{n-1}$ [Advantages] - take into account the random nature of accidents; - improves the accuracy of the estimated potential for improvement. [Disadvantages] - relatively complex.

Source: Road Safety Manual, World Road Association. 2003.

(ii) Promotion of TSA System to Road Management Authority

The target of TSA Development Plan in 5 years is that TSA system is entrenched on the national highway development project, therefore, the following action will be taken to promote TSA System:

- MOT will formulate the TSA implementation plan on Pre-F/S, F/S and D/D stage including budget allocation in accordance with executive guideline by the end of 2009.
- From 2010, TSA will be conducted in each phase of the selected project and MOT will monitor the results or output from the TSA.
- By mid-2010, VRA will formulate the TSA implementation plan for the existing roads in parallel with the formulation of practical black spot improvement guideline and review/analysis of past black spot practice (as listed in Table 3.2.1). TSA will then be conducted on the selected national road.

(iii) Strengthening Implementation Capacity for TSA

The pilot project and capacity development program of TSA will be carried out under WB VRSP-1. The Study Team recommends that the above executive guideline formulation, implementation planning and monitoring of TSA implementation on the national highways will be performed in coordination with the activities of the Traffic Safety Audit Component under VRSP-1.

3) Implementation Plan

Table 3.3.2 shows the schedule of implementation of TSA development program components in the next five years.

Table 3.3.2 Implementation Schedule of TSA Development Program

Program Components	Year					
	2008	2009	2010	2011	2012	2013
Revision of Traffic Safety Audit (TSA) Guideline						
1) Formulation of executive process and evaluation criteria by MOT						
- Pre-F/S, F/S and D/D stage						
- Operation stage						
2) Issuance of revision on TSA guideline by MOT		▲				
Promotion of TSA System to Road Management Authority						
1) Preparing TSA implementation plan on national highway						
- Pre-F/S, F/S and D/D stage (by MOT)						
- Operation stage (by VRA)						
2) Formulation of implementation plan on national highway						
TSA Pilot Project in WB VRSP-1						
1) TSA Pilot Project						
2) Capacity Development Program						

Source: JICA Study Team

3.4 Traffic Safety Corridor Development

1) Targets

Based on Decision No.1856/QD-TTg: Plan for Restoration of Traffic Safety Corridor

dated 27 December 2007, MOT/VRA will re-establish the implementation plan on traffic safety corridor on the national highway which will be divided into three (3) stages:

Stage-1 : Pilot Implementation on NH-1 (up to 2nd Quarter of 2008)

Stage-2 : Nationwide Action Program Formulation (from 2nd Quarter of 2008 to 2010)

Stage-3 : Implementation of Clearing Operations (from 2010 to 2020)

The pilot implementation on NH-1 is now on its final phase and VRA is at present compiling a review report prior to the next stage which is the nationwide action program formulation. The Study Team underscores that the following recommendations be considered in the implementation of the action pan to be formulated by MOT/VRA in order to ensure sustainability and investment effectiveness:

- Prioritization of national highway sections in the implementation plan from the perspective of current severity of traffic accidents on national roads, traffic capacity, and over-access, as well as establishment of database as backup tools.
- Formulation of supporting institutional framework to enhance restoration process.
- Issuance of supplementary legal provisions for Decree No.186/2004/ND-CP: Prescribing the Management and Protection of Road Traffic Infrastructures in order to accelerate the implementation process.

2) Program Components

(i) Prioritization of Traffic Safety Corridor Restoration Perspective

According to VRA survey, the cost of clearance and compensation for NH-1 safety corridor restoration for its entire 2,300km length is estimated at approximately VND14,366 billion, approximately 50% of MOT's 2008 investment budget for rehabilitation/improvement/upgrading projects on national highway. Since total length of national roads is 17,000 km, it is recommended that aside from financial aspects, the following indicators be considered in the prioritization of national road sections in the implementation plan: (1) severity of traffic accident, (2) traffic capacity and (3) over-access. Figure 3.4.1 illustrates this prioritization process based on proposed evaluation criteria.

(1) Severity of Traffic Accident

After obtaining accident records on national highway from the traffic police, the accident analysis will be conducted nationwide. Severity of traffic accident may be computed based on severity index formula shown in Table 3.3.1 by considering accident factors such as number of black spots.

(2) Traffic Capacity

Overloading of traffic capacity against the existing geometric condition of the road is also deemed a risk factor to high occurrence of traffic accident. Thus, it is very important to balance traffic volume with road facility conditions such as number of lane, carriageway/paved shoulder width. In addition, if the realistic road development plan for rehabilitation, improvement and upgrading are approved, this plan should be considered in the evaluation for prioritization of road sections.

JICA is at present conducting the Vietnam Transport Strategy Development Study (VITRANSS II). This study will formulate a road network development plan to consider the expressway network development based on traffic demand forecast. Therefore, the study's recommendation on national road improvement /upgrading may also be utilized as basis in the evaluation for prioritization of road sections.

(3) Over-access

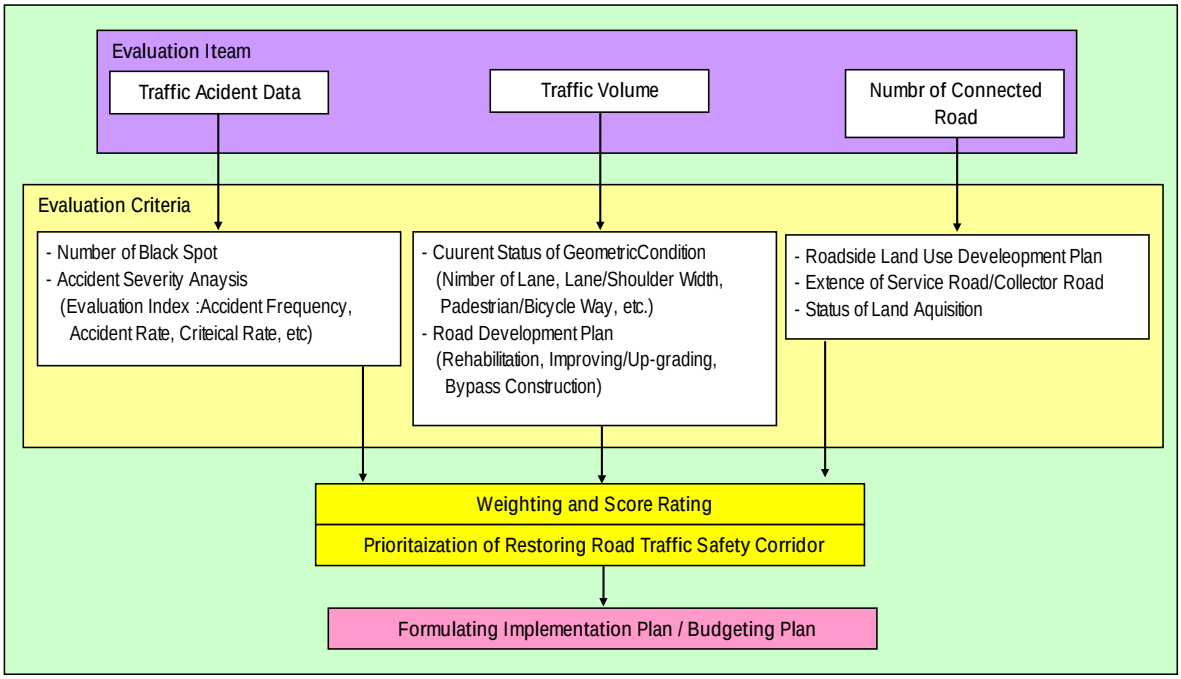
One objective of maintaining safety corridor is to regulate anarchic road connection with main road to reduce risk of traffic accidents. Therefore, the number of road connection points to the main road should be an indicator in the prioritization process. The following items are considered in the evaluation:

(a) Degree of reality or maturation value of land use development plan on roadside.

(b) Existence of road-side service road or collector road, or maturation value of this construction plan.

(c) Status or difficulty for land acquisition and compensation.

Figure 3.4.1 Prioritizing Process in Traffic Safety Corridor Implementation Plan



Source: JICA Study Team

(ii) Recommendations for Safety Corridor Restoration

(1) Roadside Land-use Planning on Heavy-Accessed Sections

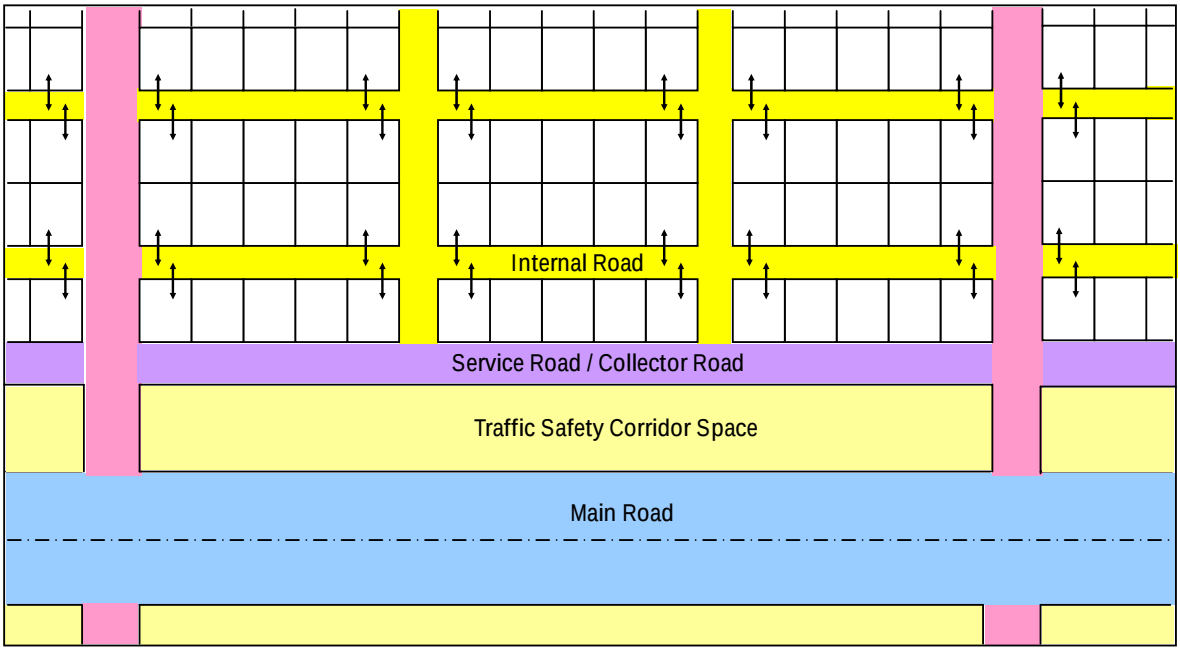
From traffic safety aspect, as well as to ensure smooth traffic flow and comfortable driving experience, the road connection with main road should be regulated along the heavy traffic, heavy-accessed sections such as commercial/ industrial zones and new residential development zones. Figure 3.4.2 shows an example of roadside land use arrangement which may be described as follows:

(a) Service road/collector road is provided parallel with the main road, and then

connection with internal road and main road are controlled by service road/ collector road.

(b) Access to service road/collector road from individual house, shop, factory should also be regulated in order to avoid congestion and illegal stopping or parking on service road/collector road.

Figure 3.4.2 Proposed Land Arrangement on Heavy Accessed Section



Source: JICA Study Team

(2) Amendment to/Supplement of Legal Provision

The following are recommended to be taken into consideration in the amendment of or supplementation to the existing legal provisions related to safety corridor:

(a) One of the objectives of the safety corridor is to ensure that the road infrastructure is protected from the outside. The expressway is constructed with full control access from the outside road by an interchange. And due to adopting higher standard in hydrological design, the road elevation is designed higher than the normal highway to ensure visual distance for traffic safety. Based on these technical perspectives, the required width of 20 m may be flexibly applied.

(b) National highways are expected to be improved and upgraded to be able to meet the increasing traffic demand in the future. Thus, required road widening should be ensured by protecting the traffic safety corridor space.

(iii) 5-year Action Program

The following action program is recommended in the implementation of traffic safety corridor restoration on national roads:

(1) Formulation of a Nationwide Implementation Plan

(a) VRA will conduct evaluation and prioritization of sections for implementation on national highway until the middle of 2009.

(b) VRA will establish a database system to integrate all related information and to formulate the nationwide implementation plan until the end of 2009. This database includes date of prioritization and examination mentioned above, inventory data, compensation price, number and location of illegal dwellers, progress on compensation, status of clearing operations, etc.

(c) VRA and local authorities will conduct inventory survey and cost estimation for compensation on priority section, and then complete to prepare and submit budgetary request form by the middle of 2010.

(d) Compensation and clearing on selected priority section will commence from the middle of 2010 after approval of the budgetary request.

(2) Establishment of Supporting Institutional Framework

(a) In collaboration with related legal authorities, MOT will formulate legal framework for strengthening and strict enforcement of sanctions against returning illegal dwellers and then issue a directive on this legal framework to the provincial government by the middle of 2009.

(b) VRA will formulate compensation framework for affected people, including determination of compensation price, executive organization, compensation process and schedule. The local authorities will formulate practical action program based on the said framework until the middle of 2010.

(c) VRA will also formulate public consultation framework and the local authorities will establish implementation plan including employment practical action progam based on the said framework until the end of 2010.

(3) Formulating Amendment to/Supplement for the Legal Provision

(a) MOT/VRA will examine the technical issues and solutions to find out from the execution/monitoring pilot implementation on NH-1 and formulating works of nationwide action program by the middle of 2009.

(b) In collaboration with related ministries, MOT/VRA will examine the technical issues and solutions in compliance with related legal framework on land use, urban development, industrial development, etc. by the end of 2009.

(c) MOT/VRA will formulate a draft amendment or supplement of legal provision for “Decree No.186/2004/ND-CP: Prescribing the Management and Protection of Road Traffic Infrastructures“ and submit to legal authorities by the middle of 2010.

3) Implementation Plan

Table 3.4.1 shows the schedule of implementation of traffic safety corridor development program components in the next five years.

Table 3.4.1 Implementation Schedule of Traffic Safety Corridor Development Program

Program Components	Year					
	2008	2009	2010	2011	2012	2013
Formulation of Nationwide Action Implementation Plan						

Program Components	Year					
	2008	2009	2010	2011	2012	2013
1) Examining Prioritization of Traffic Safety Corridor Restoration Perspective						
2) Development of database system						
3) Formulation of implementation action program						
4) Conduct of inventory survey for compensation and preparation of budgetary form on priority section of national highway						
5) Implementation of compensation plan and clearing operations on selected priority section.						
Formulation of Supporting Institutional Framework						
1) Formulation of legal framework for strengthening and strict enforcement of sanctions against returning illegal dwellers.						
2) Establishment of compensation system						
3) Establishment of public consultation system						
Amendment to /Supplementing of Legal Provision						
1) Examination of technical issues from monitoring of NH-1 pilot implementation and nationwide action program formulation.						
2) Examination of compliance with related legal frame work of land use, urban development, industrial development, etc.						
3) Formulation of draft amendment to/supplement of legal provision and submission to legal authorities.						

Source: JICA Study Team

3.5 Highway Traffic Safety Facility Enhancement

1) Targets

The highway traffic safety facility enhancement plan should serve as a core program in the engineering sector. According to the accident records, approximately 50% of accident occurs on the national highways. Therefore, the Study Team recommends that safety measures on national highway network will be intensively implemented to achieve the following targets.

(i) Accident Reduction on National Highway

The following two achievement targets are put in the traffic safety facility enhancement plan to reduce traffic accidents:

- Number of black spot in 2012 on national highway network will be reduced by 50% compare to year 2007.
- Number of fatality caused by motorcycle in 2012 on national highway network will be reduced by 30% as compared to year 2007.

(ii) Infrastructure Improvement Level

In order to achieve the target of accident reduction, the following achievement targets for infrastructure improvement are put in the plan:

- All intersection improvements on higher than grade-III national highway will be completed in accordance with design standards to be specified.

- All of high traffic volume sections on higher than grade-III national highway III which have been documented to exceed the standard traffic volume given in TCN4054:2005 (Grade-III: 6,000 pcu; Grade-II: 15,000 pcul Grade-I: 25,000 pcu) will be provided separate lanes for motorcycle/bicycle passing.
- All railway crossings will have warning signal system installed while railway crossing on national highway will be replaced with automatic opening and shifting lifting barrier.
- All of higher traffic section where there are more than 10,000 vehicles/day and high accident risk sections will have lighting system installed.

2) Program Components

(i) Design Standards/Guidelines Preparation for Traffic Safety

Before the implementation of physical infrastructure improvement, the reexamination of design standards/guidelines is suggested not only for this highway traffic safety facility enhancement plan, but also for black spot improvement and TSA system development plan. The following are the proposed sub-components, as follows:

(1) Recommendations on Improving Design Standards/Guideline

Major items considered for updating in the standards/guidelines are summarized in Table 3.5.1. It is proposed that the Science & Technology Department of MOT and other related research agencies form a technical working group among themselves and examine problems and issues on existing design standards/guidelines for the subject on traffic safety subject and improve the design standards/guideline.

(2) Integrity with Traffic Rule and Traffic Management

It is critical for MOPS (traffic enforcers) to coordinate and arrive at a consensus with MOT (traffic management) on the proper use of installed safety facilities to ensure consistency of traffic regulation/rule with traffic management. For a parallel examination and preparation of safety facility design standards/ guidelines, it is necessary for MOT to discuss with the Road & Railway Traffic Police Bureau of MOPS the interface with traffic rule, traffic management/ enforcement operation by Traffic Police. The following are proposed contents subject for discussion and consensus:

(a) Installation guideline of regulatory/warning sign post or sign board at location where there is change in speed limit.

(b) Sections where overtaking is prohibited such as in congested town area and curve section (beginning and end points should be provided with traffic signage); centerline marking and regulatory/warning sign post/board.

(c) Traffic signal system installation guideline and equipment/device mechanical requirement from aspects of traffic management/enforcement.

(d) Traffic regulation/rule as basis of safety measure to provide separate lanes by vehicle type.

Table 3.5.1 Recommended Items of Design Criteria on Safety Measure

Safety Measure	Suggestion of Supplement Criteria
Selection of Intersection Type	- Standard traffic volume on main road and crossroad to select intersection type; at-grade type without signal control, signal control type, grade-separation type. - Standard requirement for pedestrian/bicycle safety crossing measure (signal system, pedestrian bridge).
Geometric Design of Intersection	- Standard traffic volume to provide turn left or right lane - Geometric standard of turn left or right lane length on general at-grade intersection. - Setting minimum lane width of turn left and right lane.
Signal Control System	- Establishing phasing control technical manual. - Standard requirement to install signal equipment in accordance with signal type (position, height, support type, etc.). - Standard mechanical requirement of device and interface to introduce integrated system in future.
Intersection with Minor Road	- Standard arrangement of speed reduction facility such as hump and rumble strip on connected miner roads.
Traffic Sign Installation	- Standard size of sign post, sign board and character in accordance with road classification and speed limit.
Separate Lane Provision by Vehicle Type	- Standard traffic volume and vehicle mix-rate to provide separate lane for motorcycle and bicycle - Standard lane width of motorcycle and bicycle. - Traffic rule and standard safety measure on left-turns of motorcycle.
Safety for Pedestrian	- Required condition to provide pedestrian path. - Standard width and technical requirement for pedestrian path. - Standard number of pedestrian to provide pedestrian signal system at intersection crossing and phasing requirement.
Busy-stop and Bus-bay Facility	- Standard traffic volume and estimated bus passage to provide bus- bay facility. - Standard geometric guideline of bus- bay facility.
Safety on Railway Crossing	- Standard arrangement of safety facility to provide crossing facility, warning sign and signal system including lane marking arrangement according to traffic volume and number of train. - Standard traffic volume to be improved by separate-grade type of crossing.
Safety on Curve Section	- Traffic rule to regulate overtaking on curve section. - Standard curve radius and other conditions to install warning sign, guardrail and detector. - Standard arrangement to install safety facilities.
Safety on Hill & Mountainous Section	- Standard traffic volume and vehicle mix-rate to provide climbing lane or passing place/waiting lane for heavy vehicle. - Standard geometric criteria to provide climbing lane or passing place/waiting lane. - Standard arrangement of safety facility such as road marking, road stud and warning sign post/bard on overtaking regulated section.

Source: JICA Study Team

(3) Activity Plan

The Study Team recommends that a booklet on road traffic safety design to be integrated with improved standards/guidelines and existing one will be established and issued for use by road engineers in Vietnam.

(a) Technology & Science Department of MOT will lead in organizing the related research institute to examine the problems and issues and to establish the working groups by subject which will prepare the design standards/guidelines until the end of 2008.

(b) Technical issues to interface with traffic rule and traffic management/ enforcement will be solved to discuss with Road & Railway Traffic Police Bureau of MOPS and authorized with MOPS and MOT by the middle of 2009.

(c) Each working groups will submit draft design standards/guidelines to Technology & Science Department of MOT, which will be approved by MOT by the end of 2009.

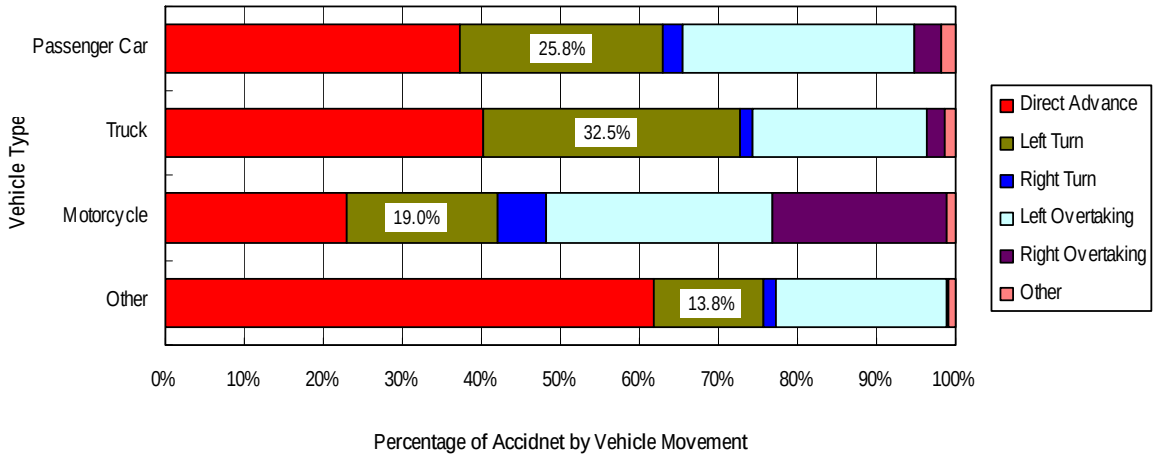
(d) Integration design standards/guideline and preparation of instruction manual for traffic safety design will be completed by the middle of 2010. Preparation of standard drawings and a booklet on Traffic Safety Design Standard will be completed.

(ii) Intersection Improvement

(1) Safety Measure on Intersection

Figure 3.5.1 shows the accident type by vehicle movement mode based on analysis by Police Academy. This figure indicates that the accident occurrence rate from left turning is 25.8%, 32.5% and 19.0% for passenger car, truck and motorcycle, respectively. Intersection improvement is therefore suggested to mitigate such accident.

Figure 3.5.1 Accident Type by Vehicle Movement Mode



Source: Accident Data (2001) form Police Academy

The following measures will be executed on the grade-III national highways, where traffic accidents occur:

(a) Completion of the intersection geometric structure to harmonize with design criteria of TCVN 4054: 2005 Highway Specifications for Design on higher than grade-III national highway.

(b) Installation of signal control system at all intersection shall be required by the specific criteria on higher than grade-III national highway.

(c) Promotion of grade-separation improvement at the required location to the specified criteria on higher than grade-III national highway.

(2) Providing Right/Left-turning Lane

(a) Recommendation on the Preparation of Supplemental Design Criteria

A standard design chart to select intersection type is given in Clause 11.1.4 of TCVN 4054: 2005 Highway Specifications for Design based on annual daily traffic volume on main road and connected road. However, in order to achieve realistic progress in intersection improvement, the formulation of the following supplemental criteria is being recommended:

- TCVN 4054:2005 has specified only turn-right channel with channelized island and did not mentioned turn-right lane. From financial perspective, the standard traffic volume to provide turn-right lane should be given in the design specification.
- Traffic volume percentage of left/right turn on main road should be specified to at-grade intersection geometric design.

(b) Criteria of Japan Highway Design Specification

The criteria to provide right/left-turning lane on Japan Highway Design Standard is summarized in Table 3.5.2. For further reference, the road classification by Japan Highway Design Standard are listed in the Volume 4: Appendices.

From the perspectives of mitigating risk of traffic accident related to left-turning and preventing to decrease traffic volume, the left-turning lane is basically provided on the truck road, except the case of the road of which traffic volume is less than 200 vehicle/hour and percentage of left turning is less than 20%.

For the geometric design of right-turning, the right turn lane or turn-right channel are designed from the traffic capacity analysis on intersection, which calculates the following saturated traffic flow rate:

$$S_A = S_B \times \alpha_w \times \alpha_G \times \alpha_T \times \alpha_{RT} \times \alpha_{LT}$$

where, S_A: saturated traffic flow rate on actual lane (vehicle/blue signal 1 hour)
S_B: standard traffic volume of saturated traffic flow rate (pcu/blue signal 1 hour)
α_w: correction factor by lane width
α_G: correction factor by inclination
α_T: correction factor by mixing rate of heavy vehicle
α_{RT}: correction factor by mixing rate of right-turning vehicle
α_{LT}: correction factor by mixing rate of left-turning vehicle

Table 3.5.2 Criteria of Providing Right/left-turning Lane in Japan Highway Design Specification

Turn Direction	Contents of Criteria
Turn Left Lane	Turn left lane is provided on at-grade intersection except on the following conditions: • No permit to turn right. • Intersection has enough traffic capacity at traffic peak hour on the following classified road: - Category-III Class-VI Road (hill/mountainous section of national road, provincial road or district road: less than 4,000 vehicle/day, or flat section of district road: less than 1,500 vehicle/day) - Category -III Class-V Road (district road: less than 500 vehicle/day) - Category -VI Class-III Road (provincial road or district road: less than 4,000 vehicle/day) - Category -IV Class-VI Road (district road: less than 500 vehicle/day) • Few traffic volume intersection of 2-lane road of which design speed is less than 40 km/hour (design traffic volume is less than 200 vehicle/hour and percentage of left turning is less than 20%)
Turn Right Lane	Turn left lane is provided on at-grade intersection except on the following conditions: • High traffic volume to turn right at intersection which has acute angle of more than 60 degrees. • Right-turning traffic volume is sand out. • High speed of right-turning. • Both of right-turning vehicles and pedestrian to cross on the right side crossroad are high volume.

Source: Highway Design Standard 1983 edition, Japan Highway Association

At the signalized controlling intersection, the traffic capacity is obtained in accordance with signal cycle time length as follows:

$$C = S_i \times g_i = S \times (G_i / C)$$

where, C : traffic capacity (vehicle/ hour)
S_i : saturated traffic flow rate on inflow (vehicle/blue signal 1 hour)
g_i: time rate of blue signal
G_I : time of blue signal (sec)
C : total signal cycle time length (sec)

The introduction of the above technical aspects in the intersection geometric design in Vietnam is being recommended, followed by the promotion of traffic safety measures for implementation.

(c) Signalized Control System at Intersection

To date, the standard traffic volume that shall require the installation of signalized control system on intersection is not specified in Vietnam's Highway Design Specification. Thus, it is deemed necessary and imperative that said criteria is prepared and issued.

As a reference, Table 3.5.3 shows the standard traffic volumes that require installation of signal system based on Japan Highway Design Standard. It should be noted though that the traffic characteristics between Japan and Vietnam are different, especially with regard to the rate of mixed motorcycle traffic. When the proposed design criteria for signal controlling intersection in accordance with the traffic characteristics of Vietnam is established, the

intersection that has high accident risk will be improved through installation of a signalized control system.

Table 3.5.3 Standard Traffic Volume to Install Signal System in Japan Highway Design Specification

Number of Lane on Main Road	Location	Peak Hour Traffic Volume (vehicle / hour / both direction)		
		Main Road	Connected Road	
			2-lane	4-lane
2-lane	Rural/Suburb Area	650	300	-
		750	230	-
		1,000	160	-
	Town/City Area	750	350	-
		800	270	-
		1,200	190	-
4-lane	Rural/Suburb Area	800	300	360
		900	230	280
		1,200	160	190
		1,500	120	140
	Town/City Area	900	350	420
		1.000	270	320
		1,400	190	220
		1,800	140	160

Source: Highway Design Standard 1983 edition, Japan Highway Association

(d) Grade Separation Improvement

In principle, from the financial perspective, signalized control system should be prioritized over grade-separation for interchange improvement and as a traffic safety measure. The Study Team however recommends that the grade-separation improvement measures should be implemented instead on the following conditions:

- In principle, intersection where both of main road and crossroad have more than 4-lanes is a candidate for grade separation improvement.
- Intersection where the traffic volume has achieved or may be forecasted to exceed the traffic capacity by signalized control system will be planned for grade-separation improvement.
- Even though the crossroad has only 2-lane, intersection to have high risk of traffic accident and obstruction of traffic flow may be planned for grade-separation improvement on strategic highway due to Vietnam transportation policy such as Grade-I or Grade-II National Highway.

In addition, with regards to grade separation, MOT should develop a design standard related to traffic capacity on road and intersection as a priority issue.

(e) Activity for the 5-year Action Program

The following action program is recommended to implement the

intersection improvement on national roads:

- Technology & Science Department of MOT will organize the creation of working groups responsible for the development of new guidelines which will be composed of related research institutes to establish the supplemental design criteria for geometric design, traffic capacity calculation method and standard traffic volume of intersection type which will be submitted to MOT for approval by the middle of 2009.
- Parallel to the above examination of design criteria, VRA/RRMU will cooperate with PDOT in conducting traffic volume count survey at all intersections crossing with national, provincial and district roads and higher traffic commune roads on higher than grade-III National Highway by the middle of 2009.
- With the support of VRA/MOT, the RRMU will prepare an implementation plan, including a financial plan for intersection improvement in accordance with said supplemental design criteria, and submit to VRA by the end of 2009.
- VRA will cooperate with MOT in the formulation of the action program, including the financial allocation plan, and submit to MOT for approval by middle of 2010, and then implement the intersection improvement program on higher than grade-III National Highway.

(iii) Lane Separation by Vehicle Type Improvement Plan

(1) Separate Lane on Highway

The very high traffic volume of motorcycle mixed traffic rate is evidently the most major feature of traffic on highway in Vietnam. And due to this traffic characteristic, it is also expected that motorcycle as the cause of traffic accident has the highest percentage. As shown in Figure 3.5.2, since 2001, the percentage of motorcycle accident is almost 70% of total accident. Thus, given this accident situation, safety measures against motorcycle accident is the most important traffic safety improvement which should be promoted in Vietnam.

Figure 3.5.3 shows the accident character of collision type by vehicle conducted by the Police Academy. This shows that the accident rate of collision with different vehicle types such as motorcycle with bicycle or car with bicycle is very high compared with other countries. Since mixed-traffic on the same lane may be deemed to be the biggest reason for this, the provision of lane separation by vehicle type is promoted on the national highway.

(2) Target Roads in the Provision of Lane Separation

The following highway section is recommended for lane separation:

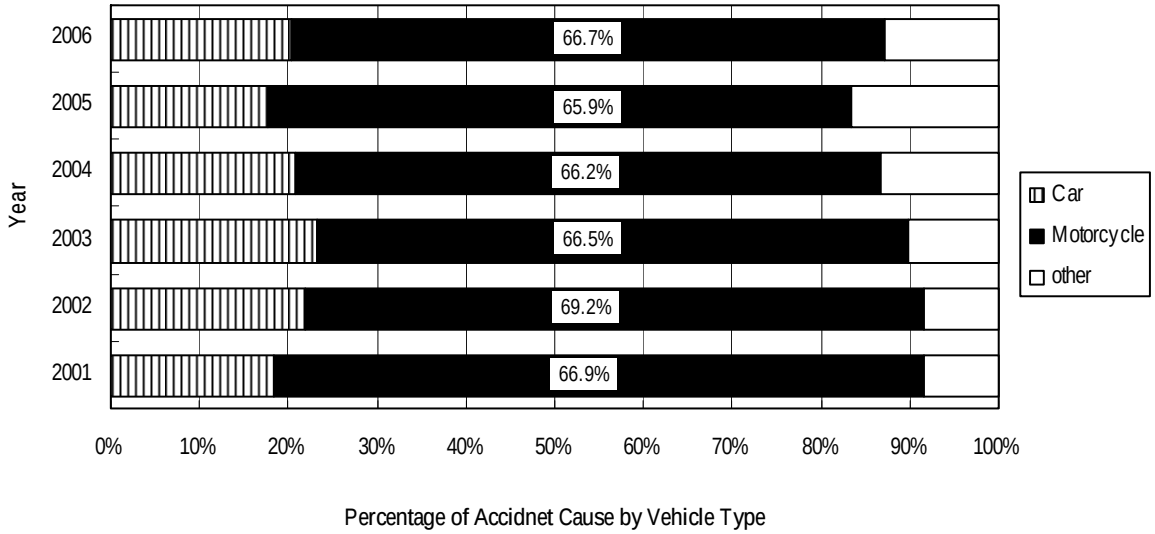
(a) National highway higher than grade-III.

(b) Traffic volume exceeds the standard volume given in TCN4054:2005 Highway Specification of Design (grade-III is 6,000 pcu, grade-II is 15,000 pcu, grade-I is 25,000 pcu).

(c) Separate lane for bicycle is provided in accordance with traffic volume to be specified in the design criteria.

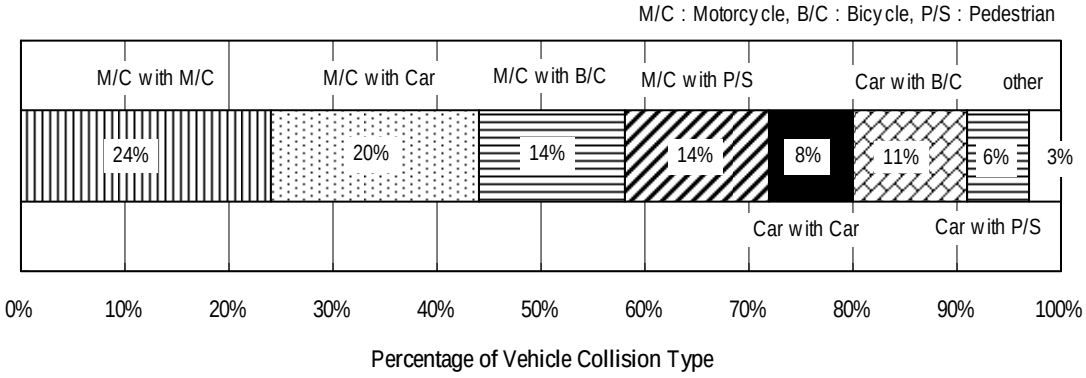
However, due to budgetary constraints, prioritization process as discussed in the preceding section on prioritization for traffic safety corridor restoration should be considered in the formulation of implementation plan.

Figure 3.5.2 Cause of Traffic Accident by Vehicle Type (2001-2006)



Source: MOPS

Figure 3.5.3 Percentage of Collision Type by Vehicle



Source: Accident Data (2001) from the Police Academy

(3) Design Criteria and Traffic Rule Arrangement

The Study Team recommends that priority should be given on the formulation of design standards for lane separation, and the following criteria should be considered during formulation:

(a) Standard lane width of motorcycle/ bicycle lane.

(b) Standard traffic volume per lane and design criteria of traffic capacity calculation of motorcycle/ bicycle lane.

(c) Technical requirement of geometric design and safety measure (sign post, lane marking, pavement marking) for separate lane.

With regards to bicycle lane, TCXDVN 104: 2007 Urban Road Specifications for Design gives the standard traffic volume and lane width that should be utilized for the highway design.

Since the safety measure of road infrastructure shall be in accordance with traffic rule, it is necessary for MOT to discuss with MOPS regarding the

following traffic rule to examine the above design:

(a) Traffic rule that automobile shifts to motorcycle priority lane, or motorcycle shifts to bicycle priority lane at right-turning.

(b) Traffic rule that motorcycle shifts to automobile priority lane at left-turning.

(c) Traffic rule on left-turning by bicycle.

(d) Traffic rule when motorcycle overtakes the stopping bus at bus stop or bus bay.

(4) Activity Plan

The following action program is recommended for implementation of the lane separation on the national highway:

(a) Technology & Science Department of MOT will organize the preparation of guideline for geometric design and safety measure of separate lanes; traffic rule on separate lane will be authorized by MOPS; said guideline will be issued by middle of 2009.

(b) VRA will select the target sections on national highway and formulate implementation plan to include cost estimation by the middle of 2009.

(c) RRMU will execute the necessary survey and design in accordance with the design guideline and construction from the beginning of 2010.

(iv) Railway Crossing Improvement

Action Program for railway crossing improvement is summarized in Table 3.5.4. Based on the 2007 traffic accident record by the National Railway Company, approximately 70% of accident occurred at the illegal/unauthorized railway crossing. Therefore, this illegal/unauthorized opening is a critical issue that should be prioritized. The following measures to keep motorized vehicles away from railway crossing facility will be promoted in the next 5 years.

- Department of Infrastructure of National Railway Company, in coordination with the local authorities, will close illegal/unauthorized railway crossing by installing a protective fence along the railway tracks by the middle of 2009.
- All authorized crossing locations with only warning sign post will be installed with automatic warning system by the end of 2009.
- Manual crossing gate and manual lifting barrier will be replaced by automatic opening and shifting system from the beginning of 2010. Automatic opening and shifting system will be completed for installation on national highway (120 locations) by the end of 2010. Crossing with provincial road (89 locations), district road (164 locations) and the selected commune road that are usually leading to schools, temples, markets, etc. will be completed by the end of 2012.

Table 3.5.4 Action Program of Railway Crossing Safety Measure

Crossing Road	Number (as of 2007)	Improved Measure	Target Year
National Road	120	- Replacement with automatic opening and shifting lifting barrier.	End of 2010
Provincial Road	89	- Replacement with automatic opening and shifting lifting barrier.	End of 2012
District Road	164	- Installation of automatic warning system at all locations.	End of 2009
		- Replacement with automatic opening and shifting lifting barrier at all locations.	End of 2012
Commune Road	960	- Installation of automatic warning system at all locations.	End of 2009
		- Replacement with automatic opening and shifting lifting barrier at selected locations.	End of 2012
Unauthorized Crossing	4,252	- Closure and installation of protective fence.	Middle of 2009

Source: Number of Crossings as of 2007 is from Department of Infrastructure, National Railway Company.

(v) Measure for Night Time Accident

An analysis of 2001 accident record by the Police Academy shows that 44% of accidents occur during nighttime, particularly from 19:00 to 7:00. Table 3.5.5 shows the percentage of traffic volume during the day and night on 10 randomly selected locations along the national road. Based on traffic accident data from these locations, traffic accidents occur at a higher rate between 22:00 and 4:00 as compared with traffic volume hourly rate shown in Figure 3.5.4.

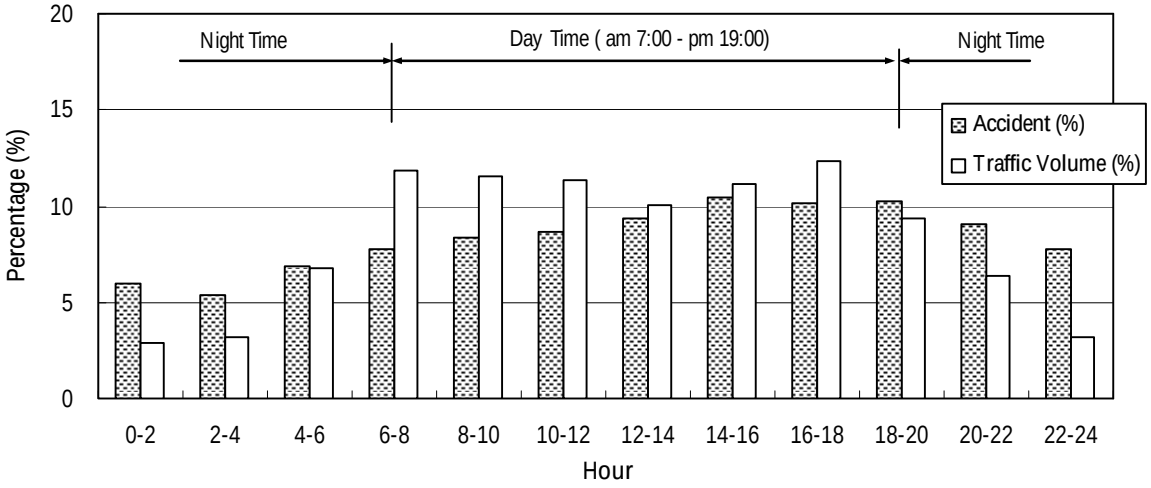
Table 3.5.5 Comparison of Traffic Volume Rate and Accident Rate between Day-time and Night-time

Sample Analysis by MOPS (Year 2001 on National Road)	Number of Accident	Daytime (7:00-19:00)	Nighttime (19:00-7:00)
	8,410	**56 %**	**44 %**

Road No.	Location	Traffic Volume (vehicle/day)	Daytime (7:00-19:00)	Nighttime (19:00-7:00)
NH-1	Thain Hoa	17,584	58%	32%
	Nghe An	15,030	62%	43%
	Quang Binh	5,982	53%	47%
	Hue	6,024	70%	30%
NH-5	Hai Doung	18,199	82%	18%
NH-9	Quang Ti	3,544	70%	30%
NH-12	Hoa Binh	3,827	74%	26%
NH-14B	Quang Nam	3,530	64%	36%
NH-25	Gia Lai	9,841	68%	32%
NH-37	Thyen Quang	14,944	73%	27%
Average :		-	**67%**	**32%**

Source: Traffic Volume on National Highway (2007), VRA.

Figure 3.5.4 Comparison of Hourly Traffic Volume and Accident Occurrence



Source: Traffic Volume on National Highway (2007), VRA. Accident Data (2001), Police Academy.

While average traffic volume rate in terms of number of vehicle per day is 32% in 10 locations, 44% of accidents occur during nighttime which indicates that nighttime has higher accident occurrence risk. The following safety measures are therefore proposed:

- All road sections with over 10,000 vehicles/day (including motorcycles) traffic volume will have lighting system installed by 2010.
- For high risk sections on grade-III road especially for residential areas, intersections, and sharp curves with radius less than 200m, among others, lighting system will be installed in these sections by 2012 even if prescribed traffic volume above is not reached.

3) Implementation Plan

Table 3.5.6 shows the schedule of implementation of highway traffic safety facility enhancement program component in the next five years.

Table 3.5.6 Implementation Schedule of Safety Facility Enhancement Program

Program Components	Year					
	2008	2009	2010	2011	2012	2013
Design Standards/Guidelines Preparation for Traffic Safety						
1) Examination of issues and establishment of working groups						
2) Formulation of solutions and authorizing technical issues to relate traffic rule/management with MOPS						
3) Preparation of supplement/update/improvement of design standards/guidelines for traffic safety facility enhancement.						
4) Integration of Design Standards/Guidelines and preparation of instruction manual.						
5) Preparation of standard drawings for traffic safety measure.						
6) Preparation and distribution of Traffic Safety Design Standard booklet.			▲			
Promoting Smooth/Comfortable Road Safety						
1) Intersection improvement						
- Preparation of supplemental design criteria of intersection design.						
- Conduct of traffic volume survey at intersection on national highway (higher than grade-III).						
- Formulation of implementation plan by RRMU.						
- Formulation of action program by VRA.						
- Implementation of action program.						
2) Lane Separation by Vehicle Type Provision						
- Preparation of design guideline by MOT.						
- Discussion on lane separation traffic rule with MOPS.						
- Formulation of implementation plan by VRA						
- Survey, detailed design and construction.						
3) Railway crossing improvements						
- Closing and installation of protective fence at unauthorized crossings.						
- Installation of automatic warning system at all locations.						
- Replacement with automatic opening and shifting lifting barrier on national road.						
- Replacement with automatic opening and shifting lifting barrier on provincial/district road.						
4) Installation of lighting system on national road.						
- High traffic volume section						
- High traffic accident risk section						

Source: JICA Study Team

3.6 Vulnerable Road User Accident Prevention

1) Targets

The pedestrian path and bicycle path provides a safe travel space for pedestrians and bicycle users, as well as providing a safer and smoother driving experience for

automobile users. In the vulnerable road user accident prevention plan, the Study Team recommends the provision of pedestrian path and bicycle path on the high traffic national highway.

(i) High Accident Rate for Bicycle Users and Pedestrians in Vietnam

Based on the accident data analysis by the Police Academy, traffic accidents involving bicycle riders and pedestrian comprise 45% of total accidents as shown in Table 3.5.2, which is regarded to be very high and deemed to be caused by mixed-traffic on the road.

In general, a running bicycle can be sighted by a driver of a moving automobile can lead to problems of safety driving. When interval of bicycle is L=500 m and average travel speed of bicycle is V=20 km/hour, the traffic volume of bicycle may be obtained as below:

N = 1,000 V / N = 40 vehicle / hour / one direction

Accordingly, bicycle traffic volume on both directions becomes 80 vehicle/hour, and if the bicycle traffic volume is more than 80 vehicle/hour, this is a situation which can have an impact on the safety of both automobile driver and bicycle rider.

(ii) Achievement Target

The Study Team recommends that focus of implementation on the following national highways be adopted for the vulnerable road user accident prevention plan:

- Grade-III National Highways of which traffic volume is 6,000 pcu/day (maximum of standard volume by TCVN4054:2005 Highway Specification of Design)
- All higher than grade-II National Highways

The achievement targets of the plan are set as follows:

(1) Target Reduction in Traffic Accidents on National Highway

Number of accident to relate with pedestrian and bicycle user in 2012 on national highway network will be reduced by 15% as compared to that of year 2007.

(2) Target Improvement of Infrastructure Level

In order to achieve the targeted level of accident reduction, the following achievement targets for infrastructure improvement are put in the plan:

(a) Pedestrian and bicycle paths will be provided in all locations in accordance with specified design standards.

(b) Pedestrian bridge or underpass will be installed in all locations in accordance with specified design standards.

2) Program Components

(i) Development of Design Criteria

There are no criteria for pedestrian and bicycle paths specified in the TCVN4054:2005 Highway Specification of Design. It is therefore recommended that

the design standards on the provision and installation of pedestrian path, bicycle path and pedestrian crossing grade-separation facility should be prepared as a first step. As reference in establishing such design standards, the criteria of Japan and other countries are introduced as follows:

(1) Bicycle Path and Pedestrian Path

Usually, the provision of bicycle path is decided based on the relation of traffic volume of automobile and bicycle. Figure 3.6.1 shows a selection chart to install bicycle path and pedestrian path by Japan Highway Design Standard. According to this Japan Standard, the provision of bicycle path and pedestrian path are classified into the following 4 categories:

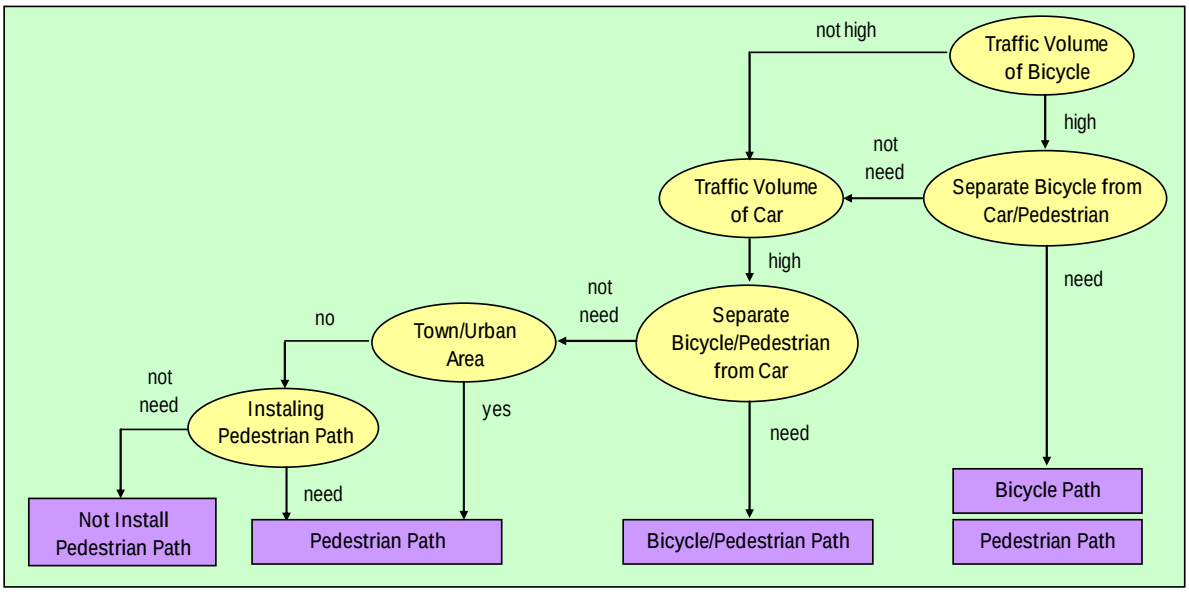
(a) To provide bicycle path and pedestrian path separately.

(b) To provide bicycle-cum-pedestrian path.

(c) To provide only pedestrian path

(d) Not to provide pedestrian path

Figure 3.6.1 Selection Chart for Installation of Bicycle Path and Pedestrian Path in Japan Highway Design Specification



Source: Highway Design Standard 1983 edition, Japan Highway Association.

The above classification may be specified the standard traffic volume shown in Table 3.6.1. Table 3.6.2 shows the criteria used by other countries such as Germany, USA, Norway, and Thailand in the provision of bicycle path.

As shown in Table 3.6.2, in the case of Thailand, since 1987, the Department of Highway set up a 5-year action program called Highway Accidents Prevention Program in order to decrease the severity of highway accidents to a certain level. Another program was set up following the first one and financed by the state budget and IBRD Loan in 1992 to provide safety facilities to reduce the servility of road accidents and improvement of hazardous locations. In 1997, the Department of Highways had launched another 5-year Road Safety Program, and the criteria used as shown in Table 3.6.2 are also one of the main components of this safety program.

Table 3.6.1 Criteria of Bicycle Path/Pedestrian Path Provision in Japan Highway Design Specification

Item	Bicycle Path and Pedestrian Path separately	Bicycle-cum- Pedestrian Path	Only Pedestrian Path
Criteria	- Bicycle > 700 vehicle/day - Car/Motorcycle ≥ 2,000 vehicle/day - Bicycle + Pedestrian > 3,000 vehicle-person/day	Car + Motorcycle ≥ 500 vehicle/day	- Pedestrian ≥ 100 person/day, - Car + Motorcycle ≥ 500 vehicle/day

Source: Highway Design Standard 1983 edition, Japan Highway Association

Table 3.6. 2 Criteria of Bicycle Path Provision in Other Countries

Country	Standard Traffic Volume to Install Bicycle Path
Germany	- Car/Motorcycle ≥ 3,000 vehicle/day and Bicycle ≥ 200 vehicle/day, or - Car/Motorcycle ≥ 2,000 vehicle/day and Bicycle ≥ 500 vehicle/day
USA	- Exclusive bikeway : Traffic volume ≥ 5,000 vehicle/day - Restricted bikeway : Traffic volume ≥ 5,000 vehicle/day, 85 % of speed ≥ 65 km/hour and heavy vehicle mix rate ≥ 5 % - Shared bikeway : Traffic volume ≤ 1,000 vehicle/day, 85 % of speed ≤ 51 km/hour and heavy vehicle mix rate ≤ 5 %
Norway	- Daily traffic ≥ 800 ton, and - Car/Motorcycle ≥ 500 vehicle/day and Bicycle ≥ 300 vehicle/day
Thailand	- Car/Motorcycle ≥ 2,000 vehicle/day and Bicycle ≥ 1,000 vehicle/day, or - Car/Motorcycle ≥ 2,000 vehicle/day and Bicycle ≥ 500 vehicle/day on high speed highway

Source: Compiled by JICA Study Team from various sources.

The standard road width of bicycle path and pedestrian path in Japan Highway Design Standard is given in Table 3.6.3 by the road classification, and the road classification is specified by traffic volume and administration class as shown in Table 3.6.4.

Table 3.6.3 Road Width of Bicycle Path/Pedestrian Path Provision in Japan Highway Design Specification

Road Category		Width of Road (m)		
		Bicycle-cum-pedestrian Path	Pedestrian Path	Bicycle Path
Town/Urban Area		2.0 (1.50)	1.5 (1.00)	2.0
Rural/Suburb Area	Class-I	3.0 (2.25)	3.0 (2.25)	
	Class-II	3.0 (1.50)	3.0 (1.50)	
	Class-III, IV	1.5 (1.00)	1.5 (1.00)	

Source: Highway Design Standard 1983 edition, Japan Highway Association.

Table 3.6.4 Road Classification on Rural/Urban Area in Japan Highway Design Specification

Design Traffic Volume / Administration Class	V (vehicle / day)			
	V ≥ 10,000	10,000 > V ≥ 4,000	4,000 > V ≥ 500	500 > V
General National Road	Class-I		Class-II	
Prefecture Road (Provincial Road)	Class-I	Class-II	Class-III	
City/Town/Village Road (District Road)	Class-I	Class-II	Class-III	Class-IV

Source: Highway Design Standard 1983 edition, Japan Highway Association.

When there is a low volume of bicycle or pedestrian traffic, or if traffic is located on a bridge with length more than 50m, the width of bicycle-cum-pedestrian path and pedestrian path may be reduced to the figure inside the parentheses. For a 2.0 m bicycle path width, 2 bicycles may pass each other and be overtaken, and the traffic capacity of moving bicycle is assumed at 1,600 bicycles/hour.

(2) Pedestrian Crossing Grade-Separation Facility

The Technical Standard for Pedestrian Crossing Grade-Separation Facility (1979) issued by Japan Highway Association has specified the installation of pedestrian crossing grade-separation facility such as pedestrian flyover bridge and underpass on the following locations:

(a) Number of people crossing to road is more than 100 persons/peak hour on the mid-section or intersection without signal control system, and the traffic volume and the crossing road width are within diagonal line as shown in Figure 3.6.2(a) as per number of crossing people.

(b) In the case of school children crossing, the crossing facility is installed within diagonal line as shown in Figure 3.6.2 (b).

(c) For crossings over 25m width of road (usually more than 6-lane) without enough space of center-media or island where a crowd of people may queue.

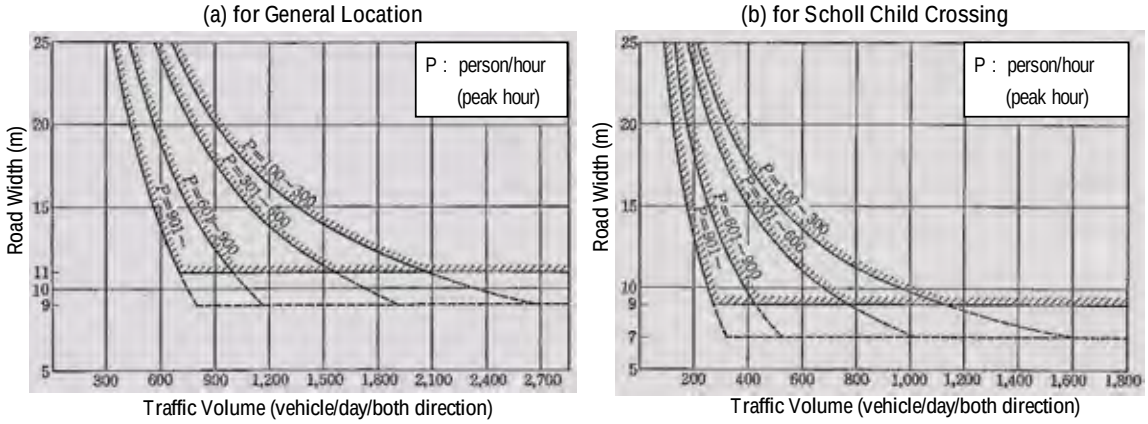
(d) Location which always has plenty of pedestrian crossing that is at least approximately 500 persons/hour.

(e) Location which is within 200m from the railway crossing or the approach section of flyover bridge.

Thailand's Department of Highway has been promoting the provision of pedestrian bridge in its road safety program from 1997 with the following criteria:

- Carriageway width is more than 14m without any medians
- Number of crossing pedestrian is more than 300 persons/peak hour
- Traffic volumes during pedestrian crossing peak hour are more than 1,100 vehicles/hour, 800 vehicles/hour, and 600 vehicles/hour, where crossing width are 15m, 20m and 25m respectively.

Figure 3.6.2 Diagram for Installing Pedestrian Crossing Grade-Separation Facility Based on Japan Standard



Source: Technical standard for Pedestrian Crossing Grade-Separation Facility (1979), Japan Highway Association.

(3) Safety Measures for Bicycle Crossing

The Bicycle Path Design Standard (1974) issued by Japan Highway Association has specified safety measures for crossing grade-separation facilities for bicycle user as shown in Table 3.6.5.

Table 3.6.5 Technical Criteria for Bicycle Crossing Grade-Separation Facility in Japan Highway Design Specification

<table>
<tr><th>Item</th><th>Contents of Criteria</th></tr>
<tr><td>Longitudinal Inclination</td><td>- Case of slope way with step : 20 ~ 25%
Standard Diameter of Step
<table>
<tr><th>Inclination</th><th>Height of Step</th><th>Width of Platform</th></tr>
<tr><td>20%</td><td>12.0 cm</td><td>60.0 cm</td></tr>
<tr><td>25%</td><td>12.5 cm</td><td>50.0 cm</td></tr>
</table>
- Case of ramp way : less than 12%</td></tr>
<tr><td>Horizontal Platform</td><td>If the height of ramp way or slope way is over 3.0m, the horizontal platform is installed at every 3.0m in height.</td></tr>
<tr><td>Width</td><td>Same width as general section.</td></tr>
</table>

Source: Bicycle Path Design Standard (1974), Japan Highway Association

(4) Pedestrian Crossing Grade-Separation Facility

The Highway Design Standard 1983 edition issued by Japan Highway Association has given a set of criteria for installing push button signal for pedestrian crossing on the midway section as shown in Table 3.6.6.

Table 3.6.6 Standard Traffic Volume to Install Push Button Signal for Pedestrian Crossing in Japan Highway Design Specification

Location	Traffic Volume of Car/Motorcycle (vehicle/peak hour)	Number of Pedestrian (person/peak hour)
Town/Urban Area	750	250
Rural/Suburb Area	650	200

Source: Highway Design Standard 1983 edition, Japan Highway Association

(ii) Activity Plan

The following are recommended for implementation, in collaboration with the traffic safety education and awareness campaign program to achieve maximum effectiveness of infrastructure improvement. The following activities are proposed to be undertaken for vulnerable road user accident prevention for this 5-year action program:

- Technology & Science Department of MOT will organize the preparation of design standard for pedestrian and bicycle path and crossing facility, which will then be issued by the end of 2008.
- In cooperation with PDOT and the Provincial Traffic Safety Committees, VRA/RRMU will complete a prospective survey by the middle of 2009 to identify the location(s) where pedestrian/bicycle paths and crossing facilities will be installed based on the design standard.
- VRA will formulate the implementation plan for pedestrian/bicycle path provision and crossing facility installation by the end of 2009.
- The Provincial Traffic Safety Committee will formulate the implementation plan of education and safety dissemination program such as school education and safety campaign in accordance with the infrastructure improvement plan by the middle of 2010.
- Infrastructure program as well as education and safety dissemination program will be commenced from the middle of 2010. It should be recommended that the enforcement activities by Traffic Police will be incorporated in this safety improvement program.

3) Implementation Plan

Table 3.6.7 shows the schedule of implementation of vulnerable user accident prevention program components in the next five years.

Table 3.6.7 Implementation Schedule of Vulnerable Road User Accident Prevention Program

Program Components	Year					
	2008	2009	2010	2011	2012	2013
1) Preparation of design standard for pedestrian/bicycle safety by MOT						
2) Survey to identify the locations that will be provided with pedestrian/ bicycle path and crossing facility.						
3) Formulation of implementation plan for road infrastructure improvement by VRA.						
4) Formulation of implementation plan for education and safety dissemination program by Provincial Traffic Safety Committee.						
5) Implementation of action program.						

Source: JICA Study Team

3.7 Expressway Safety Development

1) Priority Issues on Expressway Traffic Safety

After the approval of Vietnam Expressway Master Planning Proposal dated 19 August 2005, the expressway projects have been accelerated and promoted. In line with the

growing necessity of expressway network in Vietnam, MOT updated the design guideline of expressway and issued TCVN 5729:2007 Expressway Specifications for Design. To date, 7 expressway projects as shown in Table 3.7.1 have been ongoing and are being implemented by 4 agencies: Vietnam Expressway Corporation (VEC), Ministry of Transport (VRA will operate after completion), Vietnam Development Bank/ Vietnam Commercial Bank and CINACONEX.

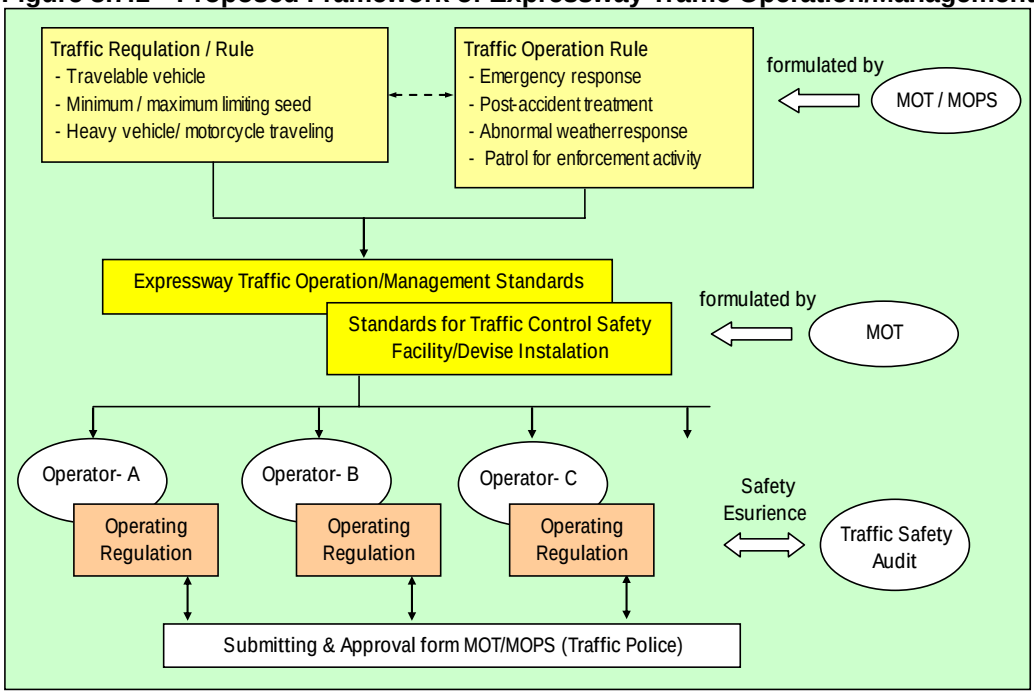
Table 3.7.1 Current Status of Expressway Network Development

Implementing Agency	Expressway Section	Status
VEC	Cau Gie – Ninh Binh Expressway (56 km)	Construction ongoing
	Noi Bai – Lao Cai Expressway (264 km)	Detailed Design Completed
	Ho Chi Minn –Trung Luong – Minh Thuan Expressway (122 km)	Construction ongoing
	Ho Chi Minn – Long Thanh – Dau Giay Expressway (55 km)	Detailed Design ongoing
MOT (VRA)	Hanoi- Thai Nguyen (NH-3) Expressway (65 km)	Detailed Design Completed
State Company (VDB/VCB)	Hanoi- Haiphong Expressway (105 km)	Detailed Design ongoing
State Company (VINACONEX)	Duong Lang- Hoa Lac Expressway (29km)	Detailed Design Completed

Source: JICA Study Team

Expressway is normally designed as having full access control and high travel speed; therefore, the traffic safety measure as well as traffic operation system on expressway should require higher technique and advanced treatment as compared with normal highways. In this regard, it is necessary to establish traffic operation rule/standard in accordance with traffic characteristics of expressway. In addition, the Study Team further recommends the establishment of a management framework as illustrated in Figure 3.7.1.

Figure 3.7.1 Proposed Framework of Expressway Traffic Operation/Management



Source: JICA Study Team

However, since there is no traffic management/operation system developed or even traffic rule that has been authorized, the following are needed be addressed as priority issues:

(i) Establishment of Traffic Regulation/Rule

Also on the expressway, traffic safety infrastructure such as sign post/board and pavement marking are provided in accordance with traffic regulation and rule, therefore, the following points should be authorized and issued as supplemental provisions of Traffic Law:

- Travelable vehicle to be allowed entry to the expressway,
- Minimum and maximum travel speed limit by vehicle type,
- Legal safety distance between vehicles and overtaking manner,
- Traffic regulation for vehicle needing to stop at road shoulder portion,
- Traffic rule of heavy vehicle and motorcycle traveling, and so on.

Regarding travelable vehicle mentioned above, for safety reasons, entry of motorcycle on expressway is not permitted in many Asian countries (Table 3.7.2), which have developed their expressway network. Upon examining the travel limitation of motorcycle, the following points should be carefully discussed with transport management authority (traffic police) and road facility management authority:

- Minimum/maximum speed limit to ensure safe traveling.
- Safety measurement in accordance with travel speed of motorcycle.
- Economical feasibility to demand forecast of motorcycle as per travel restriction.

Table 3.7.2 Motorcycle Limitation on Expressway in Asian Countries

Country	Motorcycle Limitation		
Japan	> 125 cc	Malaysia	> 50 cc
Korea	Not allowed entry	Singapore	> 50 cc
China	Not allowed entry	Indonesia	Not allowed entry
Taiwan	Not allowed entry	Philippines	≥ 400 cc
Thailand	Not allowed entry	Pakistan	Not allowed entry

Source: JICA Study Team

(ii) Establishment of Traffic Operation Rule

As well as traffic regulation/rule, the operation rule is an important issue in traffic safety on expressway, such as emergency response system, post-accident treatment system and abnormal weather conditions response system. The following should also be discussed between transport management authority and road facility management authority:

- Communication system, framework of accident treatment such as removal of crashed vehicle, rescue/transport of injured person and traffic controlling/ restriction in case of accident.

- Traffic control/restriction or closing of expressway at abnormal weather conditions and data collection method.
- Usage of parking/rest facility on expressway during emergency situations.
- Means of transmitting information to road user when restrictions are in effect on expressway traffic.
- Behavioral rule of patrol for enforcement activity on road way of expressway.

(iii) Establishment of Traffic Operation/Management Framework

Based on the interview surveys conducted by the Study Team, traffic operation standards on the expressway have not been regulated. Since respective roles of all four implementing agencies are mentioned above, the said standards are enviable to develop a unified system nationwide. In this regard, the following operational framework is recommended to be established before operation of expressways:

(1) Establishing Responsible Department in MOT

Design and construction approval are issued by MOT. However, the significantly responsible department or division concerned with expressway operation is not assigned in MOT, therefore, an organization that has the following tasks/ responsibilities is required to established:

(a) Supervise traffic operation to be executed by expressway operators.

(b) Coordinate with MOPS and NTSC in resolving traffic management and safety issues.

(c) Formulate expressway traffic operation/management standards and ensure unified standards nationwide.

(d) Review and issue approval on the operating regulation submitted by expressway operator.

(2) Formulating Expressway Traffic Operation/Management Standards

After the above traffic regulation/rule and traffic operation rule on expressway are authorized between MOT and MOPS, MOT needs to formulate and issue the Expressway Traffic Operation/Management Standards. Since the BOT scheme operation style for expressway is supposed to further increase in the future, such nationwide standards specifying the minimum requirement is necessary to develop expressway network with ensuring the certain level. Technical standards for installation of facilities/devices of traffic safety may be formulated based on the said traffic operation/management standards.

Expressway operator needs to develop a practical Operating Regulation conforming to the said operation/management standards and technical standards for traffic safety as provided by MOT. This Operating Regulation to be prepared by the expressway operator is submitted to MOT and the traffic management authority under MOPS for approval. Operating Regulation includes traffic management organization in coordination with the Traffic Police, division of task/responsibility, patrol activity to be performed by Traffic Police, etc.

(3) Formulating Technical Standards of Traffic Safety Facility/Device

Aside from the usual safety measurement such as traffic sign system and pavement marking system, the following advance information system is necessary to be introduced in traffic control and surveillance including safety management due to increasing traffic volume on expressway:

(a) Information Management System

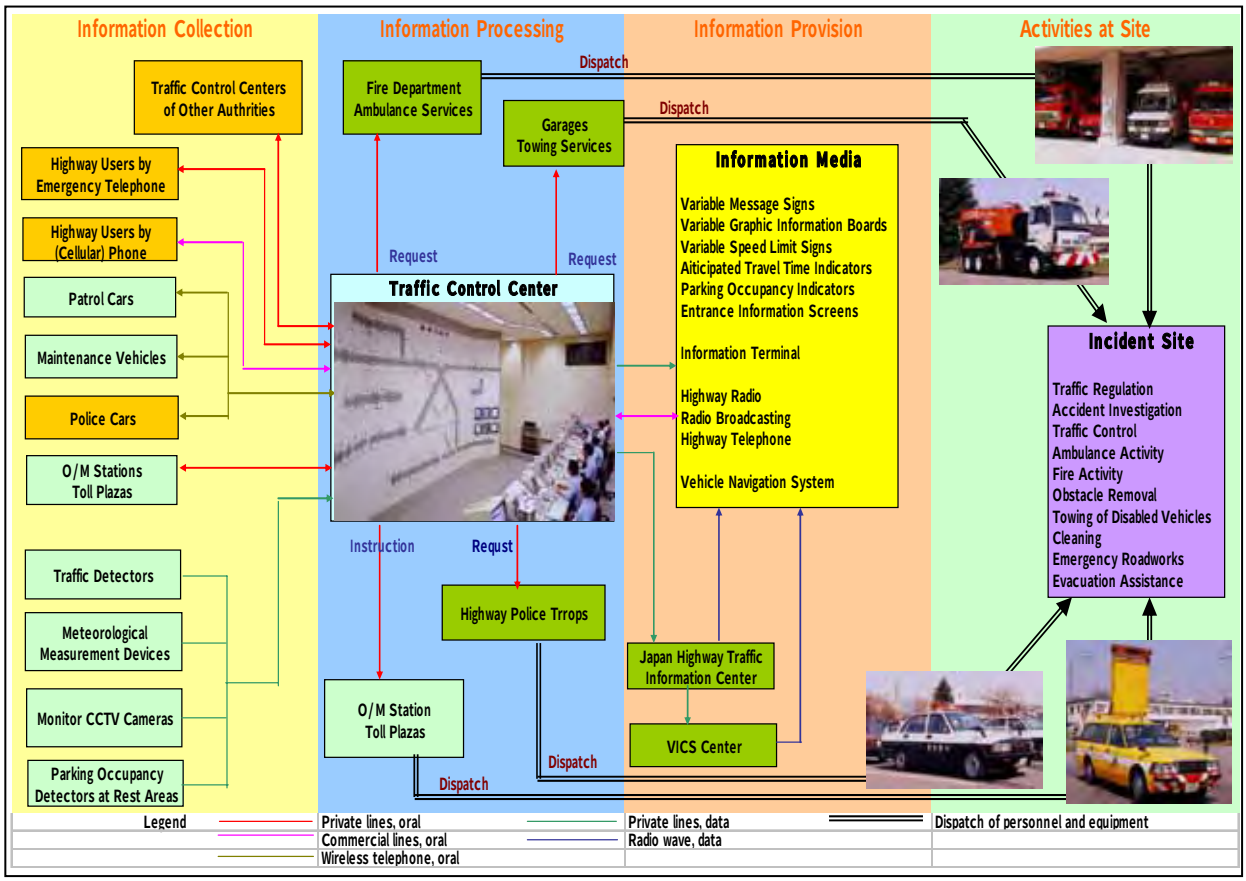
- traffic detectors, meteorological measurement, CCTV, emergency telephone, patrol cars (operator, police), O&M stations, toll plazas
- information processing and integration at traffic control center

(b) Information Provision System

- variable message signs, variable graphic information boards
- anticipated travel time indicators, parking occupancy indicators
- highway radio, highway telephone
- information terminals, vehicle navigation systems(VICS)

Figure 3.7.2 shows an example for traffic control and surveillance system on Japan expressways. The above terminal equipments/devices to be installed on expressway roadside are required to be controlled in the central operation centers.

Figure 3.7.2 Traffic Control and Surveillance Operation in Japan Expressways



Source: JICA Study Team

In order to develop nationwide unified management system, the equipment/device and information processing system should be interchangeable between the operation centers to be installed by each expressway operator. From this aspects, the standard specifications of equipments/devices is necessary to be established including interface of electronic data exchange, minimum requirement of mechanical performance, endurance, data precision, etc.

2) Program Components

The following are proposed for implementation in the 5-year action program for expressway safety development:

- MOT will establish or appoint a department/division which will be responsible for expressway operation and management by end of 2008.
- The appointed expressway operation department and the Technology and Science Department of MOT shall collaborate with Road and Railway Traffic Police Bureau of MOPS to organize a working group that will prepare the traffic regulation/rule and operation rule on expressway. The formulated expressway traffic regulation/rule and provisions will be issued by middle of 2009.
- Technology and Science Department of MOT will spearhead the preparation of the Expressway Traffic Operation/Management Standards and Technical Standard for Traffic Safety Facility/Device Installation, and will submit to MOT for approval by end of 2009.
- Expressway operation responsible department of MOT will issue instruction to expressway operators to prepare their respective Operating Regulation in accordance with the above standards issued by MOT. Approval for operation will be issued by end of 2010.
- Expressway operation responsible department of MOT will instruct the expressway operators to execute Traffic Safety Audit from end of 2010.

The Study Team suggests that the auditor will focus its evaluation on the disparity between actual operation/performance and the Operating Regulation prepared by the operators.

3) Implementation Plan

Table 3.7.3 shows the schedule of implementation of expressway safety development program components in the next five years.

Table 3.7.3 Implementation Schedule of Expressway Safety Development Program

Program Components	Year					
	2008	2009	2010	2011	2012	2013
1) Establishment of responsible department in MOT	▲					
2) Formulation of the traffic regulation/rule and operation rule of expressway.		■				
3) Preparation of the Expressway Traffic Operation/Management Standards and Technical Standard for Traffic Safety Facility/Device Installation by MOT.		■	■			
4) Preparation of Operating Regulation by expressway operators.			■			
5) Conduct of Traffic Safety Audit.				■	■	■

Source: JICA Study Team

3.8 Road Work Traffic Safety Development

1) Priority Issue on Road Work Traffic Safety

(i) Strengthening Traffic Safety Assurance System

For safety during road construction, Decision No.23/2007/QD-BGTVT by MOT dated 7 May 2007 is issued to perform Traffic Safety Audit also during construction stage. For the Auditor to perform a proper evaluation, however, the Study Team recommends the establishment of a technical guideline of traffic safety on road works.

(ii) Developing Road Maintenance System

VRA has introduced HDM-4 system and ROSY system (road pavement management system) for road maintenance from 2001. VRA formulated a 3-year road maintenance plan from 2009 to 2011 by using an analysis result of HDM-4. Table 3.8.1 shows the past 3 years budget for road maintenance and next 3years requested budget.

Table 3.8.1 Road Maintenance Budget for National Road

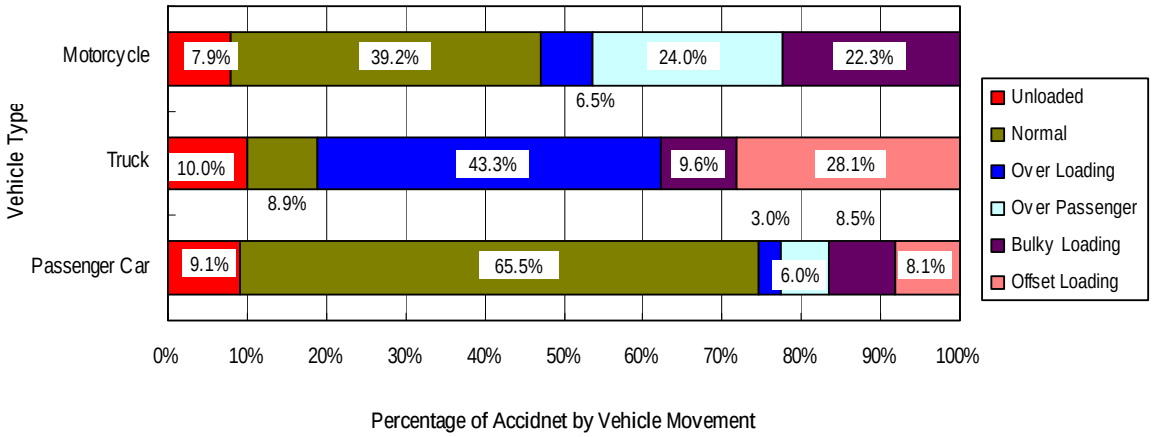
Year	2006	2007	2008	2009	2010	2011
Maintenance Budget (Billion VND)	1,704	1,875	1,916	(3,393)	(3,732)	(4,105)
Road Length (Km)	16,957	17,002	16,830	-	-	-

Source: VRA

As a matter of course, ensuring proper road condition can contribute to traffic safety; therefore, the efficient and sustainable maintenance system should be introduced as a routine and periodical maintenance in Vietnam. The Study Team recommends introducing the Long Term Performance Base Maintenance System.

In addition, overloading of vehicles affect road traffic safety, not only road maintenance. Figure 3.8.1 shows the accident occurrence rate due to loading condition by vehicle type which indicates that 43% of accident by truck is caused by overloading of vehicle. This should suggest that strengthening enforcement towards overloading vehicle may contribute to mitigating risk to traffic safety.

Figure 3.8.1 Accident by Loading Condition Mode



Source: Accident Data (2001), Police Academy.

2) Program Components

(i) Traffic Safety on Road Construction Work

(1) Establishing Road Work Safety Guideline

The technical guideline of safety measurement on road construction should include the requirement size and arrangement of sign board on construction site, and sample drawings of sign board and safety facilities arrangement. Table 3.8.2 shows a sample table of contents for the said guideline.

(2) Framework of Implementation

The following framework may be recommended for traffic safety during road construction.

(a) After preparing the technical guideline of safety measurement on road construction, MOT will make an instruction to the executive agency of road construction that the said guideline should be included in the tender document of construction work.

(b) MOT will also make an instruction to the executive agency to organize the conduct of Traffic Safety Audit during constriction stage.

As mentioned in earlier subsection on Strengthening Implementation Capacity for TSA, the pilot project and capacity development program of traffic safety audit will be carried out under WB VRSP-1. The Study Team further recommends that a pilot safety audit for construction will be performed under the said VRSP-1 component.

Table 3.8.2 Sample of Contents of Road Work Safety Guideline

Item	Article Contents
Chapter 1 : General Statement	Article 1 : Object Article 2 : Approbation Article 3 : Basic Issue Article 4 : Distinction of Road Work Area Article 5 : Traffic Opening During Night Time Article 6 : Traffic Opening at Work Interrupting Article 7 : Counseling Negotiation with Traffic police
Chapter 2 : Installing Plan of Safety Facility	Article 8 : Area or Section to be Regulated Article 9 : Time or Hour of Road Construction Works Article 10: Walk Space for Pedestrian Article 11: Road Width to be Ensured for Vehicle Passage
Chapter 3 : Safety Facility on Road Construction Work	Article 12: Standard of Sign Board due to Road Works Article 13: Installation of Sign Board Article 14: Supplemental Sing Board Article 15: Other Safety Facility Article 16: Safety Facility of Movement Restriction Article 17: Sing for Work Interrupting Article 18: Sign of Advance Notice Before Construction Work Article 19: Sign of Detour Route Article 20: Arrangement of Traffic Guide Man Article 21: Management
Chapter 4 : Reference Drawings for Safety Facilities Arrangement	- 4-lane road : restricting one lane on shoulder side. - 4-lane road : restricting one lane on center media side. - 4-lane road : restricting two lane on one direction, and ensuring one lane passing on both direction. - 2-lane road : restricting one lane, and alternating passage on one lane. - 2-lane road : restricting side strip or pedestrian path or shoulder, and providing pedestrian denture route, two way traffic on 2-lane and 1-lane - 4-lane road : . restricting movement - 2-lane road : . restricting movement - Case of closing route - Case of road work in intersection
Chapter 5 : Standard of Sign Boards	- Sign Board of “Under Construction” - Sign Board of “Arrow” - Sign Board of “Notice of Construction” - Sign Board of “Lessen Speed” - Sign Board of “Shift Left (or Right) Side” - Sign Board of “Carriage Lane Width Reduction” - Sign Board of “Stopping Location” - Sign Board of “Alternating Passage” - Sign Board of “End of Construction Section” - Sign Board of “Pedestrian Walking Space” - Sign Board of “Pay Attention for Deference Grade Level” - Sign Board of “Close Traffic” and “Detour Route” - Sign Board of “Advance Notice of Close Traffic” - Supplemental Sign Board of “Detour Route””

Source: JICA Study Team

(ii) Long Term Performance Base Maintenance System

(1) Target Road for Long Term Performance Base Maintenance

As a first step, the Study Team recommends that national highways such as grade-I, grade-II National Highway, or grade-III with high traffic should be covered by the Long Term Performance Base Maintenance system.

(2) Establishing Performance Standards/Requirements

The Performance Standards/Requirements represent the desired level of technical performance or output of the routine maintenance activity basically in terms of quality, quantity, timeliness and other aspects of the output and service, against which the actual output will be measured and compared. The objectives of Performance Standards/Requirements are:

(a) To satisfy the road users in terms of accessibility, comfort, travel speed and safety;

(b) To minimize the total road system cost, including cost to road users and to VRA over the life cycle cost of the assets and

(c) To minimize environmental impacts.

The Performance Standards/Requirements for sample bid document to be prepared by the Consultant will indicate the following:

(a) Type of Feature – e.g., potholes, pavement damage, joints/cracks, shoulder vegetation, drainage.

(b) Corresponding requirements – e.g., allowable time to remedy defects - such as within 24 hours for potholes and 10 days for pavement damage/cracks; maximum tolerable degree of defect - such as not more than 15cm of vegetation at any time, etc.

(c) Penalty for non-compliance – e.g., VNDxxxx per pothole not repaired per day, VNDxxxx per pavement damage/crack not sealed within time limit, VNDxxxx per km for excessive vegetation if not remedied within one month, etc.

Table 3.8.3 shows a sample of technical criteria for performance-based contract on routine maintenance.

Table 3.8.3 Sample of Performance Standard/Requirement for Routine Maintenance

Type of Feature	Standards/ Requirements	Penalty for Non-Compliance	Remarks
Gen. Appearance: General requirements			
Requirements	The road, structures, bridges and features shall at any given time be clean, free of garbage and obstructions and maintained to the required standards.	VNDxxxx per km per week on non- compliance	
Asphalt Pavement: Allowable time for remedy of the defect			
Potholes	To be repaired within 48 hours	VNDxxxx per pothole not repaired per day	Pothole is a hole or depression >15cmx15cmx 15 cm
Pavement Damage (PD) - cracking, raveling, rutting and shoving	To be repaired within 10 days	- VNDxxxx per Pavement Damage not repaired w/in time limit - VNDxxxx per PD per succeeding month of non-repair	PD is 100 sq.m of alligator cracking, or 400 lm of cracks, or combination, w/ crack width of 25 mm; or 100 m of raveling, or 10 m of rutting & shoving, w/ width of 1.5 m
Pavement Markings (PM)	90% of PM in good condition	- VNDxxxx/km not remedied w/in one month - VNDxxxx/km/succeeding month of non-compliance	PM is in good condition if required % of mark ings is clearly visible day and night.
Concrete Pavement: Allowable time for remedy of the defect			
Local Damage, Depression	To be repaired within 48 hours	VNDxxxx per local damage, depression not required per day	LD/D is a hole or depression >15x15cm, but < one slab, and deeper than 5 cm
Failed Slabs (Blocks)	Repair to be completed in 10 days	- VNDxxxx/concrete slab not repaired w/in time limit - VND xxxx/succeeding month of non-compliance	Failed slab is any slab w/ >8m cracks or w/ parts not in level w/ adjacent slabs
Joints/Cracks	90% of joints/ cracks sufficiently sealed	- VNDxxxx/km with joints/cracks not sealed w/in one month - VNDxxxx/succeeding month of non-conformity	Joints/cracks are sufficiently sealed when filled w/ sealant to pavement surface level
Pavement Markings (PM)	90% of PM in good condition	- VNDxxxx/km not remedied w/in one month. - VNDxxxx/km/succeeding month of non-compliance	PM is in good condition if required % of markings is clearly visible day and night.
Shoulders/Roadside: Allowable time for remedy of the defect			
Shoulder Damage	To be repaired w/in 10days	- VNDxxxx/shoulder damage not repaired w/in time limit - VNDxxxx/shoulder damage/succeeding month of non-repair	SD is total area of 100 sq. m of potholes and/or depressions deeper than 10 cm
Sufficient Level and Cross-slope	To be restored w/in 10 days	- VNDxxxx/lane-km not remedied w/in time limit - VNDxxxx/lane-km/ succeeding month of non-remedy	Shoulder level is sufficient if along pavement edge it is ≥ 5cm lower than pavement. Shoulder cross-slope is sufficient if slope is 2-4% away from pavement.
Maximum tolerable degree of the defect			
Vegetation	The height of grass and vegetation within the	- VNDxxxx lane-km if not remedied within one month	Roadside is area w/in 5 m from pavement, unless

Type of Feature	Standards/ Requirements	Penalty for Non-Compliance	Remarks
	roadside area shall not exceed 15 cm at any time	- VNDxxxx/lane-km/ succeeding month of non-compliance	private. Excludes decorative vegetation
Drainage	Allowable time for remedy of the defect		
Side Drains, Culverts and Drainage System	Disruption of free flow of water to be remedied in 10 days	- VNDxxxx/location not remedied w/in time limit - VNDxxxx/location/ succeeding month of non-remedy	Free flow of surface water is disrupted when capacity of drainage facility is reduced by more than 25%
Maximum tolerable degree of the defect			
Side Drains, Culverts and Drainage System	Siltation and debris shall not exceed 15 cm at any time	- VNDxxxx/km if not remedied w/in one month - VNDxxxx/km/succeeding month of non-compliance	
Bridges : Allowable time for remedy of the defect			
Bridge Deck, Drainage, Outlets and Waterways	Disruption of free flow of water to be remedied in 10 days	- VNDxxxx/bridge not remedied w/in time limit - VNDxxxx/bridge/succeeding month of non-compliance.	
Maximum tolerable degree of the defect			
Bridge Painting and Signage	Bridge painting, markings, warning and regulatory signs (bridge name, station limits, abutment walls, load limit and warning) shall at any time be clear of obstructions, clean and readable	- VNDxxxx/bridge if not remedied within one month - VNDxxxx/bridge/succeeding month of non-compliance	
Signage & Guardrails: Maximum tolerable degree of the defect			
Signage and Guardrails	Road signs, other regulatory and/or warning devices and guardrails shall at any time be clear of obstructions, clean and readable	- VNDxxxx/sign/device if not remedied w/in 1 month - VNDxxxx/sign/device/ succeeding month of non-compliance. - VNDxxxx/100 m of guardrails if not remedied w/in 1 month. - VNDxxxx/100 m of guardrails/succeeding month of non-compliance	

Source: JICA Study Team

(3) Suggestion on Implementation of Performance Base Maintenance

In some ASEAN countries like Thailand and the Philippines, the Department of Highway and the Department of Public Works and Highways, respectively have practiced the performance base contracts of routine road maintenance. Both agencies have executed the performance base maintenance as a component of a World Bank-financed project, and a pilot project was introduced as a first step wherein the said highway agencies received technical support from foreign experts.

In the case of Vietnam, due to the budgetary constraints in the state revenue, VRA is requesting the World Bank to finance the national highway maintenance

between 2009 and 2011. The Study Team therefore recommends that a pilot project be conducted for the performance base maintenance as one component and another will be the establishment of the framework of performance base maintenance, collaborated with a technical assistance for formulating the Performance Standard/Requirement be included in this World Bank Maintenance Project.

(4) Installation of Vehicle Weighing Station

The following activities concerning control for overloading vehicles on the national highway are proposed:

(a) Selection of toll gate where the vehicle weighing station will be installed on grade-I, grade-II and high traffic of overloading heavy vehicle on grade-III National Highway.

(b) Formal agreement between MOT and MOPS regarding responsibilities of enforcement activity.

(c) Organization and conduct of a campaign aimed at national highways for enforcement activity on overloading before and after installation of vehicle weighing station.

3) Implementation Plan

Table 3.8.4 shows the schedule of implementation of road work traffic safety development program components in the next five years.

Table 3.8.4 Implementation Schedule of Road Work Traffic Safety Development Program

Program Components	Year					
	2008	2009	2010	2011	2012	2013
Traffic Safety on Road Construction Work						
1) Preparation of Road Work Safety Guideline						
2) Conduct of traffic safety audit pilot project during construction stage under WB VTSP-1						
3) Implementation of nationwide traffic safety audit for road construction						
Long Term Performance Base Maintenance System						
1) Set up organizational framework in VRA						
2) Pilot Project of Performance Base Maintenance						
- Formulating Performance Standards/Requirements						
- Tendering						
- Implementing Pilot Project on National Highway						
3) Nationwide implementation						
Installation of Vehicle Weighing Station						
1) Agreement between MOT and MOPS regarding responsibilities of enforcement activity						
2) Installation of vehicle weighing equipment on selected toll gate along National Highway.						
3) Conduct of awareness campaign on vehicle overloading enforcement						

Source: JICA Study Team

3.9 Traffic Safety Monitoring and Maintenance

1) Priority Issue on Traffic Safety Monitoring

(i) Formulating Sustainable Accident Reduction Program

It is necessary that the accident reduction program should be formulated to be suited with financial allocation capability in order to maintain traffic safety plan. Normally, accident reduction program includes the following:

(1) Determination of a range of measures that should prevent/reduce the dominant accident pattern.

(2) Assessment of side effect. Carefully consider whether there measures will have an advance impact on other accident types and ensure that no unacceptable effects on traffic or the environment are likely.

(3) Priority assessment – first and second levels; non economic.

(4) Economical assessment of costs and benefits for those projects identified at step-iii).

(5) Selection of measures yielding the greatest benefits,

(6) Organization of a public consultation to ensure acceptance by the community and affected road user,

(7) Preparation of a priority listing of sites and development of action program.

(8) Implementation of action program.

(9) Monitoring and evaluation.

(ii) Issue of Traffic Safety Monitoring/ Evaluation

Government of Vietnam has investments on safety measures in its road network development at a certain rate. Table 3.9.1 shows the traffic safety investment cost such as traffic sign, pavement marking, pedestrian path, and traffic surveillance system on expressway in the selected national roads and expressways projects. This indicates that investment cost for safety measure takes up only 3% to 6% for expressway construction and 1% to 5% for upgrading/improvement/rehabilitation of normal national road. After issuance of Decision No.13/2005/QD-BGTVT: Black Spot Treatment, MOT/VRA are increasing the investment cost for black spot improvement on national roads year after year as shown in Table 3.9.2.

Monitoring and evaluation activity are very important in traffic accident measurement. In general, effectiveness of measurement are evaluated as number of accident reduction after measurement and economical benefit. As mentioned above, the Government of Vietnam has been seriously putting efforts to mitigate traffic accidents. In order to produce a more effective result, the Study Team recommends that the objective evaluation criteria of the assessment of traffic safety benefit should be formulated for the monitoring and evaluation for traffic safety development program.

Table 3.9.1 Safety Facility Investment Cost on Road Construction

Project Name	Road Length (km)	No. of Lane	Cost (Billion VND)		
			Construction	Safety Facility	
Expressway Construction					
1) Cau Gie - Ninh Binh	56	6-lane (pavement:4-lane)	5,345	240.5	(4.5 %)
2) Noi Bai – Lao Cai	262	Noi Bai-Yen Bai: 4-lane Yen Bai-Lao Cai: 2-lane	11,801	721.9	(6.1%)
3) Trung Luong – My Thuan – Can Tho	82	4-lane	17,001	463.9	(2.7%)
4) Duong Lang – Hoa Lac	29	6-lane	7,500	134	(2.9%)
Upgrading/Improvement/Rehabilitation					
National Road No.2 (69+300 - 109+000)	39	2-lane (grade-III)	213	2.1	(1.0%)
National Road No.2 (134+000 - 155+000)	21	2-lane (grade-V)	41	2.0	(5.0%)
National Road No.4 (190+000-238+000)	48	2-lane (grade-V)	259	3.6	(1.4%)
National Road No.4D (26+550 - 36+200)	10	4-lane (grade-III)	348	2.7	(0.8%)
National Road No.10 (Thai Binh Bypass)	12	4-lane (grade-III)	301	8.0	(2.7%)
National Road No.70 (0+000 – 188+000)	188	2-lane (grade-V)	628	26.7	(4.2%)
National Road No.70 (188+000 – 197+212)	9	4-lane (grad-III)	103	0.9	(0.9%)
National Road No.279 (Dien Bien-Tay Trang)	40	2-lane (grade-V)	652	8.3	(1.3%)
National Road No.279(Than Giao-Dien Bien)	76	2-lane (grade-V)	462	12	(2.6%)

Source: Ministry of Transport, Vietnam

Table 3.9.2 Yearly Investment Cost for Black Spot Improvement

Year	2005	2006	2007	2008
No. of Black Spot	32	66	146	351
Improvement Cost (Million VND)	2,351	11,500	54,513	130,306
Cost / one location (Million VND)	73.5	174.2	373.3	371.2

Source: VRA

2) Program Components

(i) Establishing Economical Assessment Method

(1) Parameters of Economic Assessment

An economic assessment of projected remedial actions is important to ensure that likely benefits outweigh the cost of implementing and maintaining the scheme and that the best value of money is obtained. In order to carry out such an economic assessment, it is necessary to obtain the following information for each alternative improvement scheme:

(a) Initial cost (engineering and capital)

This is simply the project's capital cost to design and build the countermeasure.

(b) Annual maintenance and operating costs

The cost of the expected regular maintenance also needs to be estimated, if indeed this is necessary by virtue of the type of countermeasure taken.

(c) Terminal salvage value

Some countermeasures may have a residual value if they are removed. For example, an intersection may be temporarily with traffic signals for a number of years until a by-pass is completed and, after completion,

subsequent lowering of traffic may warrant the removal of the traffic signals. If it can be used elsewhere, the recovery of this cost should be taken into account.

(d) Service life

For the economic assessment, it is also necessary to take into account how long the installation is likely to last; that is, before major rehabilitation or replacement is necessary.

(e) Estimate of resulting accident change

The benefits of road safety engineering schemes are usually expected in terms of the monetary savings resulting from accident prevention or reduction. The difficulty in estimating this, of course, arises from the uncertainty in accident occurrence and can only be based on previous experience. It is particularly helpful to an engineer having to make such an economic assessment if a coordinated, nationwide database has been kept on the effectiveness of different type of accident countermeasure.

(f) Estimate of any side effects

Some accident countermeasures will inevitably produce side effects on traffic movement that could be considered as adverse effects. For example, road closure required drivers to take alternative routes, and speed-reducing measures may increase travel time and fuel consumption.

(g) Monetary values for different category of road accidents

The benefits resulting over time from engineering countermeasures are estimated by placing an economic value on accident and applying this to the expected reduction in accidents. Values should not be derived on a project-by-project basis, but should be set at the national level by transport economic and update annually. Cost must be determined for accidents of varying levels of severity; usually fatal, serious, slight and damage-only. These severity levels have to be carefully defined. And cost are always based on average values, and in some countries, are also determined for broad road categories: urban, rural, motorway.

(h) Discount rate

In an economic road project assessment, it is important to identify a given base year from which all future costs and benefits can be assessed. Since sums accruing in the future are “worthless” than if they were received in base year, they must be discounted back over a defined life of the project to a “present value”.

(2) Guideline of Traffic Safety Benefit Evaluation in Japan

For reference, the evaluation method for traffic safety benefit in Guideline for Evaluation of Road Investment (1998) by Japan Road Investment Evaluation Study Group is presented as follows:

(a) Evaluation classification by road type

An occurrence rate of a traffic accident varies with factors such as road type, roadside type, road structure and characteristic of road traffic. The damage

cost of human injury, occurrence rate of human injury and loss per accident are then to be calculated in the formula defined for each category as follows:

- Expressway
- Normal road
  - Roadside type : densely inhabited district, other urban area, non-area
  - Number of lane: 2-lane, 4-lane or more
  - Road structure : with or without median strip

(b) Evaluation of traffic safety benefit

The total loss by the traffic accident in road network is the sum of the loss at each link, calculated according to road type, roadside type and the road structure type. The total traffic safety benefit is the change in total damage cost as follows;

$BA = BY_o - BY_w$

$BY_o = \sum_i Y_{io}$

$BY_w = \sum_i Y_{iw}$

where, BA : total traffic safety benefit (1,000 JPN / year)
BY_o : total accident loss without project (1,000 JPN / year)
Y_{io} : accident loss at “link–I” without project (1,000 JPN / year)
Y_{iw} : accident loss at “link–i“ with project (1,000 JPN / year)
i : link

(c) Evaluation of traffic accident loss

The calculation of traffic accident loss includes human damage (fatality and injury), material loss arising from emergency rescues or accident management, and loss due to traffic congestion caused by an accident as shown in Figure 3.9.1. The damage cost may be calculated as follows;

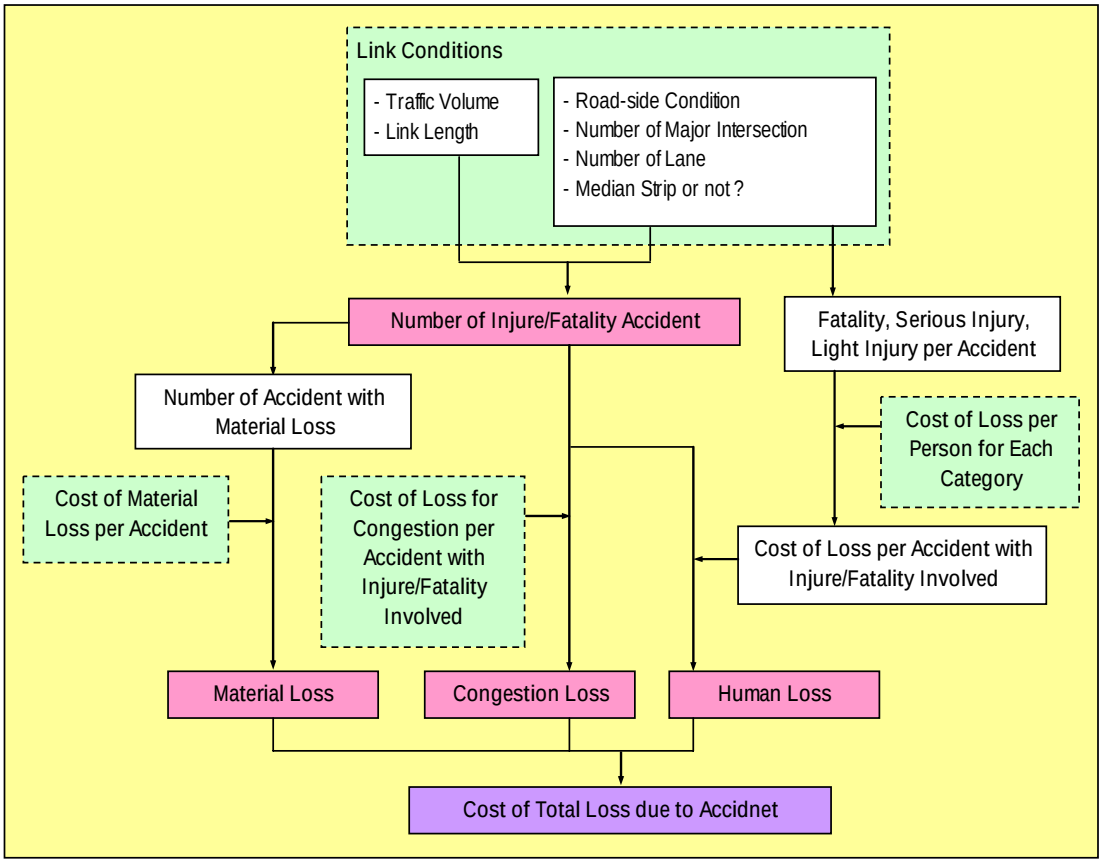
Average Damage Cost of Human Accident =

(Human Loss due to Human Accident) + (Material Loss due to Material Accident) + (Loss due to Traffic Congestion caused by Accident

$$= \sum_h (a_h \times A_h) + b \times B + C$$

where, A_h : number of injuries of “level-h” per human accident
a_h : average damage const per injury of “degree-h” (1,000 JPN)
B : material losses per human accident (1,000 JPN)
C : social loss due to traffic congestion per injure (1,000 JPN)
h : damage level of accident (1: death, 2: serious injure, 3: light injure)

Figure 3.9.1 Diagram of Traffic Accident Economic Loss Calculation



Source: Guideline for Evaluation of Road Investment (1998), Japan Road Investment Evaluation Study Group

(ii) Activity Plan

Traffic accident examination shall require full data disclosure from MOPS, thus, the proposed Cooperative Mechanism between Traffic Police and Road Management Authority in preceding subsection. The accident data analysis shall be an essential requirement to study proper guideline of evaluation for accident damage or loss.

In addition, a nationwide traffic accident database system will be developed under VRSP-1 financed by World Bank which is supposed to be implemented from 2009 to 2011. For this 5-year action program, the Study Team recommends coordination of the following activities with the program component of Traffic Accident Database Development of VRSP-1:

- After the formal agreement for traffic accident record disclosure scheme between MOT and MOPS, the Technology and Science Department of MOT shall cooperate with the Road and Railway Traffic Police Bureau of MOPS in organizing a working group that will review the past accident records to relate accident damage loss, examine issues and formulate damage loss evaluation criteria until the middle of 2009.
- MOT/VRA will conduct collection of additional data and supplemental survey to formulate the damage loss evaluation which will be completed by the end of 2009.
- Technology and Science Department of MOT to coordinate with Road and Railway Traffic Police Bureau of MOPS in formulating draft of the damage loss

evaluation criteria by the middle of 2010.

- Technology and Science Department of MOT to cooperate with Road and Railway Traffic Police Bureau of MOPS in carefully examining the parameter of damage loss evaluation criteria to be used in the accident database system established by VRSP-1. The damage loss evaluation criteria will be approved by the middle of 2010. Traffic Safety Benefit Evaluation Guideline may be issued after formulation of damage loss evaluation criteria.
- Technology and Science Department of the MOT will prepare Monitoring/Evaluation Guideline for Traffic Safety Project until the middle of 2011, and the monitoring and evaluation will be performed in related traffic safety project.

3) Implementation Plan

Table 3.9.3 shows the schedule of implementation of traffic safety monitoring and maintenance program components in the next five years.

Table 3.9.3 Implementation Schedule of Traffic Safety Monitoring and Maintenance Program

Program Components	Year					
	2008	2009	2010	2011	2012	2013
1) Formulation of Traffic Safety Benefit Evaluation Guideline						
- Agreement between MOT and MOPS regarding traffic accident record disclosure scheme.	▲					
- Review past accident record of damage loss and examine issues to prepare damage loss evaluation criteria.		■				
- Conduct of additional data collection and supplemental survey.		■	■			
- Preparation of draft damage loss evaluation criteria.			■			
- Review of evaluation parameter on damage loss by using accident database system by VRSP-1.			■	■		
- Issuance of Traffic Safety Benefit Evaluation Guideline.				▲		
Establishment of Traffic Accident Database System by VRSP-1		■	■	■		
2) Implementation of Monitoring Evaluation				■	■	■

Source: JICA Study Team

3.10 Urban Road and Urban Bypass Traffic Safety Development

1) Accident Reduction and Proposed Measures

(i) Target Accident Reduction

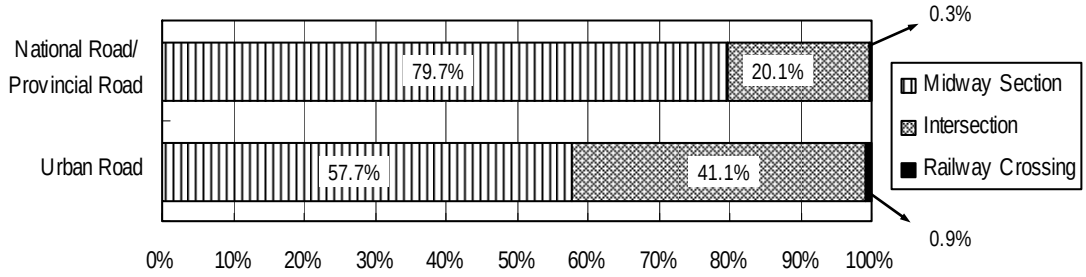
From the accident records by MOPS, approximately 20% of traffic accidents have occurred on urban roads in the past 5 years. In addition, urban road accidents are becoming more and more a significant traffic safety issue in Vietnam due to the increasing rates of urbanization and motorization. The Study Team therefore proposes to achieve a traffic accident reduction rate of 15% on urban roads (based on 2007 data) by year 2012.

(ii) Major Issues to Address to Reduce Traffic Accident Risk in Urban Areas

(1) Accidents at Intersection

Figure 3.10.1 shows a comparison of accident location between national/ provincial road and urban road based on the analysis conducted by the Police Academy, which indicates that the proportion of accident at intersection on the urban road (41.1%) is approximately twice as much as accident on national/ provincial road. This means that the safety countermeasure on intersection should be strengthened and prioritized for implementation.

Figure 3.10.1 Accident Location on National/Provincial Road and Urban Road



Source: Accident Data (2001), Police Academy.

(2) Accidents Caused by Pedestrians

Figure 3.10.2 shows accident features of the major cities of Hanoi, HCMC, Danang and Haiphong based on their respective 2006 accident records. Traffic accident data from these major cities indicated that proportion of accidents on urban roads in these cities is much higher than the national average as shown in Figure 3.10.2 (a).

The proportion of accident caused by pedestrian in Hanoi and HCMC are 12.6% and 8.6% respectively, as against 1.8% national average as shown in Figure 3.10.2 (b). From road infrastructure perspective, the following situation may be attributed to the cause of such accident pattern:

(a) Due to insufficient safe crossing road facility on high traffic roads, the pedestrian does not cross the road using designated crosswalks.

(b) Due to motorcycle parking on sidewalks, the pedestrian has no choice but to walk on the carriageway.

(c) Due to limited cycle-time of signal phasing for pedestrian road crossing at intersections, or due to insufficient signal system for pedestrian crossing, pedestrian crosses the road on red light of signal.

(3) Accidents Related to Overtaking and Lane Changing

Figure 3.10.2 (c) shows the comparison of accident causes between 4 areas and the national average. With regards to accident related to overtaking and lane changing, this figure indicates:

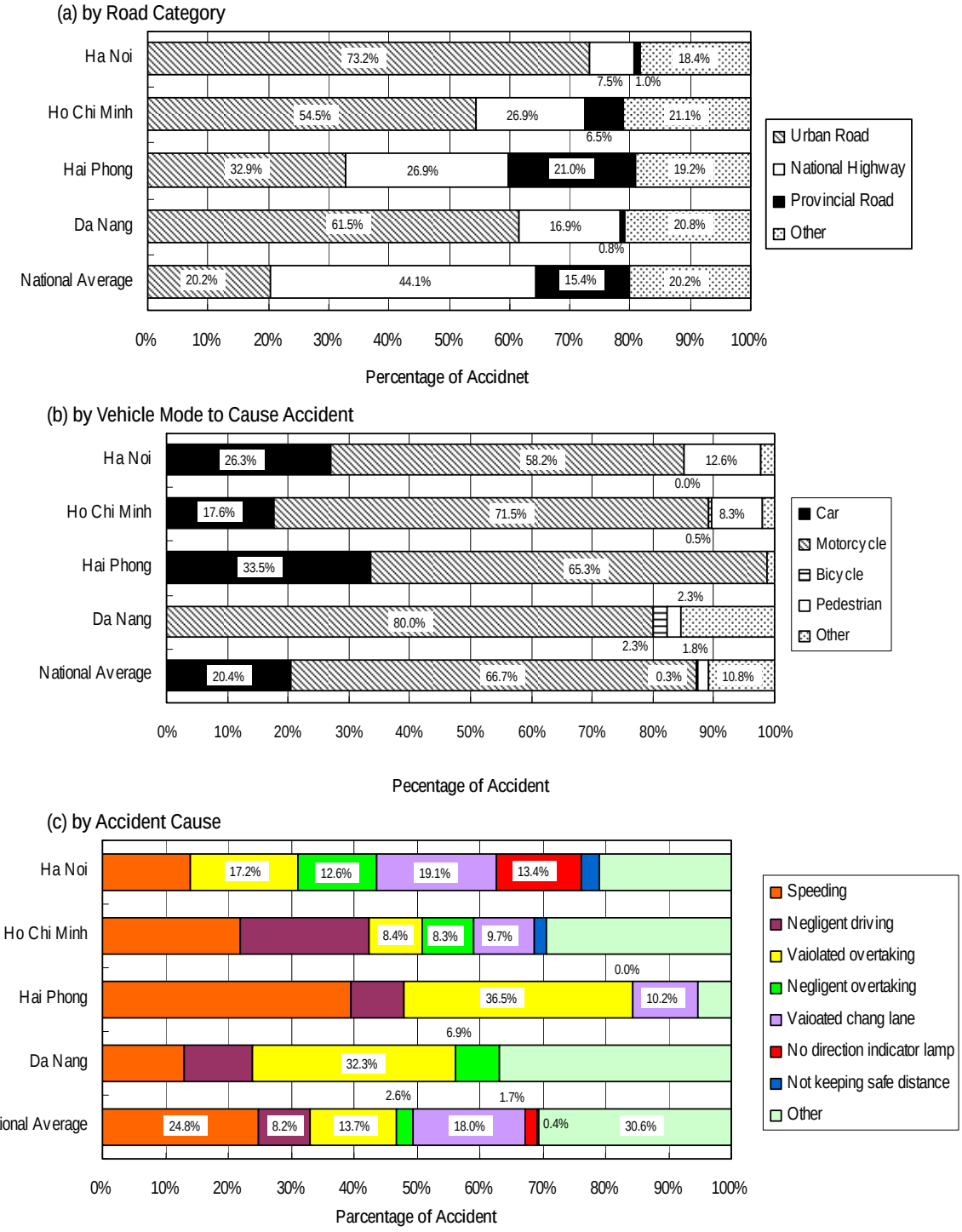
(a) While accidents caused by illegal overtaking only accounts for 13.7% of the national average, Haiphong and Danang however have accounted 36.5% and 32.3%, respectively, or twice as much as the national average.

(b) Total proportion of “illegal overtaking” and “negligence” in Hanoi is 29.8% compared with 16.3% of national average.

(c) Accident caused by “turning with no signal light indicator” is supposed to

occur during turns on intersection, overtaking and lane changing. The percentage of traffic accidents caused by this violation in Hanoi is 13.4% as compared with only 1.7% of national average.

Figure 3.10.2 Traffic Accident Characteristics in Major Cities



Source: Accident Record 2006, MOPS.

High accident risk of overtaking or lane changing may be deemed one major traffic accident characteristic in the urban areas. Therefore, the following road conditions may be expected to cause traffic accidents:

(a) On roads without median strip, the overtaking vehicle crashes with an

incoming vehicle on the opposite lane.

(b) Due to bus stopping and on-street parking, the overtaking or changing lane vehicle crashes with a vehicle passing from behind.

(c) Since bicycle travels on the carriageway mixed with motorcycle and car, accident risk related to overtaking become higher.

(4) Targeted Accident Reduction on Urban Roads

The Study Team recommends that the responsible authorities of road infrastructure development and traffic management should set the following targets to reduce accident on urban road as priority measures and policies:

(a) Installation of signal system and improvement of signal control system will be promoted to reduce accidents on intersections.

(b) Regarding pedestrian on intersections, the phasing control of signal light should be further considered for pedestrian's safe crossing. Another measure that may be promoted for consideration is the installation of pedestrian bridge on high traffic roads or roads with wider width road.

(c) In order to reduce traffic accidents caused by overtaking, installation of median strip facility will be promoted at necessary road sections.

(d) In order to reduce the accident risk due to overtaking or lane changing caused by mixed traffic, the bicycle passing space will be provided.

(e) To reduce on-street or sidewalk parking by motorcycles, comprehensive measures will be required such as formulation of an urban development plan which shall include designated parking areas; enforcement shall be enhanced against illegal parking; promotion of the formulation of a supplemental building law related to parking space/facility in new building constructions and conduct of traffic impact assessment for new, large-scale office and commercial building constructions.

(iii) Safety Measure on Urban Road Network Development

The Study Team conducted an interview survey in HCMC, Danang, Haiphong and Can Tho, particularly on issues relating to urban road network plan. Table 3.10.1 shows the outline of road network development plan in this Study's four focus areas up to 2020.

The following issues related to traffic safety and as pointed out in the urban road development plan are as follows:

(1) Review Road Network Development Plan

Urban Road Specification of Design has been revised by MOC in TCXNDVN 104:2007. However, since the road network development plan (Table 3.10.2) was formulated before issuance of TCXNDVN 104:2007, the said plan should be updated in accordance with new urban road design specification. In particular, the following points should be emphasized in its review of the development plan from the traffic safety perspective:

(a) Re-assessment of the function of each road in accordance with the road category specified in TCXNDVN 104:2007 (i.e. urban expressway, primary

main street, secondary main street, collector road and internal road).

(b) Re-examination of intersection treatment of geometric design and signalized control as per traffic volume demand forecast.

(c) Re-examination of provisions for bicycle path, pedestrian path and pedestrian crossing measures on intersection as per demand forecast.

Table 3.10.1 Urban Road Development Plan of Major City

City Name	Outline of Road Network Development Plan up to 2020
Haiphong	1) Axis Road to District/Town - Total 123.7 km (6 roads) - Upgrading on existing road: 92.6 km, construction of new alignment: 31.1 km - grade-I road: 79.4 km, grade-II road: 26.3 km, grade-III road: 18.0 km 2) Central Radial Axis Road - Total 55.8 km (13 grade-I road: 4 to 8 lane) 3) Construction of New Alignment Ring Road
Danang	- Upgrading existing road: 77.7 km (21 roads), construction of new alignment: 139.0 km (27 roads) including 4.0 km of bypass to Lien Chieu Port
HCMC	1) Centripetal Axis Road - Total 314 km (16 roads) - grade-I road: 173 km (9 roads), grade-II road : 141 km (7 roads) 2) Ring Road (to be constructed as grade-I road of Urban Road or MOT Standard) - Ring Road No.1: 25.3 km, Ring Road No.2: 65.4 km, Ring Road No.3: 83.4 km, Ring Road No.4: 152.0 km 3) Central Radial Axis Road - Baec-Nam Axis : 34 km (3 roads), grade-I urban road (20.9 km, 2 roads), grade-II urban road (13.1 km, 2 roads) - Noang-Taay Axis: 24 km (4 roads, grade-I urban road) 4) Inner City Road - total 500.2 km (98 roads) - grade-I urban road: 44.0 km (6 roads), grade-II urban road: 453.1 km (91 roads), grade-III urban road: 3.1 km (1 road)
Can Tho	1) Centripetal Axis Road - 6 roads with total length of 20.8 km will be stretched and upgraded to 35 km length. 2) Axis Road to Industrial Zone - Existing 2 roads with length of 2.6 km will be developed into 4 roads with total length of 20.5 km.

Source: TUWPS of HCMC, DOT of Haiphong, Danang and Can Tho

(2) Mass Transit System Development Plan

Hanoi Urban Transport Master Plan up to 2020 was approved by the Prime Minister in Decision No.90/2008/QD-TTg on July 2008. This master plan includes VND138,000 billion investment cost for urban railway network development and VND117,000 billion for road network development. The framework of land transport system in the master plan is based on modal shift to railway network and public bus network by 20% and 25% respectively (Table 3.10.2).

Enhancement of the public bus network service will not only contribute in alleviating congestion in Hanoi's urban roads but also in the provincial town centers. Consequently, this measure can expectedly result to reduction of

accident risks.

While the Study Team supports the government's shift to mass transport, it however recommends that, to enhance traffic safety, the urban development plan should consider priority lanes for bus passing on peak hours which can reduce accident risk caused by overtaking and lane changing.

Table 3.10.2 Transportation Mode and Investment Cost in Hanoi Urban Transport Master Plan up to 2020

Mode of Land Transport	Transportation Assignment (%)
Bicycle	4 %
Motorcycle	30 %
Passenger Car (including Taxi)	17 %
Normal Bus Network	20 %
Rapid Bus Network	5 %
Urban Railway Network	20 %
Other	4 %

Mode of Transport	Investment Cost (billion VND)
Urban Railway	138,000
Road Network	117,000
Waterway Transportation	14,000
Airport	14,000

Source: Decision No.90/2008/QD-TTg

(iv) Safety Measure on Urban Bypass Development

The urban bypass or ring road development should be promoted as an important option of traffic safety measure on urban roads. Therefore, major cities and provincial town centers should have urban bypass development plans on arterial national highway. Table 3.10.1 shows that HCMC and Haiphong have ring road development plans. Danang is implementing Danang-Hue Bypass Project and Can Tho has an ongoing National Road 1A Bypass Project with Can Tho Bridge Construction.

In general, urban bypass or ring road development is used for roadside land use development planning such as industrial zones, commercial facility development and new residential area development. From traffic safety perspective, the following should be taken into consideration in the new bypass road or ring road implementation plan in connection with roadside land use development:

- Bypass development plan as well as roadside land use development plan should be updated in accordance with Decision No.1856/2007/QD-TTg: Plan for Restoration of Traffic Safety Corridor.
- Land development authority of City or Province or land developer should conduct a traffic impact assessment for new road connection to bypass.
- Road management authority needs to arrange for a traffic safety audit including assurance of traffic safety corridor and evaluation of roadside development plan during feasibility study and detailed design stages.

2) Program Components

Traffic safety action program for urban road and bypass development will be presented hereafter; however, it should be noted that formulating action program for specific cities

is not the purpose of this Study. Since each city/province has its own unique traffic conditions, the Study Team recommends that the following guidelines for the formulation of traffic safety measures should be considered and incorporated in the urban development plan and road network development plan to be prepared by the local authorities.

(i) Safety Measure on Intersection

(1) Priority Plan of Intersection Safety Measurement

The following measures should promote the reduction of traffic accidents at intersections:

(a) Signalization as well as geometric lane arrangement on intersection based on traffic conditions will be promoted as the first priority.

(b) Safety measure for pedestrian crossing; setting an adequate traffic light phasing for pedestrian crossing; installation of pedestrian waiting area in the center median; installation of pedestrian flyover/bridge or underpass, depending on traffic conditions.

(c) Signal control system will be replaced with advanced system depending on the degree of traffic volume and congestion (i.e. point control system will be replaced with line control system, and line control system will be upgraded to area-wide system to be controlled from an integrated central operation center).

(2) Necessity of Upgrading Signal Control System

Since signal control system installation is not only a traffic safety measure but also aimed at regulating smooth traffic flow, the signal control system needs to be upgraded in accordance with increase of traffic volume and traffic congestion.

To date, almost all signal systems installed in major cities such Hanoi and HCMC is the multistage programming control by point control system. The whole sensing control signal system was installed on National Highway No.5 in 2005. However, the said system is not functioning well because the said signal system was not suited with traffic and geometrical conditions of the intersection.

The signal control is generally classified into 3 broad categories: point control system, line control system and area-wide control system (Table 3.10.3). Each control system varies widely depending on the intended use, as follows:

(a) Point Control System

- Fix-cycle control system (Multistage programming control)
  - To incorporate switching pattern of signal indication into signal control system in advance.
  - Setting daily pattern of peak hour, normal hour and night hour, and weekly pattern of week day, Saturday, Sunday and national holiday.
- Point sensing control system

  [Whole sensing control]
  - To install detector on all of traffic inflow sections in intersection.

- To control switching of signal indication in accordance with traffic flow to be perceived by detector.

Table 3.10.3 Type of Signal Control System

Covering Area	Type of Signal Control	
Point Control System	Fixed-cycle control system	Multistage programming control
	Point sensing control system	Whole sensing control
		Semi-whole sensing control (Night time semi-whole sensing control)
		Simple semi-whole sensing control
		Push button control (night time push-button control)
		Bus sensing control
		Train sensing control
Line Control System	Multistage programming system control	
	Route automatic sensing control system	
Area-wide Control System	Integrates computer control system by central operation	

Source: JICA Study Team

[Semi-whole sensing control]

- To install detector on crossroad, and then to give necessity minimum green signal for the traffic on crossroad.
- If the crossroad has few traffic and vehicle form crossroad is difficult to cross or flow in main road, the simple semi-whole sensing control type signal system may be adopted, which give fixed time of green signal for the traffic on crossroad.
- On the case of urban or suburb intersection where has very few traffic from crossroad, night time semi-whole sensing control may be adopted.

[Push button control (night time push-button control))

- Since the number of pedestrian to cross at pedestrian crossing on midway of road generally changes in time, the push-button control system is prefer to be installed to comply with demand of pedestrian crossing.

  For the pedestrian crossing on arterial road to locate at urban or suburb section, the night time push-button control system is an option to be selected.

[Bus sensing control)

- To aim at promoting efficiency of bus transporting operation as a mass transit.
- Sensor to be installed at roadside perceives approaching bus, and then arrange to extend blue-light or early turning to blue-light on

traveling lane of bus, in order to minimize stop time at intersection.

(b) Line Control System

- Multistage programming system control
  - This system is adopted where distance between signals is less than 500 m and 400 m for rural/suburb area and urban/town area respectively.
  - All signals within a system are controlled as one system to be connected communication cable and to be given offset time to green signal.
  - If there is clear-out traffic pattern on peak hour, normal time and night time, Multistage programming system control type may be adapted.
- Route automatic sensing control system
  - To control switching of signal by optimum cycle, sprit and offset within the system due to traffic flow perceived by detector within the system.
  - This may be adapted on the article highway where daily variation of traffic volume is higher.

(c) Integrates Computer Control System

- Traffic data to be collected from the numerous detectors to be installed on roadside is processed at central operation center.
- Signal phasing is controlled by computer control system of central operation center.

(3) Supplemental Program to Strengthen Signal Control

As already mentioned, installation of signal control system must be in accordance with traffic conditions and requirements of traffic control, and should be upgraded from point control to line control to area-wide control. Thus, a supplemental program to strengthen capacity of signal control is necessary for road infrastructure management authorities as well as traffic management authorities. The Study Team recommends that the concerned authorities will execute the following programs:

(a) Establishment of an Inter-agency organization between MOPS and MOT

Concerning to signal control system, the responsibility of installation belongs to MOT/PDOT/TUPWS and the responsibility of operation belongs to MOPS/Traffic Police. To achieve an effective signal control management, an inter-agency organization shall be established and the technical manual/guideline and capacity development framework to be described hereafter will be developed through the collaboration of both agencies.

(b) Phasing Control Manual and Capacity Development System

Phasing control of signal system is an essential role to ensure smooth traffic flow as well as for safety control, therefore, the phasing control technical manual will be helpful for traffic management authorities in Vietnam, and

thus, necessary to developed. However, performing proper phasing control requires a higher level of knowledge and skills which can only be made possible from actual trial and error experience. The signal phasing manual should therefore be developed through the establishment of a combination of the following capacity development systems:

- MOT/MOPS to coordinate with major cities such as Hanoi and HCMC in organizing a trainer training framework aimed at conducting capacity development for local authorities to manage urban roads. A task force will then be established to prepare the phasing control manual.
- The task force will formulate an implementation plan to formulate the phasing control manual which includes:
  - Route selection to perform experimental pilot project for trial signal phasing control.
  - Technical assistance from foreign experts.
  - Training program for the said experimental practice of signal phasing control.
  - Selection of trainees who will be developed as trainers to local authorities.
- The phasing control manual will be formulated be based on the above experimental pilot project to be supported by the foreign experts.
- The task force will send announcement to implement training program of signal phasing control to local authorities to manage traffic of urban roads. The expenses related to the training program shall be clarified in the announcement.
- The task force will formulate a training plan for the local authorities to assign trainer who is trained in the said experimental pilot project.

(c) Installation Standard and Mechanical Standard

The following technical standards are needed to be formulated:

- The above task force between MOT/MOPS will formulate nationwide technical standard for the requirement to install signal equipment in accordance with signal type; position, height, support type, etc.
- Since the signal system of point controlling to be introduced at first stage will be upgraded to line control and area-wide system, the management authorities should establish the mechanical standard for requirement of device and interface to integrate between each signal system in the future.

(ii) Safety Measure for Overtaking/Lane Changing Accident

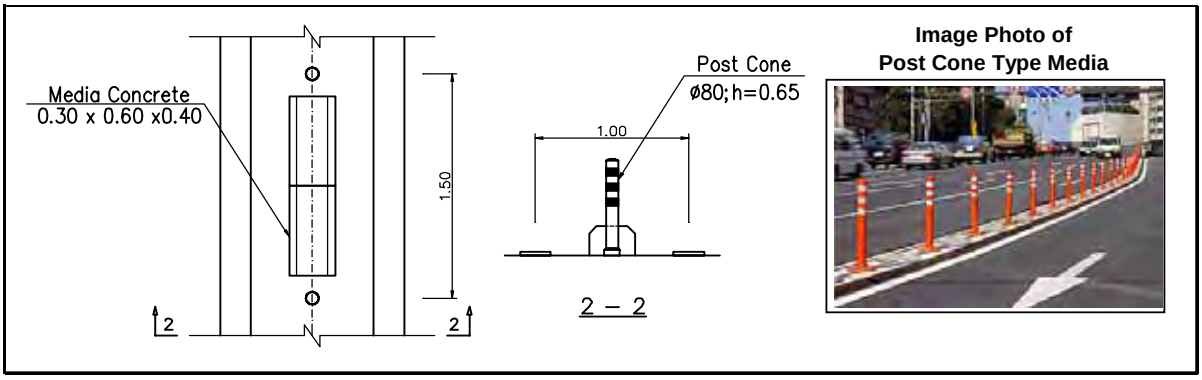
(1) Installing Center-median Facility

As a preventive measure for traffic accidents caused by overtaking, installing center-median facility is the most effective measure. Therefore, this should be promoted in road sections which have with higher accident occurrence due to this accident type.

(a) In case of center-median facility installation on existing roads without center-median, the allocated space for center-median should be minimized in order to avoid significant reduction in lane width of existing carriageway. Figure 3.10.3 shows a sample of portable type of center-median facility by post cone.

(b) Lane width on major urban roads usually is designed as 3.5 m width. Even though portable type of center-median is installed on the existing road, the lane width of existing carriageway is forcedly reduced. Therefore, the traffic rule on speed limits will be acted flexibly in accordance with lane width reduction.

Figure 3.10.3 Sample of Center-median Facility by Post Cone



Source: JICA Study Team

(2) Provision of Bicycle Path

With regards to the provision of bicycle path as a preventive measure in connection with overtaking or lane changing accidents, the following technical and institutional points are required:

(a) Bicycle path should be planned and designed in accordance with TCXDVN 104:2007 Urban Road Specification of Design issued by MOC.

(b) Traffic rules such as turn left and right at intersection when bicycle user use bicycle path should be authorized between MOT/PDOT/TUPWS and MOPS/Traffic Police, and then the pavement marking and sign posts to relate to bicycle traveling may be planned and designed.

(c) As with the Vulnerable Road User Accident Prevention Plan mentioned in subsection 3.6, the local traffic safety committee will formulate an implementation plan on the information dissemination about the program such as safety campaign to enhance effectiveness of providing bicycle path.

Figure 3.10.4 shows a sample of bicycle path provision and safety measures being used in Japan.

Figure 3.10.4 Sample of Bicycle Path Provision in Japan

Sidewalk Space Provision	
Divided by Lane Marking	Separated by Median Facility with Sign Board
	
Provision of Paved Shoulder Portion in Carriageway	
Divided by Lane Marking with Corn Post	Separated by Guardrail
	

Source: JICA Study Team

(3) Provision of Exclusive Bus Lane

Figure 3.10.5 shows a sample of exclusive bus lane in Japan. Exclusive bus lane has been introduced in major cities in Japan from the beginning of the 1990s as a part of traffic demand management (TDM) policy, which has contributed to traffic safety. The following institutional points are required to introduce exclusive bus lane system:

(a) Since the exclusive bus lane should be applied during peak hours, traffic and road management authorities should enter into an agreement with bus operators for the bus lane enforcement period.

(b) Traffic rules relating exclusive bus lane should be authorized between MOT/PDOT/TUPWS and MOPS/Traffic Police, and then the pavement marking and sign posts related to bicycle traveling may be planned and designed.

(c) In the case of a number of bus operators using exclusive bus lane, the unified operating regulation should be established, and then submitted to concerned authorities for approval.

(d) When the exclusive bus lane commenced operation, the local traffic safety committee and bus operator will conduct information campaign activities.

(e) As a first step in introducing bus lane, a pilot project will be implemented on

the selected routes in collaboration with the road management authority, traffic management authority and bus operator.

Figure 3.10.5 Sample of Bus Priority Lane Provision in Japan

Provision on Sidewalk Side (Fukuoka City)	Provision on Road Center Side (Nagoya City)
	

Source: JICA Study Team

(4) Countermeasure for On-Street Parking

Since the problem of on-street parking and sidewalk parking of motorcycles are generated due to insufficient parking space in the urban areas, a comprehensive approach should be formulated to address this problem with a medium- to long -term policy and approach.

Parking system in major cities is a very important infrastructure which ensures daily activities of urban population, serves comfort to road users as well as creates conditions for optimum use of roadway for traffic. In major cities of Vietnam, parking system includes:

(a) Parking lots, parking places in inner part of the city, residential areas including parking lots for motorcycles, cars etc.

(b) Bus stations for city public transport, bus and train stations, ports for inter provincial transport.

(c) Truck stations (including train stations, ports), main markets where goods are handled to serve the daily life of urban population.

At present, there has been parking system in major cities of Vietnam as mentioned above, but such system does not meet the demand. Proportion of land used for parking is too small as compared to the demand and simply used as open parking areas; there has so far no investments made in building multi-storey car parks with specialized equipment. The major Issues to be addressed are as follows:

(a) Insufficient parking areas in urban areas, which lead to disorderly parking and in turn cause obstruction to traffic and to pedestrians as well.

(b) No planning of parking system to serve the urban traffic, so parking areas are not only insufficient but also small in size.

(c) Simple security guard services, which do not meet the requirements of vehicle owners.

(d) No effective countermeasures in the short- and long-term.

(5) Urban Planning at Local Levels

Urban development plans by the local authorities are recommended for updating to incorporate the following:

(a) Preparation of plan to implement urgent projects for parking lot arrangement in accordance with forecast of vehicles owned by urban population.

(b) Application of advanced technology in multi-storey car parks.

(c) Consideration of the possibility of arranging public motorcycle parking areas for residents living in the old part of the city with narrow sidewalk.

(6) Legal / Institutional Aspect

The concerned authorities need to establish the following legal and institutional framework in order to support the promotion of parking area establishment:

(a) Review laws of building standards related to parking space assurance and establishing supplemental regulations.

(b) Urban development authority will establish a regulation compelling the developer of large scale office building or complex commercial building to conduct a traffic impact assessment which shall be submitted to road/traffic management authorities for approval prior to construction.

(c) With regards to arrangement of public motorcycle parking space on commercial zone in old town area, a liaison council between urban authority and community association will be established, and then public consultation scheme will be also formulated.

(d) Strengthening of regulation and enforcement in connection with the proper usage of sidewalk, in addition to the conduct of awareness campaign.

(e) In connection with car registration institutional system, the related authorities will establish a regulation to require car owners a parking space certification to be attached with registration documents.

(iii) Urban Bypass Development

Roads planned for bypass construction are mostly the arterial national highway. Therefore, VRA and local urban development authorities are required the following:

- VRA will instruct the executing agency of bypass construction project that the bypass plan or design should be updated in accordance with Decision No.1856/2007/QD-TTg: Plan for Restoration of Traffic Safety Corridor.
- VRA will also instruct to the local urban development authorities that traffic impact assessment shall be conducted in connection with roadside land use development, particularly on the arrangement of crossroads to bypass and collector road/service road, and submit to VRA/MOT for approval.
- VRA will instruct the executing agency of bypass construction project that the feasibility study or detailed design should be reviewed and revised to comply with the safety measurements discussed in earlier subsections on Highway Traffic Safety Facility Enhancement Plan (3.5) and Vulnerable Road User Accident Prevention Plan (3.6).

- VRA will instruct the executing agency of bypass that a traffic safety audit should be arranged in accordance with Traffic Safety Audit System Development Plan discussed in 3.5.

3.11 Human Resources Development

1) Targets

The action program for road infrastructure sector mainly is focused on reducing traffic accidents on the national highway since the accidents occurring on national highway makes up approximately 50% of total traffic accidents in Vietnam. Black spot improvement programs have been implemented to be centered on the national highway, and the restoration of traffic safety corridor and the traffic safety audit system are supposed to be applied on the national road.

In this regard, VRA should play an important role in the traffic safety management, thus a human resources development plan should be focused on the capacity development of traffic safety management by VRA. In this action program for human resource development, the following technical tools to support the practice of safety management are recommended and aimed to enhance the enforcement capabilities of black spot treatment and traffic safety audit:

(i) Developing Technical Guidebook of Black Spot Treatment

Black spot treatment is usually planned depending on various conditions: accident situation, road infrastructure condition and roadside condition. Countermeasures are then designed on a case-to-case basis which means that it is not easy to establish a standard technical guideline for black spot treatment. From this aspect, a technical guidebook including the following contents are recommended to be developed:

- To collect best practices of black spot treatment that is implemented on the national highways.
- To cover the various conditions in terms of accident situation, road infrastructure condition and roadside condition.
- To include accident record, traffic condition, road condition of before improvement, treatment design and traffic condition of after treatment and evaluation of accident risk mitigation.

The above technical guidebook should be used by the road management authorities of local government and consultant engineers, not only for VRA engineers.

(ii) Developing Technical Manual of Traffic Safety Audit

The Study Team recommends the establishment of an executive guideline for traffic safety audit (refer to 3.3 Traffic Safety Audit System Development Plan) that is suggested to be supported by a technical assistance under Vietnam Traffic Safety Project Phase-1 financed by World Bank.

The safety audit system should develop main pillar of traffic safety assurance scheme; therefore, the Study team recommends that the said guideline should

develop to a practical technical manual to come up with case example of actual practice for usage of auditors. The following contents are proposed to be included in the said technical manual:

(1) Identify Project or Existing Road to be Audited

As a result of this process, the project or existing road to be audited is determined and the parameters for a safety audit are set.

(2) Select Safety Audit Team

As a result of this process, an independent, qualified and multidisciplinary team of experts suitable for the specific safety audit stage is selected.

(3) Conduct Pre-audit Meeting to Review Project Information

The meeting brings together the project owner, the design team and the audit team to discuss the context and scope of the safety audit and review all project information available.

(4) Perform Field Reviews under Various Conditions

The objective of project data review is to gain insight into the project or existing road, prepare for the field visit and identify area of safety concerns. The field visit is used to get further insight into the project or existing road and to further verify/identify areas of safety concern.

(5) Conduct Audit Analysis and Prepare Report of Findings

As a result of this process, the safety issues are identified and prioritized and suggestion are made for reducing the degree of safety risk. The safety audit results are then succinctly summarized in the formal safety audit report.

(6) Present Audit Findings to Project Owner/Design team

In this process, audit team orally reports the key audit findings to the project owner and design team in order to facilitate the understanding of audit findings.

(7) Prepare Formal Response

Once submitted, the formal response becomes an essential paper of the project documentation. It outlines what the project owner and/or design team will taken in response to each safety issue listed in the safety audit report and why some of the safety audit suggestions could not be implemented.

(8) Incorporate Findings into Project When Appropriate

This final process ensures that the corrective measures outlined in response report are completed as described and in the time frame documented.

2) Program Components

The Study Team proposes to perform the following activities to establish the above technical guidebook and manual in the human resources development action program:

(i) Technical Guidebook on Black Spot Treatment

- The Black Spot Management Unit of VRA mentioned in the Strengthening Black Spot Management subsection will formulate a reporting form of black spot treatment and issue to RRMU and PDOT by the middle of 2011, and then

continue to collect data and information for practice of black spot treatment until the middle of 2012.

- The Black Spot Management Unit will organize a working group to prepare the technical guidebook by the middle of 2012, and the working group will conduct and analysis of data/information of black spot treatment until the end of 2012.
- The working group will determine the contents of guidebook by the end of 2012, and then the editing of guidebook will be finalized by the middle of 2013.

(ii) Technical Manual on Traffic Safety Audit

- MOT/VRA will organize a working group to prepare the technical manual by the end of 2011, and the working group will examine the issue of safety audit system by reviewing actual practice of traffic safety performance until the middle of 2011.
- The working group will determine the contents of guidebook by the end of 2012, and then the editing of technical manual will be finalized by the middle of 2013.

3) Implementation Plan

Table 3.11.1 shows the schedule of implementation of human resources development program components in the next five years.

Table 3.11.1 Implementation Schedule of Human Resource Development Program

Program Components	Year					
	2008	2009	2010	2011	2012	2013
Development of a Technical Guidebook on Black Spot Treatment						
1) Data collection on black spot treatment practice						
2) Organization of working group for guidebook preparation						
3) Review and analysis of black spot treatment practice						
4) Determining contents of guidebook						
5) Editing and publishing guidebook						
Development of a Technical Manual on Traffic Safety Audit						
1) Organization of a working group for manual preparation						
2) Review practice of traffic safety audit						
3) Determining contents of manual						
4) Editing and publishing manual						

Source: JICA Study Team

3.12 Implementation and Investment

1) Implementing Agency

The implementing agencies responsible for each program on infrastructure development action program are summarized in Table 3.12.1.

Table 3.12.1 Responsible Agency for Road Infrastructure Proposed Safety Measures

Program	Leading Agency	Concerned Agency
1. Black Spot Improvement Plan		
1) Implementation of Black Spot Improvement	VRA/RRMU	
2) Formulation of Cooperative Mechanism between Traffic Police and Road Management Authority	VRA	MOPS NTSC
3) Establishment of Practical Criteria for Black Spot Improvement (In collaboration with Word Bank or JBIC Traffic Safety Project)	MOT	NTSC-TSPMU
4) Strengthening Capacity of Black Spot Management (In collaboration with Word Bank or JBIC Traffic Safety Project)	VRA	NTSC-TSPMU
2. Traffic Safety Audit System Development Plan		
1) Revision of Traffic Safety Audit (TSA) Guideline (In collaboration with Word Bank or JBIC Traffic Safety Project)	MOT	NTSC-TSPMU
2) Promotion of TSA System to Road Management Authority	MOT	VRA, Proj. Owner
3) TSA Pilot Project in WB VRSP-1	VRA	NTSC-TSPMU
3. Traffic Safety Corridor Development Plan		
1) Formulation of Nationwide Action Implementation Plan	VRA/RRMU	Local Authority
2) Formulation of Supporting Institutional Framework	VRA	Local Authority
3) Amendment of /Supplement to Legal Provision	MOT	
4. Highway Traffic Safety Facility Enhancement Plan		
1) Preparation of Design Standards/Guidelines for Traffic Safety	MOT	MOPS
2) Promotion of Smooth/Comfortable Road Safety		
- Intersection improvement	VRA/RMMU	
- Lane Separation by Vehicle Type Provision	VRA/RMMU	
- Railway crossing improvements	Railway Company	
- Installation of lighting system on national road	VRA/RMMU	
5. Vulnerable Road User Accident Prevention Plan		
1) Preparation of design standard for pedestrian/bicycle safety by MOT	MOT	
2) Conduct of survey to identify locations where pedestrian/bicycle path and crossing facilities should be provided/installed	VRA/RRMU	Local Authority
3) Formulation of implementation plan for road infrastructure improvement	VRA/RRMU	
4) Formulation of implementation plan for education and safety dissemination program	VRA/RRMU	Local Authority
5) Implementation of action program	VRA/RRMU	Local Authority
6. Expressway Safety Development Plan		
1) Establishment of traffic regulation/rule and operation rule of expressway.	MOT, MOPS	
2) Preparation of Expressway Traffic Operation/Management Standards and Technical Standard for Traffic Safety Facility/Device Installation	MOT	Project Owner
3) Execution of Traffic Safety Audit	MOT	Project Owner
7. Road Work Traffic Safety Development Plan		
1) Traffic Safety on Road Construction Work		
- Preparation of Road Work Safety Guideline	MOT	
- Implementation of nationwide traffic safety audit for road construction	MOT	Project Owner
2) Long-term Performance Based Maintenance System	VRA/RRMU	
3) Installation of Vehicle Weighing Station on Selected National Highway	VRA/RRMU	Traffic Police
8. Traffic Safety Monitoring/ Maintenance Plan		
1) Formulation of Traffic Safety Benefit Evaluation Guideline	MOT	
2) Implementation of Monitoring Evaluation	MOT	Project Owner
9. Urban Road and Urban Bypass Traffic Safety Development Plan		
1) Safety Measure on Intersection	TUPWS, Traffic Police	
2) Safety Measure for Overtaking/Changing Lane Accident	TUPWS	Local Authority
3) Urban Bypass Development	VRA	Local Authority
10. Human Resources Development Plan		
1) Development of Technical Guidebook of Black Spot Treatment	VRA/RRMU	MOT
2) Development of Technical Manual of Traffic Safety Audit	MOT	VRA

Source: JICA Study Team

2) Investment Budget Plan

Table 3.12.2 shows the summary of investment cost for road infrastructure safety development action program. It should be noted that the cost for the urban road and urban bypass traffic safety measure is not included since the investment cost must be clarified based on the urban development plan by the specific authorities. The cost of each program is given in Table 3.12.3.

Table 3.12.2 Overall Investment Plan for Road Transport Infrastructure Development Five-Year Action Program

Program	Year						Total Cost (2009-2013)
	2008	2009	2010	2011	2012	2013	
1. Black Spot Improvement Plan	(8.2)	8.3	7.9	10.9	13.1	12.0	52.0
2. Traffic Safety Audit System Development Plan		0.3	0.7	0.6	0.5	0.4	2.5
3. Traffic Safety Corridor Development Plan	(0.2)	0.7	30.4	50.1	50.0	50.0	181.2
4. Highway Traffic Safety Facility Enhancement Plan	(4.4)	39.6	77.0	92.2	91.9	91.9	392.6
5. Vulnerable Road User Accident Prevention Plan	(0.2)	1.5	12.8	25.0	25.0	25.0	89.3
6. Expressway Safety Development Plan		1.2	1.0	0.3	0.3	0.3	3.1
7. Road Work Traffic Safety Development Plan		6.7	2.7	5.1	0.2	0.2	14.9
8. Traffic Safety Monitoring and Maintenance Plan		0.5	0.3	0.4	0.4	0.4	2.0
9. Human Resources Development Plan				0.1	0.7	0.4	1.2
Total :	(13.0)	58.8	132.8	184.7	182.1	180.6	739.0

Source: JICA Study Team

Table 3.12.3 Assumed Investment Cost Per Program of Road Transport Infrastructure Development Five-Year Action Program

Unit: USD Million

Program and Program Components	Year						Total Cost (2009-2013)	Note
	2008	2009	2010	2011	2012	2013		
1. Black Spot Improvement Plan								
(1) Implementing Black Spot Improvement on National Highway by VRA	8.0	8.0	7.0	6.0	5.0	4.0	30.0	Same as budget of year 2008
(2) Formulating Cooperative Mechanism between Traffic Police and Road Management Authority								
1) Establishing Traffic Accident Database System by WB VRSP-1		(1.7)	(1.8)	(1.8)			(5.3)	Project cost under WB VRSP-1
2) Promoting black spot improvement scheme between road management authority and traffic police				0.1	0.1		0.2	Administration cost only
(3) Establishing Practical Criteria for Black Spot improvement								
1) Review of black spot identification by current criteria	0.1						0.1	
2) Implementation of black spot improvement pilot project including training/capacity development for engineers								
- Black spot improvement (NH-1,51) under WB VRSP-1		(0.9)	(0.9)	(0.9)			(2.7)	Project cost under WB VRSP-1
- JBIC Traffic Safety Improvement Project (NH-3, 5, 10, 18)		(9.0)	(9.0)	(9.0)	(9.0)	(9.0)	(45.0)	Project cost under JBIC Project
3) Formulating practical criteria			0.1				0.1	
(4) Strengthening Capacity of Black Spot Management								
1) Developing human resource/techniques/expertise exchange system related to black spot improvement								
- Review and analysis past black spot practices	0.1	0.1					0.1	
- Training of VRA Headquarter engineers in JBIC/WB Project		0.2					0.2	Counterpart fund under WB VRSP-1
- Training to RRMU engineers by VRA Headquarter			0.8				0.8	0.2 M $ / one RRMU office
2) Promotion of black spot improvement implementation to local governments								
- Training to PDOT engineers by VRA RRMU				0.8			0.8	0.2 M $ / one RRMU office
- Provincial Road by PDOT				4.0	8.0	8.0	20.0	
Sub-total :	*8.2*	*8.3*	*7.9*	*10.9*	*13.1*	*12.0*	*52.0*	
2. Traffic Safety Audit System Development Plan								
(1) Revision of Traffic Safety Audit (TSA) Guideline								
1) Formulating executive process and evaluation criteria by MOT								
- Pre-F/S, F/S and D/D stage		0.1					0.1	
- Operation stage		0.1					0.1	
2) Issue revision of TSA guideline by MOT			0.1				0.1	
(2) Promotion of TSA System to Road Management Authority								

Program and Program Components	Year						Total Cost (2009-2013)	Note
	2008	2009	2010	2011	2012	2013		
1) Preparing TSA implementation plan on national highway								
- Pre-F/S, F/S and D/D stage (by MOT)			0.1				0.1	
- Operation stage (by VRA)				0.1			0.1	
3) Executing implementation plan on national highway			0.4	0.4	0.4	0.4	1.6	20,000 US$ / one project
(3) TSA Pilot Project in WB VRSP-1								
1) TSA Pilot Project		(0.4)	(0.3)				(0.7)	Project cost under WB VRSP-1
2) Capacity Development Program		0.1	0.1	0.1	0.1		0.4	Counterpart fund under WB VRSP-1
Sub-total :		*0.3*	*0.7*	*0.6*	*0.5*	*0.4*	*2.5*	
3. Traffic Safety Corridor Development Plan								
(1) Formulating Nationwide Action Implementation Plan								
1) Examining prioritization of implementation	0.1	0.1					0.1	
2) Developing database system		0.2					0.2	
3) Formulating implementation action program			0.1				0.1	
4) Conducting inventory survey for compensation and preparing budgetary form on priority section of national highway			5.0				5.0	1,000 US$ x 5,000 km
5) Implementing compensation and clearing on selected priority section.			25.0	50.0	50.0	50.0	175.0	0.1 million US$ / km
(2) Formulation of Supporting Institutional Framework								
1) Formulating regal framework for Strengthening and strict enforcement of sanctions against returning illegal dwellers.		0.1					0.1	
2) Establishment of compensation system			0.2				0.2	
3) Establishment of public consultation system				0.1			0.1	
(3) Amendment/Supplement of Legal Provision								
1) Examining technical issue form monitoring of NH-1 pilot implementation and nationwide action program formulation.	0.1	0.1					0.1	
2) Examining compliance with related regal frame work of land use, urban development, industrial development, etc.		0.2					0.2	
3) Formulating draft amendment/supplement of legal provision and submitting legal authorities.			0.1				0.1	
Sub-total :	*0.2*	*0.7*	*30.4*	*50.1*	*50.0*	*50.0*	*181.2*	
4. Highway Traffic Safety Facility Enhancement Plan								
(1) Design Standards/Guidelines Preparation for Traffic Safety								
1) Examining issue and establishing working groups	0.1							

Program and Program Components	Year						Total Cost (2009-2013)	Note
	2008	2009	2010	2011	2012	2013		
2) Making to solve and authorizing technical issue to relate traffic rule/management with MOPS		0.1					0.1	
3) Preparing supplement / update / improve design standards/guidelines for traffic safety facility enhancement.		0.4					0.4	Employed local consultant
4) Integrating Design Standards/Guidelines and preparing instruction manual.			0.4				0.4	Employed local consultant
5) Preparing standard drawings for traffic safety measure.				0.2			0.2	Employed local consultant
6) Issue of booklet of "Traffic Safety Design Standard".				0.1			0.1	Editing and publish cost
(2) Promoting Smooth/Comfortable Road Safety								
1) Intersection improvement								
- Preparing supplemental design criteria of intersection design.	0.6	0.6					0.6	by Technical Assistance
- Conducting traffic volume survey at intersection on national highway (more than grade-III).		2.0					2.0	500 US$ / location
- Formulating implementation by RRMU.		1.2					1.2	Including Pre-F/S by RRMU office
- Formulating action program by VRA.			0.5				.5	Including F/S study
- Implementing action program.			18.0	36.0	36.0	36.0	126.0	0.12 million US$ / location
2) Separate Lane by Vehicle Type Provision								
- Preparing design guideline by MOT.	0.1							
- Discussing traffic rule on separate lane with MOPS and authorizing rule.		0.1					0.1	
- Formulating Implementation Plan by VRA		0.5					0.5	Including F/S study
- Survey, detailed design and construction.		25.0	50.0	50.0	50.0	50.0	225.0	0.15 million US$ / km
3) Railway crossing improvements								
- Closing and protecting by fence at unauthorized crossing	2.1	2.1					2.1	Guard fence : 200 US$ / m
- Installing automatic warning system at all locations.	1.5	3.1					3.1	7,500 US$ / location
- Replace to automatic opening and shifting lifting barrier on national road.			3.6				3.6	30,000 US$ / location
- Replace to automatic opening and shifting lifting barrier on provincial/district road.				3.8	3.8	3.8	11.4	20,000 US$/ location
4) Installing lighting system on and on national road.								
- High traffic volume section		4.5	4.5				9.0	18,000 US$ / km
- High risk accident section				2.1	2.1	2.1	6.3	43,000 US$ / km (including guardrail)
Sub-total :	4.4	39.6	77.0	92.2	91.9	91.9	392.6	
5. Vulnerable Road User Accident Prevention Plan								
1) Preparing design standard for pedestrian/bicycle safety by MOT	0.2							Employed local consultant

Program and Program Components	Year						Total Cost (2009-2013)	Note
	2008	2009	2010	2011	2012	2013		
2) Surveying to identify the location to provide pedestrian/bicycle path and crossing facility.		1.0					1.0	200 US$ / km
3) Formulating implementation plan for road infrastructure improvement by VRA.		0.5					0.5	Including F/S study
4) Formulating implementation plan for education and safety dissemination program by Provincial Traffic Safety Committee.			0.3				0.3	Employed local consultant
5) Implementing action program. (Pedestrian/bicycle path : 0.15 million US$ / km, Pedestrian bridge : 0.14 million US$ / location)			12.5	25.0	25.0	25.0	87.5	
Sub-total :	0.2	1.5	12.8	25.0	25.0	25.0	89.3	
6. Expressway Safety Development Plan								
1) Establishing Traffic regulation/rule and operation rule of expressway.		0.2					0.2	
2) Preparing “Expressway Traffic Operation/Management Standards” and “Technical Standard for Traffic Safety Facility/Device Installation” by MOT.		1.0	1.0				2.0	by Technical Assistance
3) Executing “Traffic Safety Audit”.				0.3	0.3	0.3	0.9	30,000 US$ / one project
Sub-total :	0.0	1.2	1.0	0.3	0.3	0.3	3.1	
7. Road Work Traffic Safety Development Plan								
(1) Traffic Safety on Road Construction Work								
1) Preparing Road Work Safety Guideline		0.3					0.3	by Technical Assistance
2) Conducting traffic safety audit of constriction stage under WB VTSP-1			(0.1)				(0.1)	Project cost under WB VRSP-1
3) Implementing nationwide traffic safety audit for road construction				0.1	0.2	0.2	0.5	5,000 US$ / one project
(2) Long Term Performance Base Maintenance System								
1) Pilot Project of Performance Base Maintenance								
- Formulating Performance Standards/Requirements		0.2					0.2	by Technical Assistance
- Tendering			0.1				0.1	by Technical Assistance
- Implementing Pilot Project on National Highway			2.5	5.0			7.5	Maintenance cost : 15,000 US$ / km
2) Implementing nationwide					(50.0)	(50.0)	(100.0)	Maintenance cost : 10,000 US$ / km
(3) Installation of Vehicle Weigh Station on Selected National Highway.								
1) Installing vehicle weigh equipment on selected toll gate		6.0					6.0	0.2 million US$ / location
2) Performing overloading vehicle enforcement campaign		0.2	0.1				0.3	
Sub-total :	*0.0*	*6.7*	*2.7*	*5.1*	*0.2*	*0.2*	*14.9*	
8. Traffic Safety Monitoring/ Maintenance Plan								
1) Formulating Traffic Safety Benefit Evaluation Guideline								

Program and Program Components	Year						Total Cost (2009-2013)	Note
	2008	2009	2010	2011	2012	2013		
- Review past accident record of damage loss and examining issues to prepare damage loss evaluation criteria.		0.2					0.2	Employed local consultant
- Executing additional data collect and supplemental survey.		0.3					0.3	by Technical Assistance
- Preparing draft damage loss evaluation criteria.			0.3				0.3	by Technical Assistance
- Review evaluation parameter of damage loss by using accident database system by VRSP-1.			(0.1)				(0.1)	Project cost under WB VRSP-1
- Formulating Traffic Safety Benefit Evaluation Guideline				0.2			0.2	Employed local consultant
2) Implementing Monitoring Evaluation				0.4	0.4	0.4	1.0	10,000 US$ / one project
Sub-total :	*0.0*	*0.5*	*0.3*	*0.4*	*0.4*	*0.4*	*2.0*	
9. Human Resource Development Plan								
(1) Development of Technical Guidebook on Black Spot Treatment								
1) Collecting data of black spot treatment practice.				0.1	0.1		0.2	
2) Review and analysis of black spot treatment practice.					0.3		0.3	by Technical Assistance
3) Preparing / editing / publishing guidebook.						0.2	0.2	by Technical Assistance
(2) Development of Technical Manual on Traffic Safety Audit								
1) Review practice of traffic safety audit					0.3		0.3	by Technical Assistance
2) Editing and publishing manual.						0.2	0.2	by Technical Assistance
Sub-total :	*0.0*	*0.0*	*0.0*	*0.1*	*0.7*	*0.4*	*1.2*	
Total Cost	13.0	58.8	132.8	184.7	182.1	180.6	739.0	

Source: JICA Study Team