# Road Traffic Safety Guideline in Suphan Buri


March 2020

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The Research Report for IATSS Social Contribution Project 1920, March 31, 2020

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# Preface

The purpose of the IATSS Social Contribution Project 1920 “Social Implementation of Information Sharing-type Traffic Safety Measure Scheme in Model Regions in South East Asia” is to examine the applicability of Japan’s approach to traffic safety in Thailand and Malaysia. In particular, we will use the results of the IATSS research projects 1602/1702/1802 “Implementation support for information sharing-type traffic safety measure scheme in South East Asia” conducted between 2016 and 2018, which aimed to establish a system for analyzing HIYARI-HATTO incidents and/or traffic accident data and propose appropriate countermeasures. The Suphan Buri Road Traffic Safety Guidelines compiled here are part of the results of this activity.

According to reports from the World Health Organization, fatality by road traffic accidents in Thailand is notoriously high, and the Thai government has taken the matter seriously. In such circumstances, under the strong leadership of the former Minister of Transport, His Excellency Mr. Arkhom Termpittayapaisith, a traffic safety working group was established by Thailand’s Ministry of Transport and Japan’s Ministry of Land, Infrastructure, Transport and Tourism (MLIT). During last three years, nine working group meetings were organized; in the model areas, inspections were have been conducted, and measures have been proposed. Suphan Buri is one of the model districts selected for the traffic safety working group. Various safety measures in Japan were incorporated into those at traffic black spots in Suphan Buri Province, resulting in a significant reduction in traffic accidents. The research group of IATSS considered that incorporating the planning system for traffic safety measures involving residents implemented in Japan will be more effective in this context to promote road traffic safety measures in Thailand; for this reason, we have worked in cooperation with the MLIT and the Japan International Cooperation Agency (JICA).

The stakeholders in Suphan Buri have make an efficient team, collaborate across organizations, and are suitable as model districts for traffic safety in Thailand. They welcomed our visits and carefully considered our suggestions: it was a good opportunity to reflect on what we must do to promote road safety in Thailand. Therefore, we aimed to use the experience we gained at the end of the project, along with what the people involved in Suphan Buri had been working on, as a guideline—the purpose of which is to use this wonderful experience in Suphan Buri to guide efforts in other districts. We all hope that the number of traffic fatalities in Thailand will be reduced.

Atsushi FUKUDA,
Project Leader of IATSS Social Contribution Project 1920

# Contents

# 1. How Can We Tackle Road Traffic Safety? Message to Suphan Buri

**Kunimichi TAKADA**

In human society, an "accident" is an element of fate that cannot be avoided, whether it is a natural or a human disaster. Although traffic accidents cannot be avoided even in the automotive industry, they can be reduced with everyone's continuous effort.

The development of the automotive industry has generated economic growth, and many people have the right to move in their free time with a car. The widespread use of automobiles has produced a positive effect; at the same time, however, we have the downside of frequent traffic accidents. Automobiles are humans' greatest technological achievement, but that technology has caused many accidents.

Therefore, we must strive to bring the frequency of traffic accidents close to zero through human wisdom. Moreover, if this frequency is successfully halved, it is necessary to make efforts to further halve it.

As shown in Figure 1-1, automobile traffic consists of an integrated "people-car-road" system and of the environmental system that surrounds it. Traffic safety then largely depends on the efforts of "people," that is, drivers.

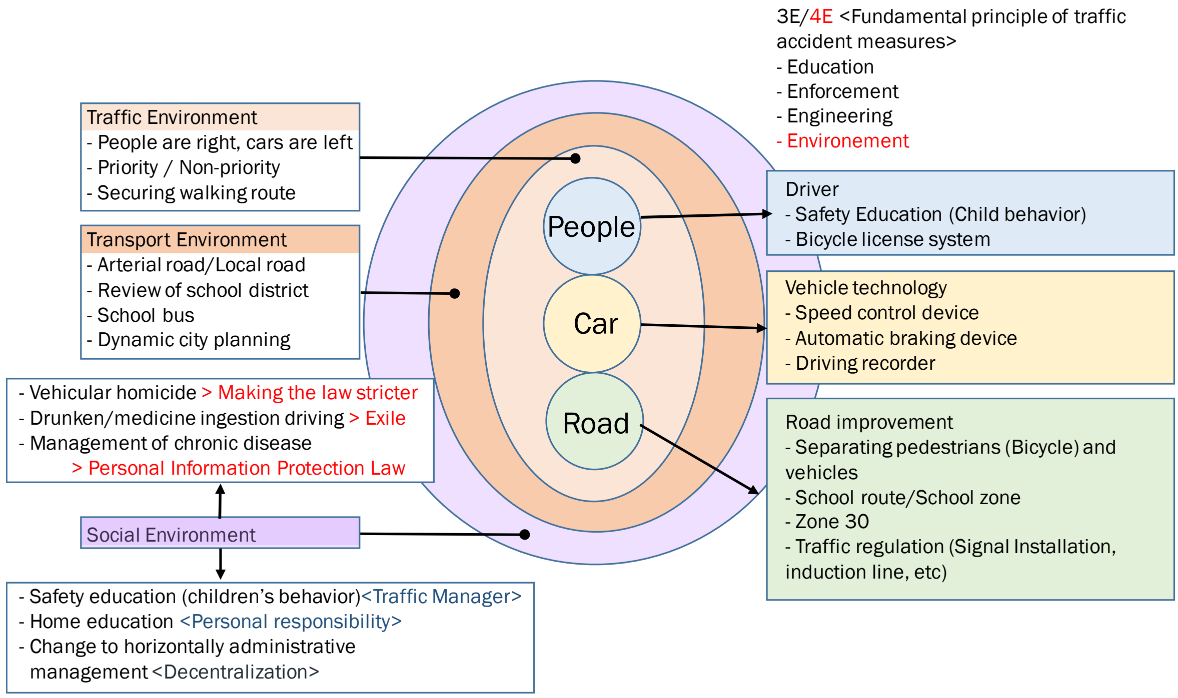



Figure 1-1 Schematic diagram of traffic accident countermeasures on school route

The advancement of vehicle technology in recent years has led to the possibility of greatly reducing accidents caused by "cars." Currently, autonomous vehicles have reached a performance level that enables their continuous manufacturing, and traffic accidents are expected to be further reduced in the future.

We have also created “highways” that are highly likely to reduce traffic accidents, and the problem of “people” should have overcome the traffic safety problem by creating traffic safety laws, driving technology manuals, and driving license systems.

However, the number of traffic accidents is currently high. Regardless of how the car or road is improved, traffic accidents occur because people act as if they were alone and break laws and regulations that support technology for safety. On the other hand, the traffic safety system is limited within safety standards and cannot cope with such self-righteousness of human beings. In other words, the traffic safety system is not a comprehensive system that identifies each individual’s actions.

Based on my participation in and observation of traffic accident countermeasure activities here in Suphan Buri, Thailand, the following briefly summarizes the author’s thoughts on road safety. The basic concept of technical methods for road traffic safety consists of the following four points:

(1) Reduction of collision points (also called conflict points or intersections) in Figure 1-2.

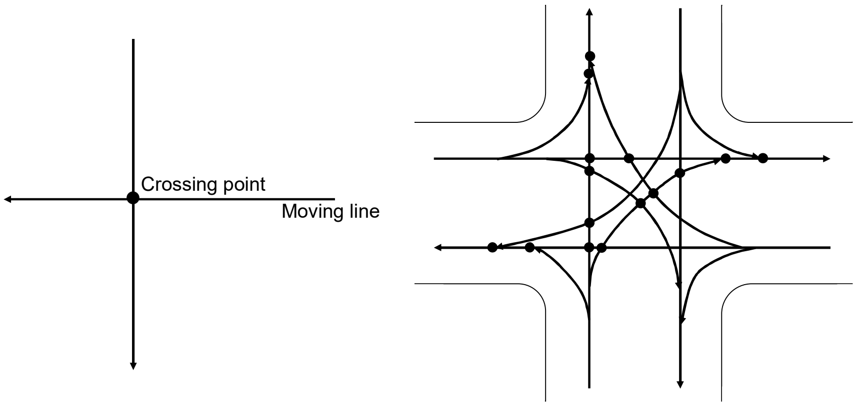



Figure 1-2 Crossing point and Moving line

(2) Separation of car, pedestrian, and bicycle (figures 1-3 and 1-4)

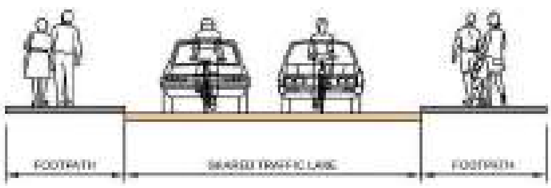



Figure 1-3 Cross section of separation of road and sidewalk

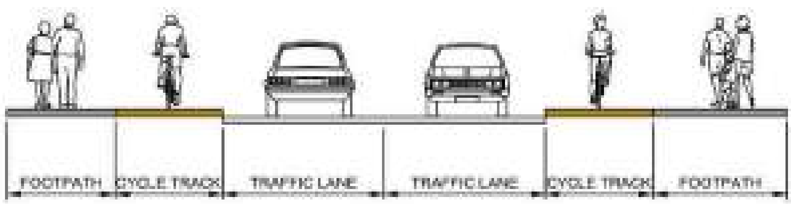



Figure 1-4 Cross section of separation of road, bicycle lane, and sidewalk

(3) Access control in Figure 1-5.

Access Control
(1) Express Way(Design speed is 80Km/h or more)
>Inflow / outflow is possible only at interchange and service area
(2) General Road(Arterial)
>At an intersection
>Prohibition of inflow and outflow from parking lots
(3) General Road(Local)
>Almost available at any place

Figure 1-5 Fundamental Concept of Access Control

(4) Suppression of speed. The fatality rate of a pedestrian colliding with a vehicle is shown in Figure1-6.

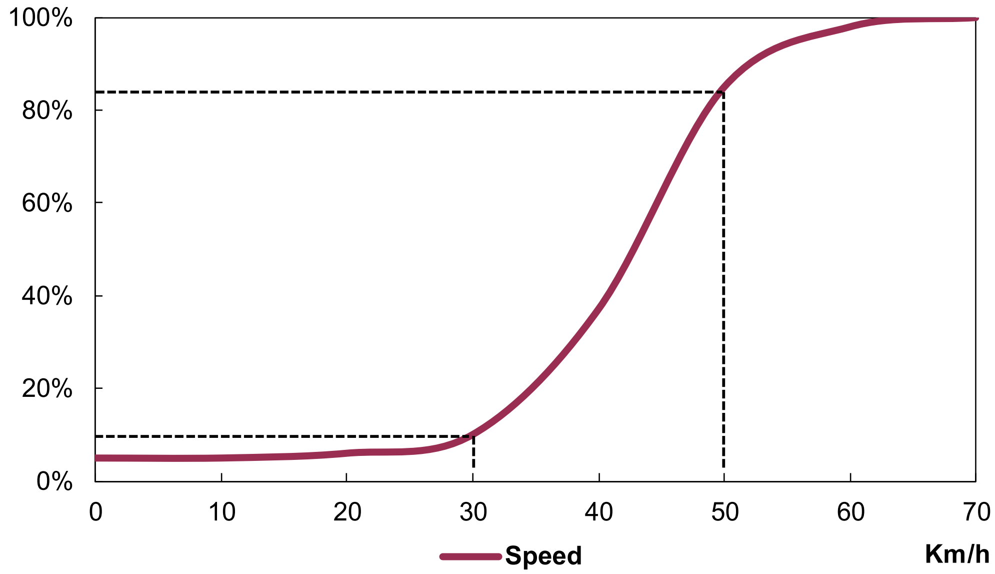



Figure 1-6 Probability of fatal injury for a pedestrian colliding with a vehicle

The wider the road, the higher the speed. In order to suppress the speed on the road, it is necessary to select an appropriate road width according to it. Figure 1-5 shows the experimental results of the relationship between the vehicle speed on a two-lane road and the roadway width in Japan. As shown in Figure 1-7, the roadway width is about 6 m (lane width: 3 m) for 60 km/h vehicle speed, and 7 m (lane width 3.5 m) for around 90 km/h for passenger vehicle.

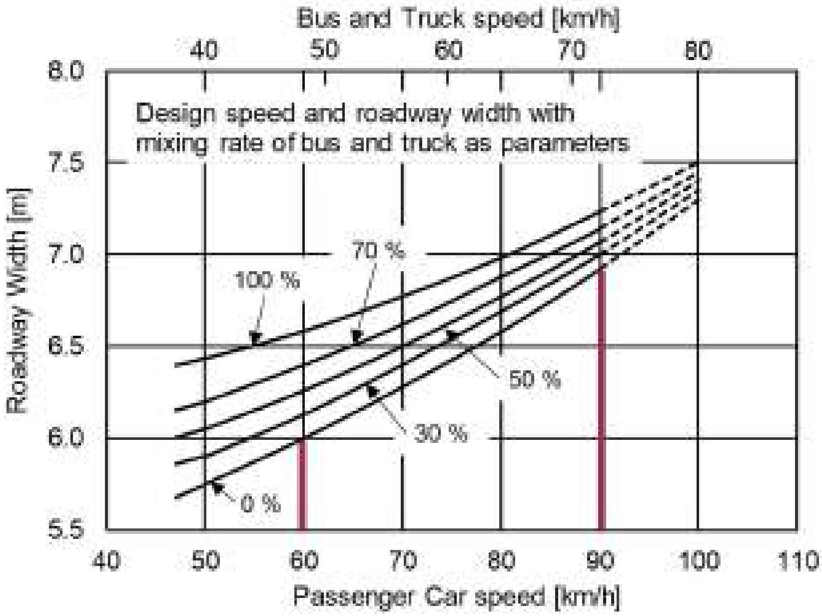



Figure 1-7 Relationship between vehicle speed on two-lane road and roadway width

To make these technical methods more effective, the following efforts are required:

(5) Traffic-related laws (road traffic law in Japan)

(6) Educational methods for road safety

Over the past three years, we have held five workshops in Suphan Buri to collect HIYARI-HATTO experiences based on the Kamagaya model.

We also invited residents to participate in those workshops along with officials in charge of various administrative agencies such as the Department of Highway, Department of Rural Road, Department of Land Transportation, Local Police, City Hall, and Rescue, which used to tackle traffic accident problem. Participating people remembered “what kind of act was dangerous at which point” and thought about why “it was dangerous” as to pay attention to their own traffic action and show consideration for others. By discussing such content with family, friends, or colleagues, each person knows where the danger lies, and the actions at the points/routes indicated as dangerous will lead, at least, to a reduction in traffic accidents. This series of actions, which is born from the discussion with family, colleagues, and friends, is called.

(7) Traffic engineering in the living room.

In short, it is important to acquire the ability to avoid danger and detect danger in close groups.

However, it takes a budget for the government to implement appropriate measures without leaving points or sections that are dangerous for residents and drivers. Since this is limited, it is effective to use the administrative budget to identify points, sections, and districts where accidents (or near accidents) occur frequently and to work in order from the highest in Figure 1-8 to aim for a reduction of traffic accident. In order to achieve that objective within a limited budget, it is most effective to determine the location and countermeasures by analyzing traffic accident data and HIYARI-HATTO data through new technologies such as multivariate analysis methods and geographic information systems (GIS); it is also preferable to objectively determine the priority of improvement based on the results (Note-5).

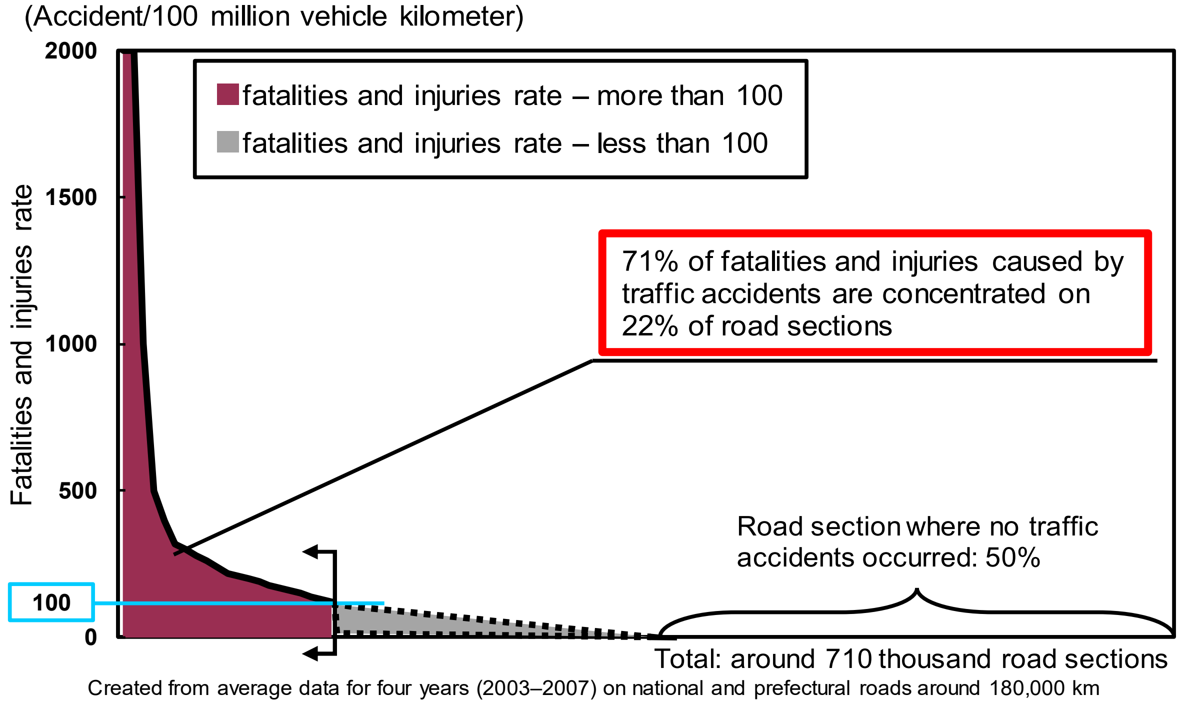



Figure 1-8 Fatalities and injuries rate in accidents

Based on this concept, the Kamagaya model is divided into point measures (mainly intersections), line measures (routes), and surface measures (mainly a district unit surrounded by a main road or a range of 500 meters from an elementary school). Based on the number of traffic accidents and the number of HIYARI-HATTO incidents, each priority was determined, and countermeasures were implemented, requiring a long-term response. In Kamagaya City, only monitoring has been continued after the mayor changed, and accident countermeasures have been delayed. In Japan, many cities are interested in the Kamagaya model; however, due to administrative restrictions, local governments are not able to respond adequately. Here in Suphan Buri, a system exists in which people from various administrative positions, such as the Road Bureau, Regional Road Development Bureau, Land Transport Bureau, City Hall, Police, and Rescue, work together. I hope that the Suphan Buri Model will succeed, and that this Traffic Safety Measure Model will spread throughout Thailand.

## What is the Kamagaya Model?

**Satoru KOBAYAKAWA**

### Kamagaya is the city of Japan

Kamagaya is a city located in Chiba Prefecture, Japan. Since the 1950s and particularly in recent years, its population has been increasing, and the city has developed residential areas, representing a characteristic bedroom community for the cities of the Tokyo Metropolitan Area.

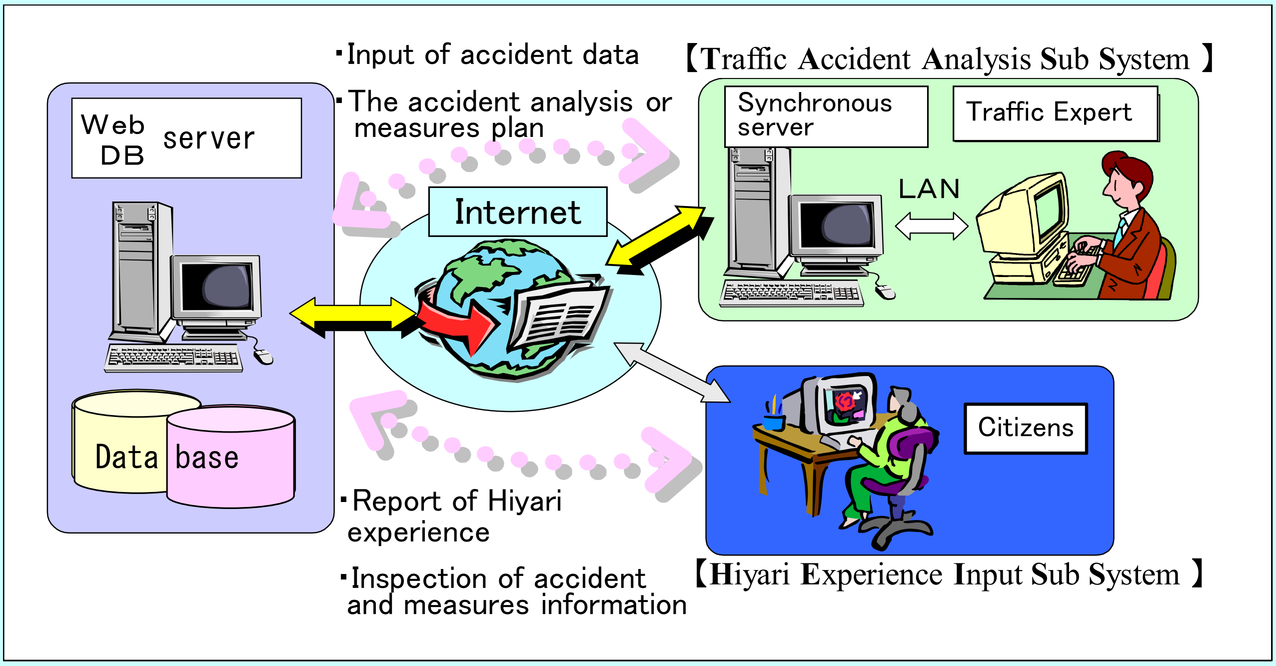
### Why was Kamagaya City selected as the model case?

The reasons for selecting it are as follows:

- There is a high demand for citizens' traffic safety measures, and the city government hopes to take drastic measures to reduce traffic accidents.
- With the cooperation of the government, including the mayor, it is possible to implement a policy of citizen participation.
- Since the city officials include a traffic technician, it is feasible to develop future specialists and set up an administrative window for traffic safety.
- Since the volumes of the accident data and the road structure data are small, the creation of the initial data and the structure of the database are relatively simple.
- Existing survey data, such as road diagnostics, is available, and it may be possible to determine the effectiveness of the measures.

### Traffic Safety Measure Support System = Kamagaya Model

This system integrates managing traffic accident data and HIYARI experience data to collect from the citizen using Web GIS technology. Then, it creates a basis for rationalizing and streamlining the planning and the drafting of the safety measure. As shown in the following figure, this system has two sub-systems: the HIYARI Experience Input Sub System (HEISS) and Traffic Accident Analysis Sub System (TAASS). The former has the function to report the HIYARI experience of the road user and to create a HIYARI map. The latter has the function to exchange the information between the area residents, the road traffic administration, and the expert to plan traffic safety countermeasures. Both can easily understand and improve the traffic safety plan.
This system is called the Kamagaya Model.




TSMSS (**T**raffic **S**afety **M**easure **S**upport **S**ystem)

## Characteristics of the Kamagaya Model

- Real-time internet data collection
  Possible frequent input of citizens' HIYARI experience and viewing of these inputs. Traffic officials become approachable and thus able to participate in traffic measure preparation and evaluation.
- Advanced and efficient analysis use of GIS
  The locations of areas where accidents occur are mapped visually; therefore, the exact location can be determined even in areas with no street signs. Accident-prone areas and HIYARI experience areas categorized into points (intersections), lines (routes), and areas (zones), making the allocation of targets for the project easier.
- A traffic safety measure system based on the participation of citizens
  Using the website to organize the traffic accident occurrence and the HIYARI experience data and then comparing this data with the situation before the enforcement of these measures. An evaluation system converges the opinions of road users or district citizens on traffic safety measures; the HIYARI experience mapping system allows zone citizens or road users to report their Hiyari experiences through a website managed by the local government and participate in the mapping. The traffic safety information website can gather information from road users or zone citizens as well as distribute information on behalf of the local government.

## The Kamagaya Model applied to other local governments

After the model produced good results in Kamagaya City, the system was applied to the adjacent Ichikawa City and Shiroi City.

# 2. Current Situation of Road Traffic Safety and Community-based Traffic Safety Initiatives in Thailand

**Tuenjai FUKUDA**

Roads play a primary role as transportation and communication support of the economy and human access to many places across the country. Each year, new roads are built or extended in upcountry to shorten distances and increases traffic flow. However, they accommodate mixed use of traffic regardless of passenger transport and logistics with various vehicle types, meaning that pedestrians, bicycles, motorcycles, cars, pickup trucks, buses, light and heavy-duty trucks, trailers, and so on are sharing and running on the same road spaces. Thus, road traffic accident occurrence with any vehicle types at any time is highly possible if the driver or road user is not precautious or considerate of others but pays less attention to traffic rules, not keeping their eyes on the road.

In Thailand, almost every hour a number of road users are killed by road traffic accidents on national highways, rural roads, and municipal roads. According to a WHO report, 22,491 people in 2016 and 19,904 people in 2019 were killed in road crashes (see Figure 2-1). Comparing to ASEAN countries, Thailand has the highest road traffic accident rate of 32.7 (see Figure 2-2). The loss of human lives on roads is equivalent to the loss of invaluable human resources, which not only has a significant impact on the mental health of the families losing their loved ones but also causes a loss for the national economy at large.

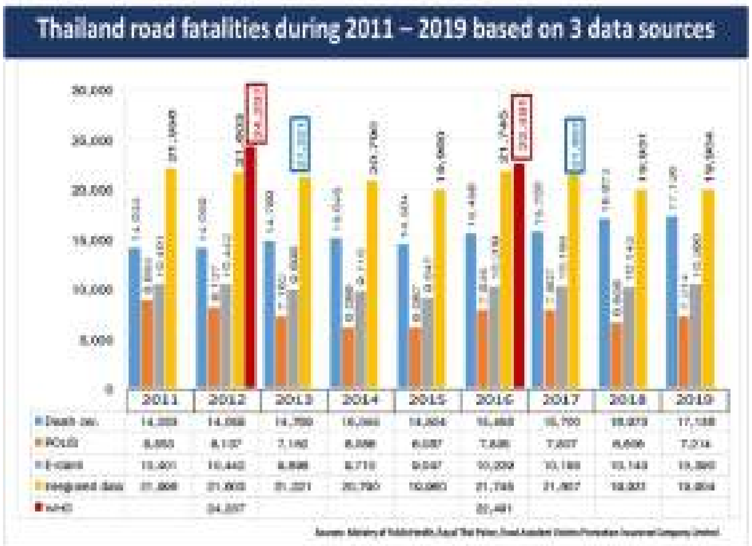



Figure 2-1 Thailand road fatalities during 2001–2019

*Sources: Ministry of Public Health, Royal Thai Police, Road Accident Victims Protection Insurance Company Limited*

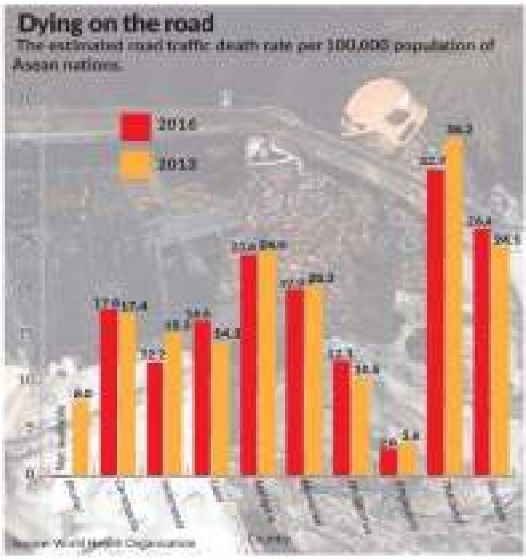



Figure 2-2 The estimated road traffic death rate per 100,000 populations of ASEAN nations

*Sources: World Health Organization (WHO), 2016*

Like Japan and Singapore, Thailand has been confronting an aging society and a decelerating population growth (see Figure 2-3). Some aging people (e.g., grandfathers, grandmothers) live with their children as extended family and with joint family responsibilities, while others prefer to live independently. At present Thailand has 66,558,935 people divided into 32,605100 males and 33,953,835 females (see Figure 2-4). According to a WHO report on the Global Burden of Disease Project, males, particularly aged 15–44, tend to be involved with road crashes more than their female counterparts (see Figure 2-5 and Figure 2-6). This implies that the number of working males decreased, whereas that of single mothers conversely increased. This will diminish socioeconomic capacity, especially on household income, as single mothers must work twice as much to feed their children and have less family time for communication and education on safety, which ought to be provided by parents or grandparents at an early age.

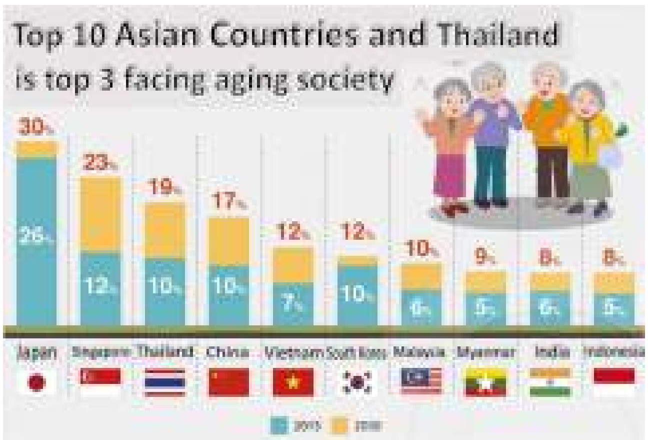



Figure 2-3 Top 10 Asian countries facing aging society

*Sources: Nielsen Thailand; https://positioningmag.com/1100779*

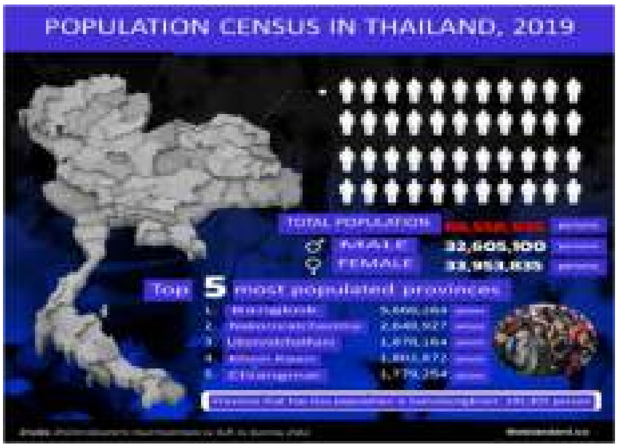



Figure 2-4 Population growth in Thailand

*Sources: Bureau of Registration Administration, Department of Provincial Administration, Ministry of Interior. https://thestandard.co/thai-population-2562/*

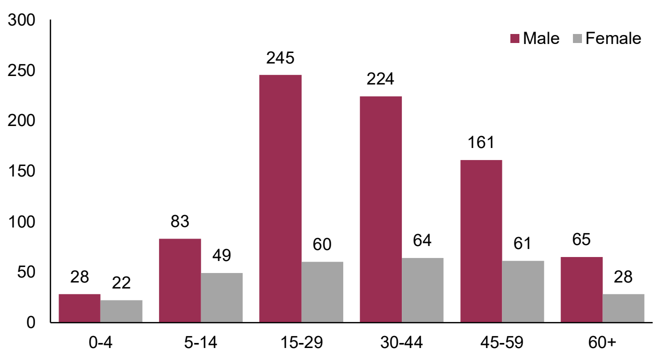



Figure 2-5 Global Road traffic fatalities by gender and age group

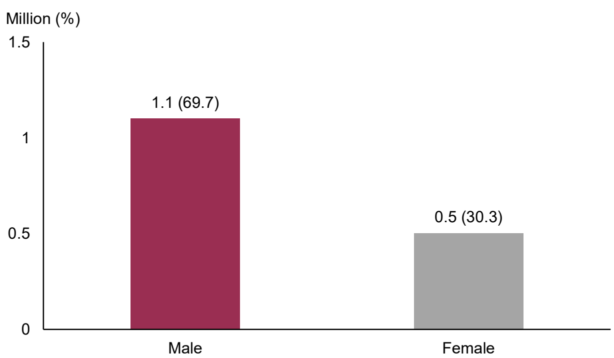



Figure 2-6 Road traffic fatalities by gender in Thailand

## 2.1 Situation analysis of road traffic safety in Thailand

### 2.1.1 Correlation on road traffic

In a world of traffic, humans, cars, and roads, surrounding environments, and land use, planning plays an active key role in road traffic safety. At the same time, humans, cars, and roads, along with the surrounding environment, are also contributing factors to road traffic accidents if the land use does not properly plan the access control of traffic/vehicles.

### 2.1.2 Relationships between roads, cars, and humans

Roads without cars and cars without humans (as a driver or road user) cannot cause an incident or accident occurrence. Predominantly, human errors (as a road user and/or as a driver) are a major contributing factor to road traffic accidents. Making our roads safer is entirely dependent on human efforts.

### 2.1.3 Accumulative number of registered vehicles versus number of driver's licenses

At present, Thailand has a cumulative number of 40,978,437 registered vehicles divided into 21,474,767 motorcycles, 10,141,379 passenger cars, 6,806,326 vans and pickups, and 1,153,743 heavy-duty trucks, respectively (see Figure 2-7). It is interesting to note that, according to the Department of Land Transport (as of March 31, 2020), the number of motorcycle driving license holders is only 13,678,688 out of 21,474,767 registered motorcycles. This means that 7,796,079 people are riding motorcycles on the roads without a driver's license.

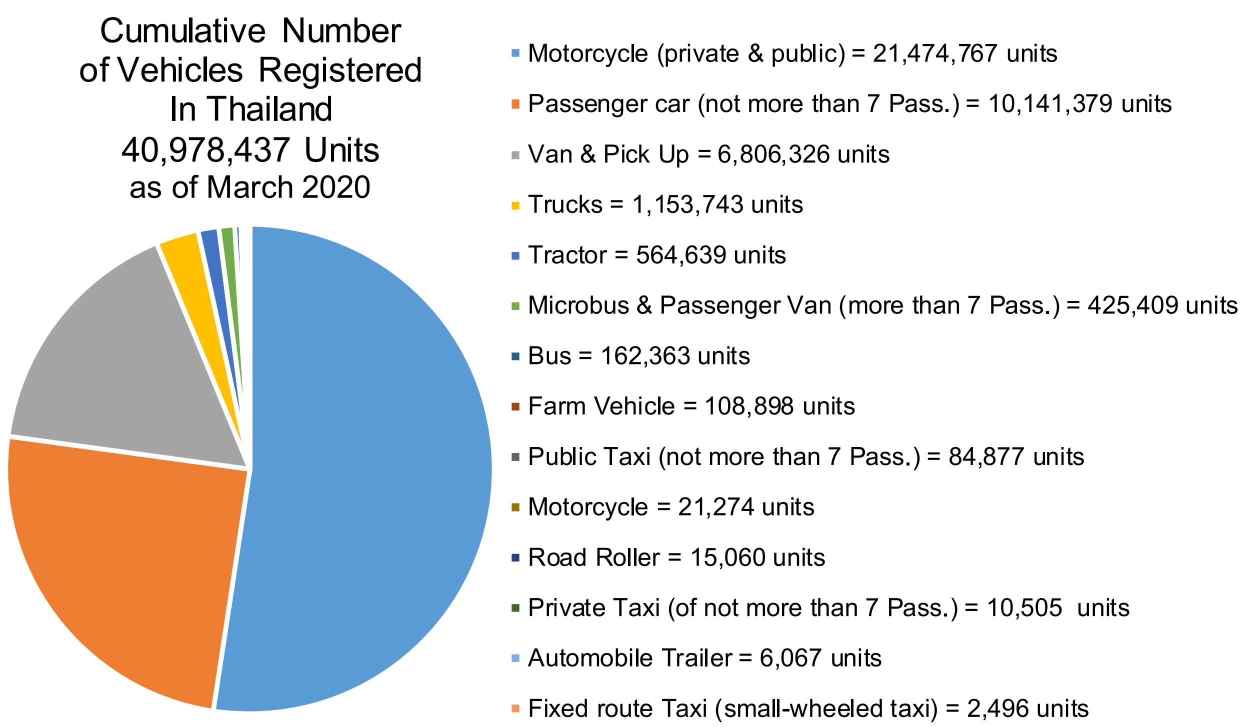



Figure 2-7 Cumulative number of vehicles registered in Thailand

*Source: Transport Statistics Sub-Division, Planning Division, Department of Land Transport, 31 Mar 2020*

### 2.1.4 Motorcycle accidents: the major cause of road fatality

Compared with the global road fatality ratio by vehicle type, more than 70% of Thai motorcyclists died in a road traffic accident (see Figure 2-8), and the numbers are steadily on the rise. These fatalities mostly involve young males (a number three times higher than that of females) between 15 and 29 years of age as they are young, vigorous, and inexperienced.

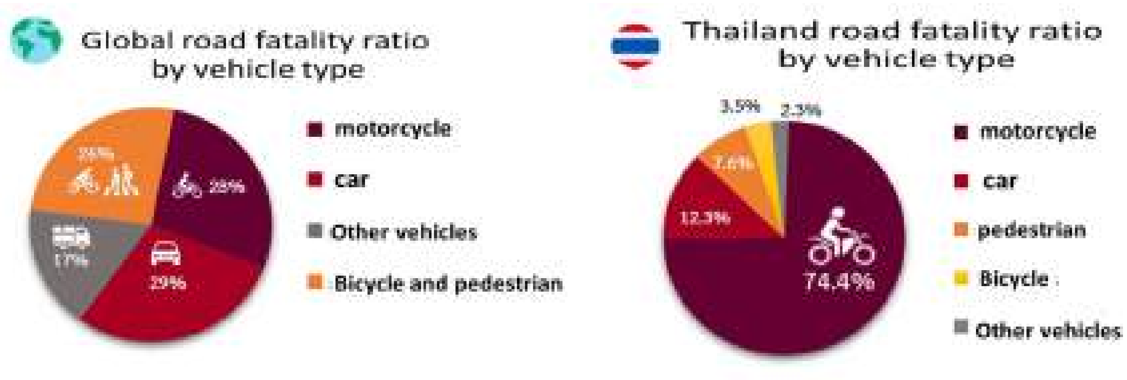



Figure 2-8 Comparative global road fatality ratio with Thailand case

*Source: Global Report on Road Safety 2018, WHO as of July 2019*

Recently, "big bikes" (or motorbikes larger than 400cc) have been popular and in tremendous growth. Their powerful speed generates outrageous accidents resulting in death on the scene, which is a daily occurrence. Even though the number of deaths caused by such bikes is rather small compared to that of smaller motorcycles, the death rate of big bikers has risen dramatically to 34 percent last year, according to the Road Accident Victims Protection Co Ltd. (see Figure 2-9).


Figure 2-9 The death toll from accidents involving big bikes in Thailand

*Sources: Road Accident Victims Protection Company Limited, https://www.nationthailand.com/news/30374080*

### 2.1.5 Human errors are a major cause of accidents

Driving habits play an important part in keeping the roads safe. Drivers with discipline tend to obey traffic rule and be considerate of others, whereas aggressive drivers tend to take risk and disobey them.

Most accidents are caused by drivers' behavior. According to the Ministry of Public Health (2012) driving at a speed exceeding the legal limit, running out in front of a car at a close distance, and overtaking a car illegally are the top three major causes of car accidents in Thailand. The leading cause of road injuries and fatalities by vehicle type is found in motorcycles, and most fatal injuries and deaths are caused by the lack of a helmet while driving or riding a motorcycle. Figure 2-10 shows the top three major causes of accidents as well as helmet-wearing statistics in Thailand.

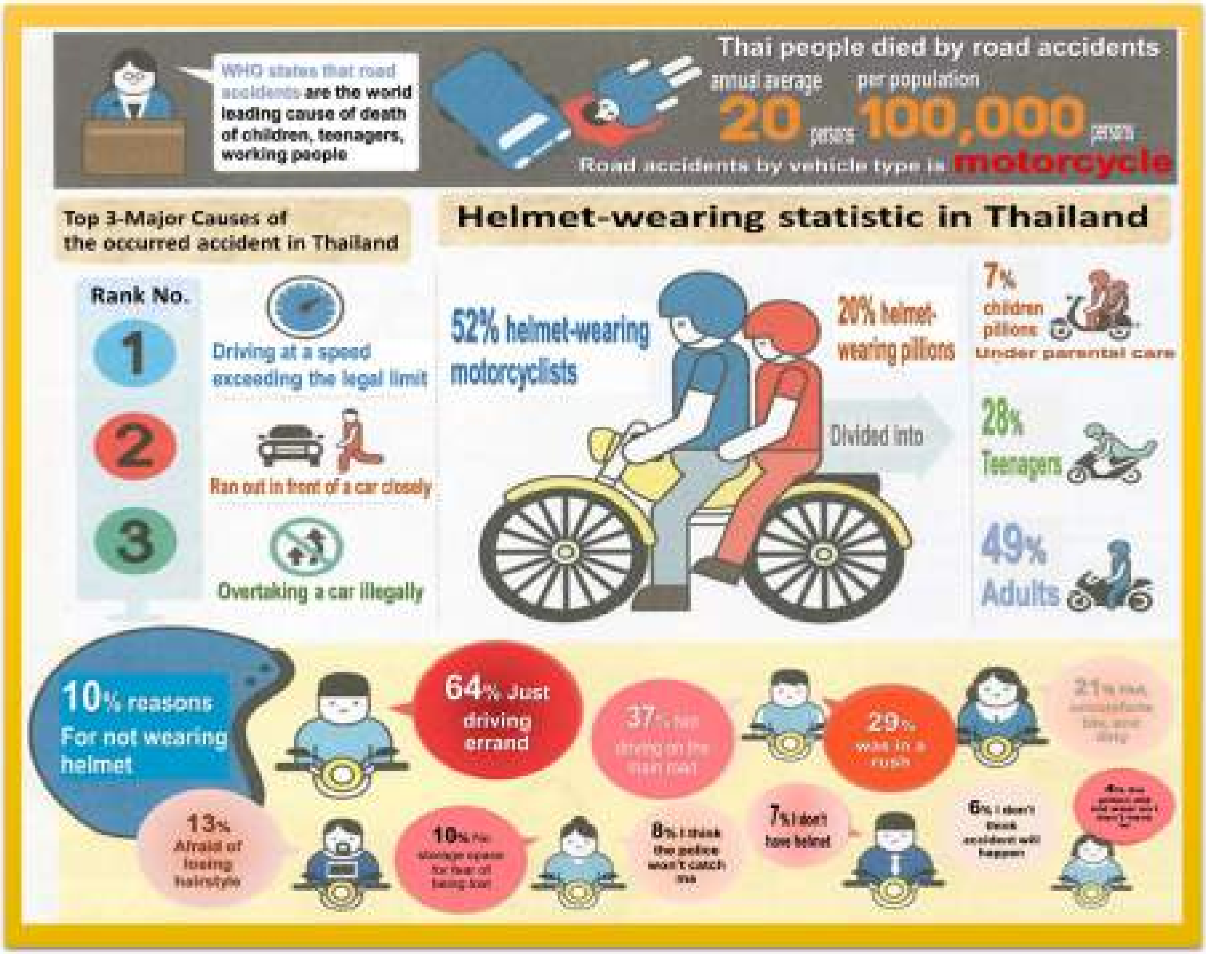



Figure 2-10 Top three major causes of accidents and helmet-wearing statistics in Thailand

*Source: Ministry of Public Health, 2012*

Interestingly, between 2012 and 2016, drunk driving was the major cause of accidents for five consecutive years, with the leading cause of road injuries and fatalities by vehicle type being the motorcycle, see Figure 2-11. In 2017, Royal Thai Police statistics reported that speeding, cutting in front of other vehicles, riding on the wrong side of the road, and poor driving skills accounted for about half of the total motorcycle crashes. Similarly, in 2017, the Department of Land Transport (DLT) reported that 37% of motorcyclists did not have driving licenses, and that 34% of the motorcycles were not insured.


Figure 2-11 Alcoholic beverage was the major cause of accidents between 2012 and 2016

*Source: Thai Alcohol Beverage Business Association, https://www.bltbangkok.com/news/4194/*

However, recent studies conducted by some research institutes such as the Asian Transportation Research Society (ATRANS), automobile loans business names Thitikorn Public Company Limited and Thailand Accident Research Center (TARC) found that the leading causes of motorcycle accidents, injuries, and deaths were the lack of skills in perceiving incoming hazards, the inability to control their vehicle, and the incapability of making a split-second decision in expected situations (see Figure 2-12).

Furthermore, an observational survey by ATRANS and a study by TARC found that for those who drive/ride an unlicensed motorcycle learned how to do so from their families and friends, lacking an understanding of the rules of road and hazard perception (see Figure 2-13). This may be due to the weak licensing policy (i.e., five hours of theory and 10 hours of driving practice compared to 60-hour courses in Japan and 120-hour courses in Australia) and people's underestimation of risks.

Insufficient training time, a one-time paper test without a road test requirement, and the lack of specific regulations for young riders are among the weaknesses of the DLT's current licensing system for motorcyclists. While regular training classes fail to produce qualified riders, the situation is worse for "big bikers" as they have not yet been required to pass specific driving and licensing tests, according to the TDRI report.

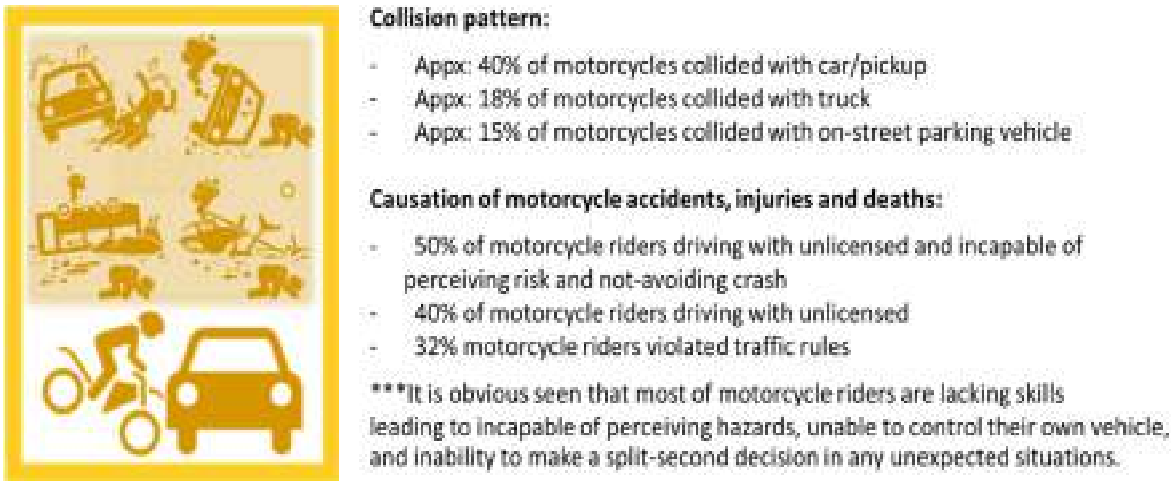



Figure 2-12 Lacking skills for safe driving is the top cause of road fatalities

*Sources: ATRANS, Thitikorn Public Company Limited and Thailand Accident Research Centre (TARC), 2019*

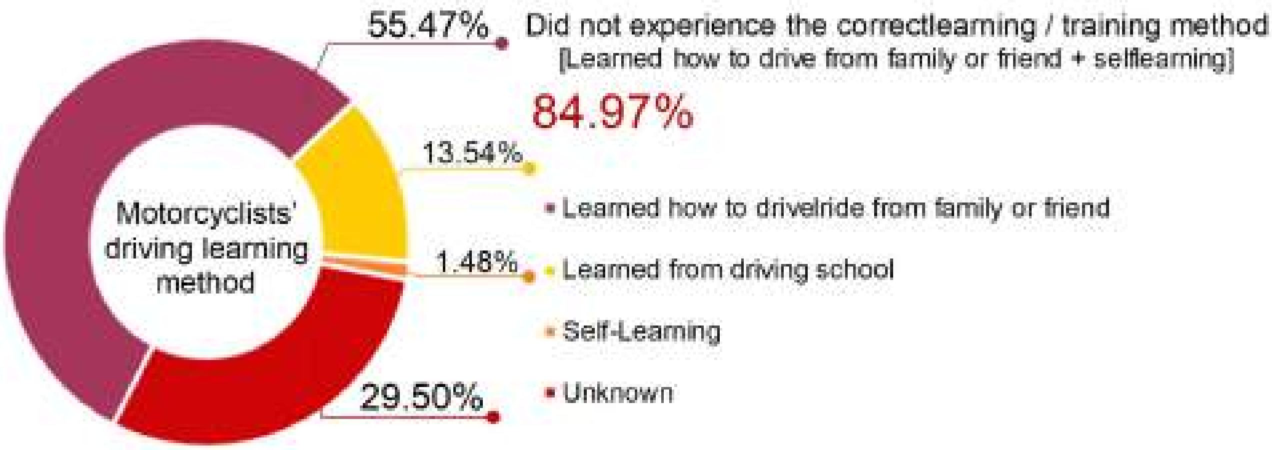



Figure 2-13 Motorcyclists' driving learning methods

*Source: Thailand Accident Research Center (TARC)*

## 2.1.6 Human errors and law enforcement

Many ways exist to strengthen motorcycle safety with the aim to prevent road traffic fatalities caused by human errors, including a stricter training program by applying a riding simulator for training and testing the perception of risk among others, screening, and licensing rules to produce qualified drivers/riders. Imposing specific rules and requirements for high-risk groups such as youngsters/youths and big bikers is essential, and so is stricter law enforcement. Effective modern technology should be deployed to monitor, evaluate, and punish traffic offenders to strengthen the operation of traffic law enforcement efficiently—

for example, a speed camera detection system installation at every intersection, a demerit point system, and an information linkage system between the traffic police and the DLT who hold overall driving license database to instantly identify a traffic violator. Traffic law must be enforced regularly throughout the year rather than merely on festive holidays like New Year and Songkran; repeated offenses, in particular, should receive doubly higher penalties. Nevertheless, it is vitally important to road traffic safety that any introduction and utilization of technological systems for road traffic facilities and law enforcement as well as knowledgeable public relations campaign primarily address public (drivers and road users) for a better understanding of the system and safe driving. Once knowledgeable information is sufficiently publicized but driving offenses still happen, then traffic law must be enforced immediately.

### 2.1.7 Lack of a common accident database: an obstacle to identify the actual cause of accidents

Three different data sources have been collected from (1) Information Technology of Emergency Medical System (ITEMS) and Injury Surveillance Information System (ISIS), Ministry of Public Health (MOPH); (2) Police Information and Statistics (POLIS), Royal Thai Police (RTP); and (3) E-Claim System, Road Victims Protection Company Limited (RVP).Then, the Road Traffic Death Data Integration (RTDDI), Department of Disease Control, Ministry of Health integrated those collected data into Thailand's road traffic accident database.

Surprisingly, Thailand road traffic accident database exclusively contains data on locations where accidents most frequently took place provided by the Department of Highways (DOH) and the Department of Rural Roads (DRR) under the Ministry of Transport and Municipal Roads under Ministry of Interior (see Table 2-1). This may be one among several obstacles to identifying the actual cause of accidents for the improvement of black spots.

Nevertheless, an attempt has been made to combine those big data from relevant data sources into one common accident database; the key issue is to determine who will be leading and coordinating this task until it becomes of practical use.

### 2.1.8 Road infrastructure and technology development versus safety education

One of the major problems related to road traffic injuries and deaths is the presence of "black spots." In Thailand, 71,349.019 km of road length are managed by the DOH, as of 1 Nov 2018) and 45,000 km of road length by the Department of Rural Roads. Further, another 597,667 km of municipal roads are under the Department of Local Administration, Ministry of Interior (DLA, as of 29 April 2019). Every road section does possibly have near-miss spots or potentially black spots (in Japanese called "HIYARI spots") as well as the black spots due to the road's geometric design or limited physical environment. Imagine how many "HIYARI spots" and the black spots do exist on highways, rural roads and municipal roads that the drivers/road users have to take their risk driving every day without recognizing them.

Table 2-1 Thailand road traffic accident database collected and integrated from various data sources

*Source: ATRANS Road Safety Project: 006-2014, Asian Transportation Research Society (ATRANS)*

| Name | Organization | Main objectives | Function | User(s) | User interface | Important data | Benefit | Include / Exclude |
|---|---|---|---|---|---|---|---|---|
| **POLIS** | Royal Thai Police (RTP) | · To collect the data of traffic accidents (criminal cases)<br>· To monitor accident situation and plan for police resources | · Input and store accident data<br>· Display statistical information | · Police stations (internal use) | · Intranet database<br>· Graphic user interface | · Details of testimony from witness | · Details of accident investigation | **Included in 3 accident data sources** |
| **HAMS** | Department of Highways (DOH) | · To support infrastructure maintenance and black spot treatment for national highways | · Accident map<br>· List of accidents<br>· Summary report | · DOH districts (report accidents related to their damages)<br>· DOH center (allocate budget to improve road safety) internal use | · Online database<br>· Graphic user interface | · Accident location in GIS form<br>· Details of road condition | · Support highway maintenance and black spot treatment | **Excluded in 3 accident data sources** |
| **ARMS** | Department of Rural Roads (DRR) | · To support the accident report from regional sectors | · Accident map<br>· List of accidents<br>· Summary of accidents | · DRR districts (report accidents)<br>· Safety Bureau (verifies the data)<br>· Public | · Online database<br>· Graphic user interface (Chart and Table)<br>· Public can view summary and location of accidents | · Accident location in GIS form<br>· Details of road condition | · Support rural road maintenance and black spot treatment | **Excluded in 3 accident data sources** |
| **TRAMS** | Office of the Permanent Secretary, Ministry of Transport (MOT) | · To report and display road accidents | · List of accidents<br>· Summary of the details of each accident | · Public | · Online database<br>· Graphic user interface<br>· Public can view summary of accidents | · Accident data from DOH,DRR and EXAT | · Accident data from the authorities under MOT | **Excluded in 3 accident data sources** |
| **ISIS** | Ministry of Public Health (MOPH) | · To serve injuries and EMS<br>· To solve, prevent, and control the injury in provincial and national levels | · Accident map<br>· List of accidents | · Regional hospitals (internal use) | · Online database<br>· Graphic user interface (Chart and Table) | · Cause of injury/death | · Support injury prevention and surveillance from road accident | **Included in 3 accident data sources** |
| **ITEMS** | Ministry of Public Health (MOPH) | · To link accident data from various sources (e.g., ISIS, POLIS, E · claim, MOT, trauma registry, death certificate) | · List of accidents<br>· Summary report | · Regional hospitals (internal use) | · Online database<br>· Graphic user interface | · Cause of injury/death | · Integrate the details of accident data from various sources | **Included in 3 accident data sources** |
| **E-Claim System** | Road Victims Protection Company Limited (RVP) | · To monitor accident of vechles with insurance | · Summary accident report<br>· Accident map | · Insurance companies and their network (report accidents)<br>· Public | · Online database<br>· Graphic user interface<br>· Public | · GPS location<br>· Property damage only data<br>· Accident data from some hospitals | · Accurate number of accidents from insured vehicles<br>· Strong partners | **Included in 3 accident data sources** |

Road infrastructure, technology, and telecommunication have been expanded. However, a correct and proper provision of knowledgeable road safety education on the safe use of roads from the government to the public has been inadequate. This resulted in learning trial-and-error behavior based on one's own experience, which entailed a high risk of road accident occurrence and hence turned it into a "culture of road safety negligence."

The improvement of road infrastructure and the development of technology for traffic facilities are essential for road traffic safety. However, before and during those improving and developing processes, knowledgeable public relations campaigns ought to be conducted to educate road users to understand and utilize traffic facilities while driving or using the roads correctly and safely, since individual road users have different socioeconomic backgrounds (i.e., age, education, income) and cultural differences (i.e., normative and behavioral beliefs).

It would not be an overstatement to say that road users play an important role in studying traffic engineering as they assume various roles—drivers, rider, pedestrians, cyclers, etc.—and assess the conditions in their own individual way. Physical, mental, and psychological factors are the main road user characteristics that govern the safe operation of their vehicle on the road. Important mental characteristics include knowledge, literacy, skill, intelligence, and experience; individual road users/drivers/riders should have proper knowledge of the rules of roads, traffic behavioral manner, vehicle characteristics, and driving practices that are necessary for safe traffic operations.

Nevertheless, road safety education has not been taught to children as part of the Thai school curriculum for decades, and only some short-term activities related to road safety are conducted by a number of governmental units and private firms as CSR. Likewise, being disciplined, in order, and responsible for oneself and be considerate of others and society have not been taught to children from an early age—neither in the family nor in school. The situation has worsened as the technological and environmental surroundings have been changed, whereas the education system has remained the same.

Policy measures on road safety education and training programs for sustainable development must be provided to children and youth to make our roads safer. Regular workshop and training with public relations campaigns must also be provided to experienced drivers to avoid knowledge-based and rule-based mistakes as well as skill-based errors on action slip and memory lapse (see Figure 2-14). Since most road users, riders, and drivers lack road traffic safety knowledge and driving skills, unable to perceive the risk leading to a wrong decision (whether to avoid a crash or to take the risk) while driving or using the roads (see Figure 2-15), the improvement of licensing policy is urgently required for the sake of the novice driver's perception of risk and accident prediction in avoiding a crash and making roads safe.

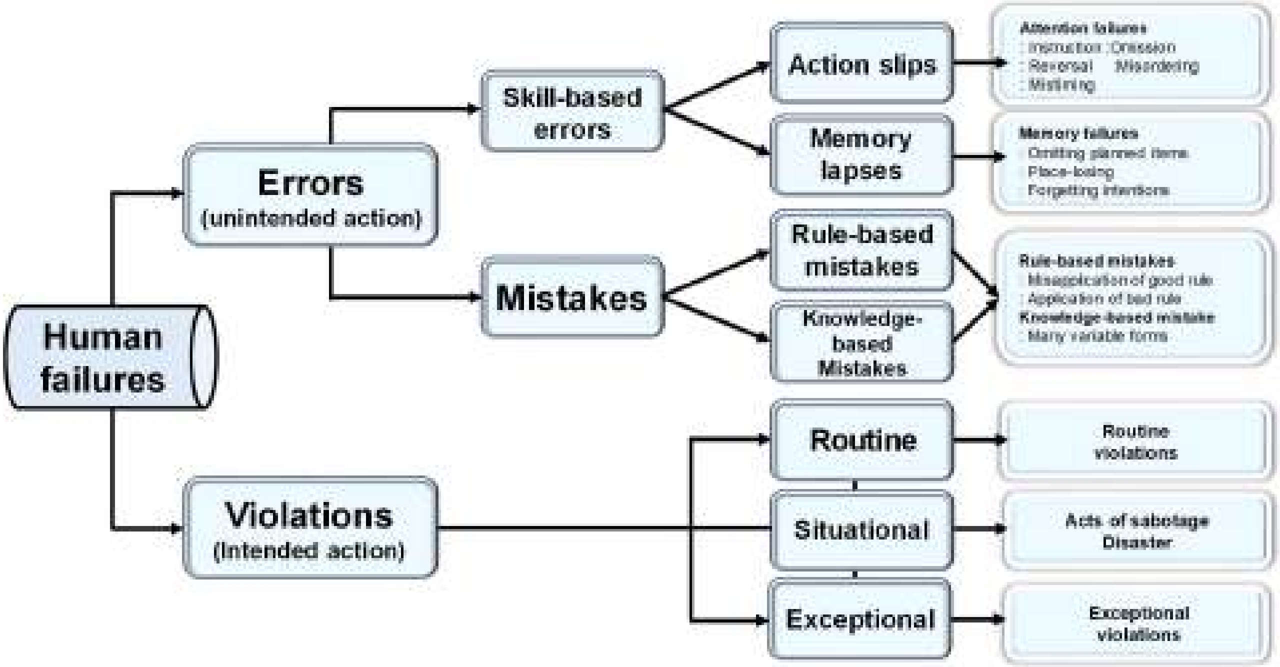



Figure 2-14 Types of human failures / errors

*Source: SRK Framework, Rasmussen, 198; Introduction to Health and Safety at Work, 2007, 3rd Edition*

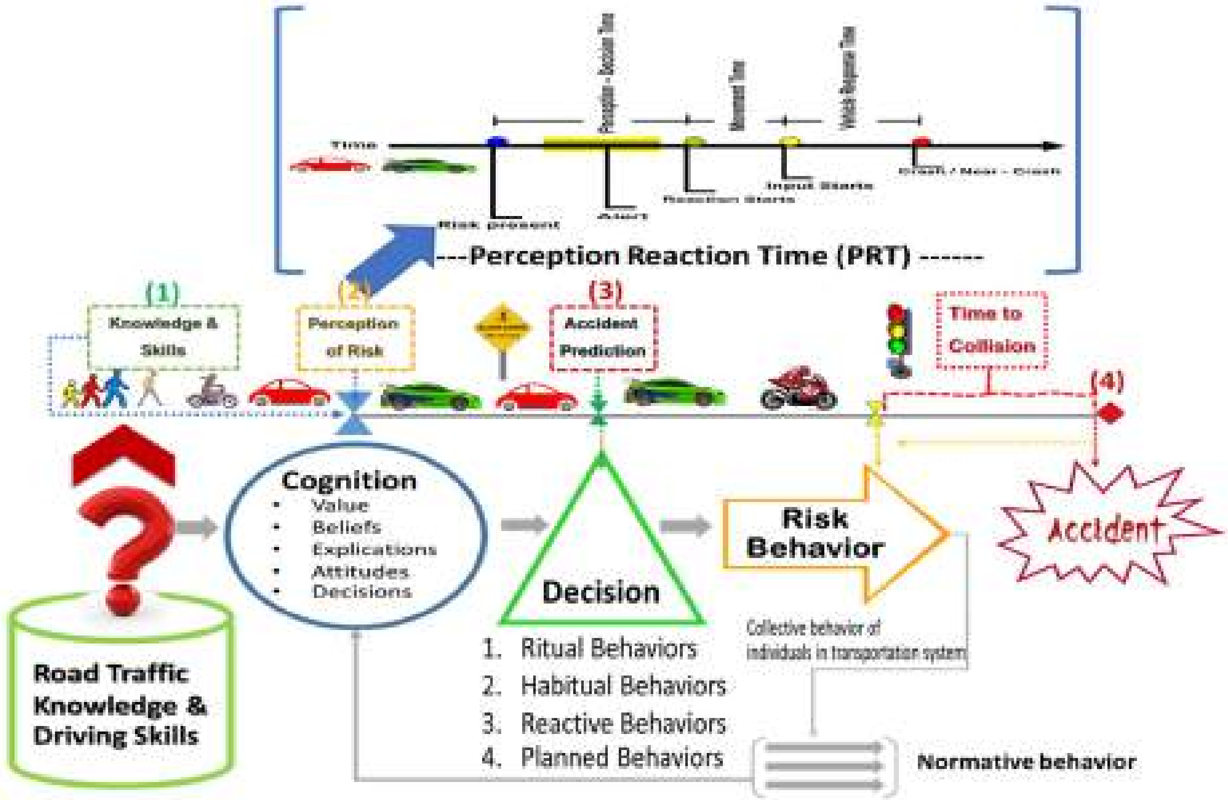



Figure 2-15 Human error caused by lacking perception of risk and accident prediction

*Source: Workshop on "ESAN Zero Road Safety Accident" lectured by Dr.Tuenjai Fukuda, 7 Nov 2013, Khon Kaen*

## 2.2 Community-based traffic safety initiatives in Thailand

A community-based approach is one of the most proactive strategic methods for improvement of road traffic safety. A community-based approach enhances and encourages collective participation, which is key to improving road safety in the community. Collaboration among the community, local government agencies (i.e., municipality, police, traffic engineer, public health) schools, and academia (university, research institute) as well as private firms, social media, and NGOs plays an active role in making community participation practically possible.

In a community-based traffic safety initiative in Thailand, a provision of simply practical education is a must since the majority of people living in a community have different physical and mental characteristic (i.e., knowledge, literacy, skill, intelligence, and experience) and socioeconomic (i.e., age, education, income) and cultural belief (i.e., normative and behavioral beliefs) backgrounds. Raising awareness on road traffic safety among people living in communities—particularly those who tend to exhibit unsafe acts/risk behaviors—should be directional, and common understanding necessitates safe driving operations (see Figure 2-16).

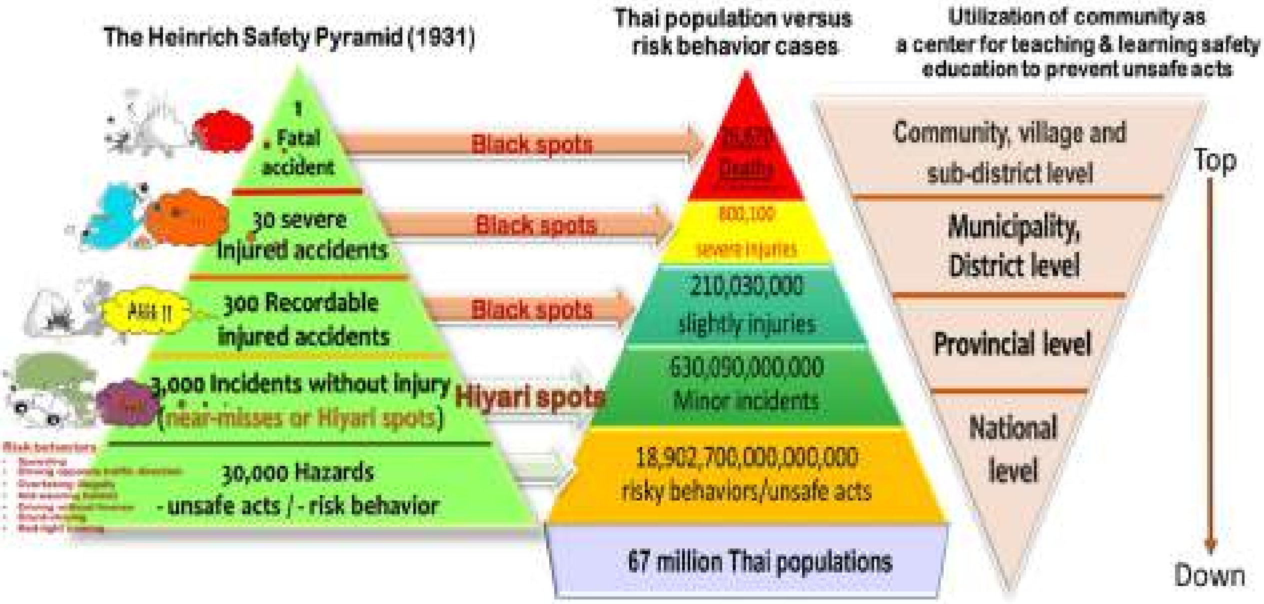



Figure 2-16 Learning and managing unsafe acts/risk behaviors and HIYARI spots through community participation with related-agency cooperation at the community level

*Sources: The Heinrich Safety Pyramid (1931), https://de.wikipedia.org/wiki/Herbert_William_Heinrich; Seminar on "ESAN Zero Road Safety Accident" in Khon Kaen by Dr. Tuenjai Fukuda, ATRANS, 7 Nov 2015*

The root cause problem of long-drawn out road traffic accidents in Thailand has not been identified until recently. A common misinterpretation among the general public, particularly road users/drivers/riders, is the misperception of risk (e.g., underestimate/incapable of foreseeing the velocity of the incoming speeding car) versus the overestimation of their driving skills; another cause may be the lack of understanding of the physical condition of the roads versus a lack of understanding of the "risk spots" or "potential black spots" (or "HIYARI Spots" or "near-miss spots") and those on the roads ahead.

Locations where road traffic incidents occurred repeatedly or tended to cluster together but no one was injured or damaged are commonly known as "risk spots," "potential blackspots," "near-miss spots," or "HIYARI spots." Locations where road traffic accidents repeatedly taken place or tended to cluster together are commonly known as "accident black spots" or "black spots." Hazardous spots are prioritized based on an Accident Severity Index (ASI) and standard deviation, and those with an index higher than the threshold value (average severity + 1.5 times standard deviation) are considered "black spots."

A pioneering empirical study aiming to identify potential black spots and black spots through a public participation approach was conducted in Bangkok in 2005 by introducing a Japanese experience in the HIYARI Model of Kamagaya City, Chiba Prefecture (Fukuda, T et al., *Journal of Eastern Asia Society for Transportation Studies*, Vol. 6, pp. 3683–3696, 2005). The HIYARI Model is a traffic psychological method to encourage road users and drivers to participate in the traffic safety program in order to elicit potential black spots or HIYARI spots and black spots information through their expression of incident/accident experiences or eyewitness testimonies of the accident scene or vice versa that almost caused them to be injured or killed.

A cognitive map of the study area was used as a tool and the respondents were asked to locate potential black spots or HIYARI spots and black spots on the cognitive map and draw the car accident collision characteristic on the blank sheet provided.

It was found that one of the biggest obstacles in the survey was represented by the majority of the respondents being unable to read the map and differentiate the risk spots from the black spots as they thought they were the same. Likewise, most of them could not draw the map from their house to their workplace and pinpoint the potential black spots or even black spots location on the map despite being regular road users of that area, requiring the interviewer's assistance for giving directions. The few opportunity to acquire knowledge provided by the government may be the reasons why Thai people lack perception of risk and understanding of the physical condition of roads.

Since then, HIYARI map development workshops were carried out by Transportation System Lab., Nihon University and ATRANS in collaboration with local authorities as part of research on road traffic safety practical activities funded by IATSS to raise awareness among people in the communities throughout Thailand (see Figure 2-16).
A recent HIYARI map development workshop took place in the Suphan Buri Province in collaboration with the Ministry of Transport (MOT), the RTP and the MLIT under a memorandum of cooperation on road safety during August 2016–August 2019 and JICA.

More details on HIYARI map development workshop activities can be found in the next chapter.

### 2.2.1 Community & school-based traffic safety activity at a technical college in the Saraburi Province

One example of community & school-based traffic safety activity took place in the Saraburi Province with the cooperation of ATRANS, Ubon Ratchathani University, Prince of Songkla University, Saraburi Provincial Police, Thalan Municipality, Thaluang Cementhaianusorn Technical College, and Siam Cement Group (SCG) as well as other road safety-related authorities to jointly work on the promotion of practical road safety education and training programs for three consecutive years.

**Background**: This joint activity targeted students at Thaluang Cementhaianusorn Technical College, where 3,000 male and female students enrolled in vocational and/or diploma programs. The technical college is located in Thalan Municipality, Baan Mor District, Saraburi Province, near the Cement Mills of SCG and other agricultural factories.

**Existing problems**: Each day students and teachers commute to college on the same route with logistic trucks and trailers. Approximately three to five students are severely injured and one dies by road accidents per year. The main causes of accident are speeding, driving opposite traffic direction, overtaking illegally, and red-light running. What is interesting is that more than 70% of students ride motorcycles to college without wearing a helmet and without driving license.

**The activity theme**: After having met and discussed with the college principal, teachers, and SCG, an activity was launched under the theme of “Road Safety Education on Safe Driving: Preventive Training on Wheel.”

**Target group**: 60 male and female students of Thaluang Cementhaianusorn Technical College between 14–18 years of age were selected as the primary target group, and 30 teachers were selected as the secondary target group.

According to human learning and psychosocial development, students or adolescents at age 13–18 years seek their own identity and devotion but sometimes have an unclear role (see Figure 2-17); hence, they must learn more technique as they are in the stage of taking new things as a challenge and lightly.

**Objectives:** The goals are to raise awareness on unsafe acts or risk-taking behaviors—which the students may or may not be able to realize themselves—and to provide practical road safety education and training programs in accordance with the unsafe acts or risk-taking behaviors.

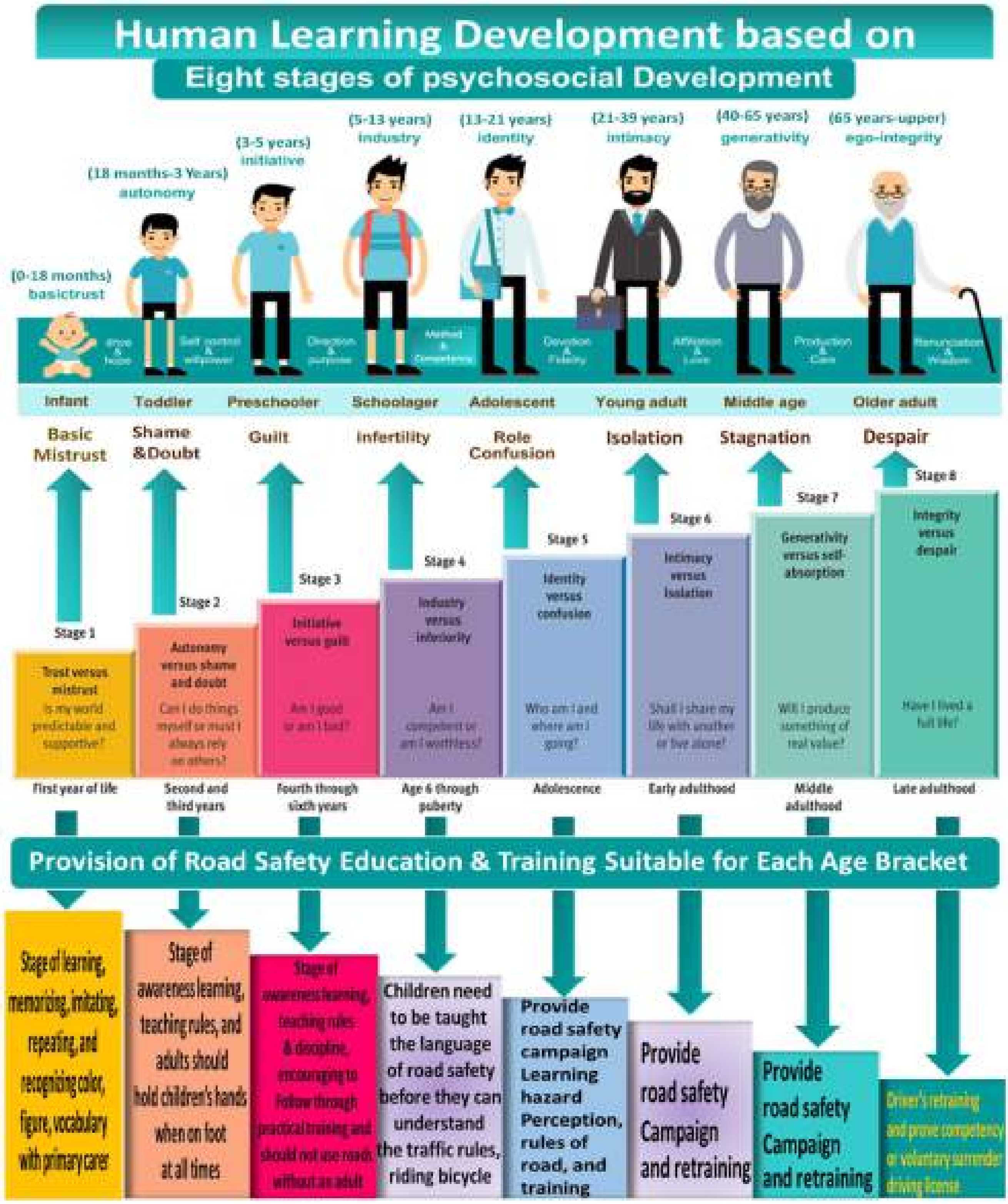



Figure 2-17 Human learning development based on the eight stages of psychosocial development

*Sources: Erik Erikson's 8 Stages of Psychosocial Development, https://courses.lumenlearning.com/teachereducationx92x1/chapter/eriksons-stages-of-psychosocial-development/; https://meded.psu.ac.th/binla/class05/388_541_2/Working_with_adolescents_in_family_medicine/index2.html; https://www.baanjomyut.com/library_2/extension-1/concepts_of_developmental_psychology/05_1.html; Human Development Across the Life Span Development, https://slideplayer.com/slide/10649761/*

**Method/approach**: School-based approach was introduced to the activity in accordance with their unsafe acts or risk behaviors as follows:

(1) *Regular Seminar/Meeting* with the principal, advisory teachers, the targeted students, and the working team for discussion and preparation of each activity; (2) *Establishment of student activity club* (the so-called *Safe You Safe Me: Road Safety Club*), as a platform to encourage a group of students to play a key leading role in road traffic safety educational activities and influencing their friends and classmates to act accordingly; (3) *Organization of workshop and training programs* in cooperation with local agencies concerned (see Table 2-2, Figure 2-18, and Figure 2-19 below).

Table 2-2 Organization of workshop and training program activities

| Item | Activity | Expected outcomes |
|---|---|---|
| **Activity 1** | Workshops on identification of HIYARI spot and black spot locations on campus | Students can understand and recognize HIYARI spots and black spots. |
| **Activity 2** | Campaign on "My Safety My Fantasy Helmet" on campus | This will increase the number of helmet-wearing students as they create their own decorated helmet style. |
| **Activity 3** | Workshop on hazard perception at TTK Logistic Safety Training Center | |
| | Drunk-goggles wearing and testing situation | Students will understand the degrees of drunken state and how to avoid it. |
| | Demonstrating heavy-duty truck driving speed at 60 km/hr on wet and dry road conditions | Student are enabled to perceive risk if drive speedy and slow down speed. |
| | Demonstrating cause & effect of overtaking, driving opposite traffic direction, red-light running | Students' perception of risks of those illegal activities is increased. |
| **Activity 4** | Provision of training programs to 60 targeted students at SCG Skill Development School | |
| | Five-lesson theory and 10-lesson driving practice for testing and gaining driver's license | Students gain ample knowledge to undertake a driver's license test. 56 passed the exam and got a license. |
| | Provision of one-day "train the trainer" program to the 30 teachers at SCG Skill Development School | |
| | A seven-hour lesson for training on learning and teaching college students how to ride motorcycles safely | It is expected that the teachers can provide lessons on safe motorcycle riding to the students in addition to their regular classes. |
| **Activity 5** | Organization of "Road Safety on Campus" campaign activity | |
| | Traffic quiz by Kahoot Game by ATRANS Team | Students have fun and understand more about traffic rules. |
| | Traffic Police talk and walk with you by the Saraburi Police | Bridges relations b/w students & police |
| | Vote for Safety Ambassador by the 1500 participating Students | Students are eager to be represented to lead the group and society on the road safety. |
| | Road Traffic Safety campaign booths by various agencies concerned: Parent & teacher association, Municipality, Police, Department of Land Transport, Department of Highways, Department of Rural Roads, Department of Disaster Prevention and Mitigation, local charitable rescue foundation, Road Accident Victims Protection Company Limited, SCG and SCG Skill Development School, and AP HONDA | Students and teachers have an opportunity to learn, exercise, and experience a lot regarding road safety rules and safety equipment; moreover, participating agencies gain an information interchange with students and discover what students want to make road safer for them. |

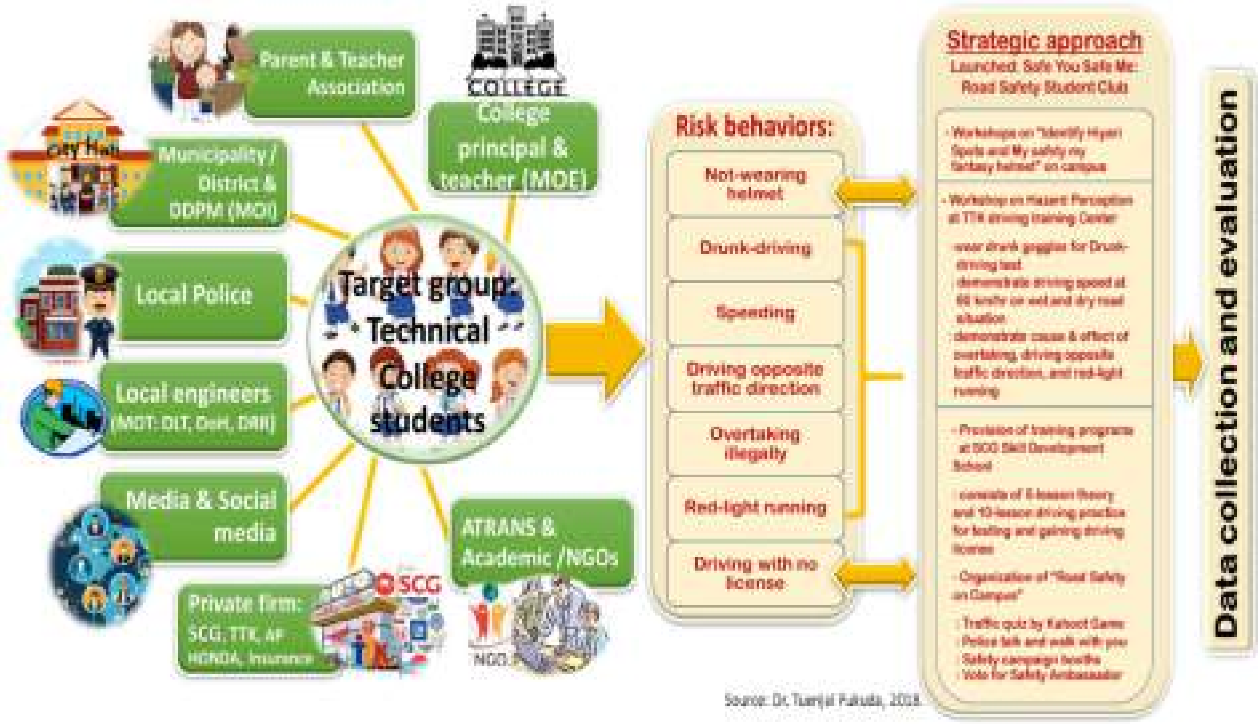



Figure 2-18 School-based activity for “Road Safety Education on Safe Driving: Preventive Training on Wheel,” at Thaluang Cementhaianusorn Technical College


Figure 2-19 Pictures of the activities of the school-based approach for students in the Saraburi Province

**Outputs and outcomes**: The school-based approach on "Road Safety Education on Safe Driving: Preventive Training on Wheel" received attentions from not only the teachers and students from the other departments but also from the parents. This activity also gained insights of the students' thoughts, such as "road safety is not my primary concern" and "accidents will never happen to me," or "I do not see the road safety problem as a threat, but my daily living is more important than road safety" and "I consider those who got injured by road accident to hve had bad luck." Furthermore, the socioeconomic characteristics of their family (i.e., income, education) play an important role in influencing their way of thinking or mindset. One of the significant findings is a common practice in school and college, by which the teachers will tell/order students to do something only if backed by a strong policy or order from the Office of Vocational Education Commission or college principal. Even though some teachers are concerned about the safety of their students, they still lack road traffic safety knowledge, skills, and experiences to teach or train them.

However, after the first year of having applied these practical activities, it was found that students perceived risk and understood the cause and effect of their risk-taking behaviors or unsafe acts; consequently, they took precautions and became more conscious about driving and using the roads. The principal and the teachers understood the importance of road safety education and practical training. The student members of the "Safe You Safe Me (SYSM): Road Safety Student Club" developed their own Facebook and website to distribute information on road traffic rules, knowledge on safe driving, and publicize and campaign for the incoming activity among their classmates, friends, and teachers on campus.

**Discussion and recommendation**: Nevertheless, this kind of practical road safety education activity requires a diverse approach to suit the specific target age groups as each stage of human learning development is different (see Figure 2-17). The principal's strong leadership and the teachers' intention are important to raise awareness on road safety among college students. Enforcing the law with the offending students may effectively work in a short period of time, but giving correct and proper education will sustainably work in long run. It needs continuation, repetition, and consistency in order to implant road safety culture into their daily life, which requires a long-term process, subsidy, and support from the government and private firms as well as the participation of other related agencies and communities.

### 2.2.2 Community-based traffic safety at a senior community in Suphan Buri Province

Another exemplification of community-based practical activity on traffic safety took place in Suphan Buri City.

**Background:** Each year, the number of retired government officials increases significantly, and so does that of retired government officials in the Suphan Buri Province. While some are still actively driving a car, others are becoming novice motorcyclists as riding a motorcycle is fast, convenient, and is a door-to-door mode of transportation.

**Existing problem**: The number of accidents involving senior motorcyclist has been increasing gradually. The police found that most injured motorcyclists do not wear a helmet while riding/driving motorcycles as they deemed it useless because it cannot prevent accidents from occurring. Riding without signaling and overtaking illegally are their unsafe acts.

**Cooperation and Activity theme**: The police perceived risk and requested ATRANS for research cooperation and technical assistance on this problem. ATRANS, in cooperation with Ubon Ratchathani University, Prince of Songkla University, Suphan Buri Police, Municipality, and the local community in Suphan Buri City, joined hands in promoting practical road safety education and training program for safe motorcycle riding and helmet use under the theme of "*Super Senior-Act Safe-Super Senior*" (see Figure 2-20).

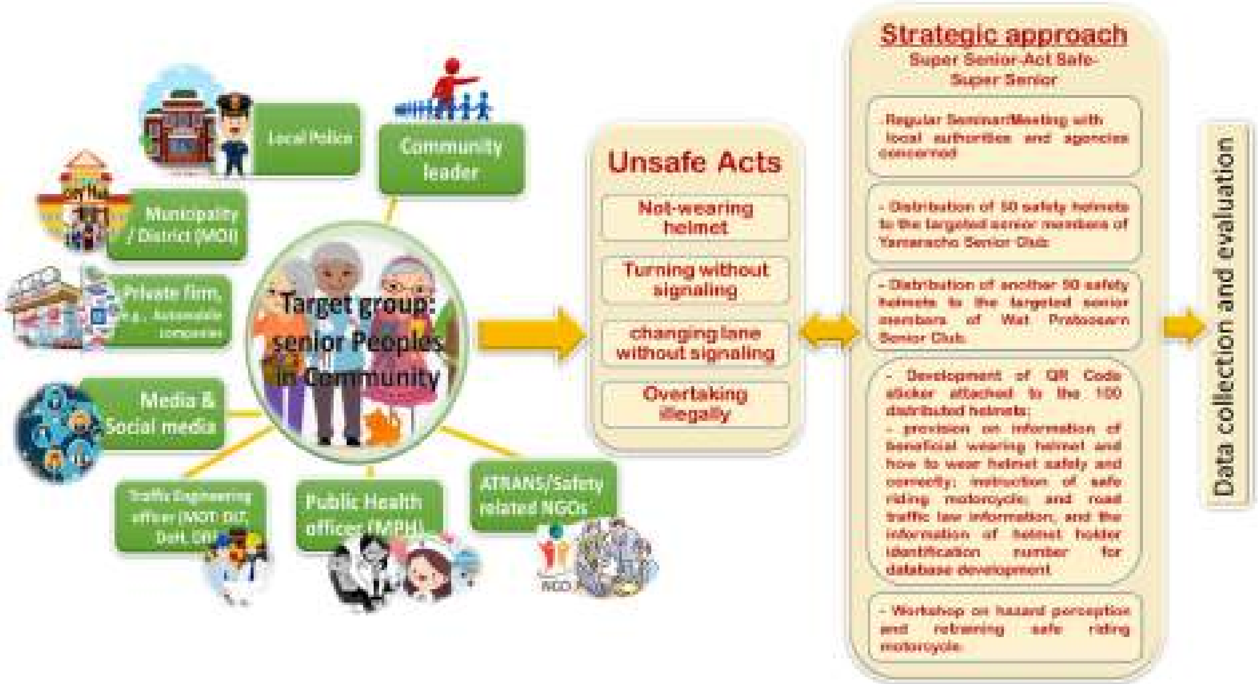



Figure 2-20 Cooperation between community and local authorities for senior community-based activity on safe acts

**Target group**: 100 male and female seniors aged between 60 and 75 years of the Baan Yamaratcho Senior Club and the Wat Pratoosarn Senior Club in Suphan Buri City were selected as the target group.

According to human learning and psychosocial development in Figure 2-17, senior people aged 60 and over have either integrity (e.g., lifetime achievement and pride) or despair (e.g., loneliness) or vice versa; they also have a diminishing capacity of their senses and sensitivity.

Hence, they need to partake in more practical and knowledgeable retraining activities than a mere lecture in a seminar room. Once they gain knowledge and skills, they will transfer them to their grandchildren and/or family members.

**Objectives:** The objectives are to raise awareness on unsafe acts (e.g., not wearing a helmet while driving/riding motorcycle) or risk-taking behaviors, which seniors may or may not be able to realize themselves, and to provide practical road safety education and retraining programs on riding motorcycles safely in accordance with unsafe acts or risk-taking behaviors.

**Method/approach**: A school-based approach was introduced for the activity in accordance with the participants' unsafe acts or risk behaviors as follows:

(1) *Regular Seminar/Meeting* with the Suphan Buri Police (Pol.Col. Somdech Kasemsuk), the mayor of Suphan Buri Municipality (Dr. Ekkapan Injai-oua), the community leader and head of the Yamaracho Senior Club and Wat Pratoosarn Senior Club; (2) *Distribution of 50 safety helmets* to the targeted senior members of the Yamaracho Senior Club *and another 50 safety helmets* to the targeted senior members of the Wat Pratoosarn Senior Club; (3) *Development of QR Code sticker* attached to the 100 distributed helmets and *provision of information* (which can be downloaded by scanning the QR code) about the benefits of wearing a helmet and how to wear it safely and correctly; instructions on riding motorcycles safely; road traffic law information; information on helmet holder identification number (e.g., name, age, gender, telephone, contact address, and so on) for database development; (4) Workshop on hazard perception and retraining on riding motorcycles safely (see figures 21 and 22).

**Outputs and outcomes**: The community-based approach on "Super Senior-Act Safe-Super Senior" is an ongoing process that received attention from not only the target groups and the participating local authorities but also the neighboring community and the media from Channel TNN 16, Channel 8, and Channel 3 (33), which can be viewed at the following link https://www.youtube.com/watch?v=fOVYFJY3Qt4&feature=youtu.be.

The proposed helmet with the QR code system appears to be a new paradigm of distributing/donating safety helmet rather than simply giving them free of charge; this system can indirectly control unsafe acts or risk-taking behaviors. One obstacle is the technology barrier: even though all the targeted senior members have a driver's license and are eligible to receive the safety helmet, some may not be able to understand and operate a smartphone in order to read the QR code. A training workshop may be required to train them on this matter.

**Discussion and recommendation**: The community-based approach on "Super Senior-Act Safe-Super Senior" is an ongoing process. More data need to be collected on whether it may be worth conducting research activity to save the lives of elderly people in the Suphan Buri Province and in other parts of Thailand. Of course, people of any age have an equal chance to live safely against the disruption of technology; changing human behavior—and especially elderly people—may take longer than expected. This kind of practical road safety education activity requires a diverse approach to suit the specific target age bracket groups as each stage of human learning development is different (see Figure 2-17).

Enforcing the law with the offending elderly may effectively work for a short period of time, but giving correct and proper education will sustainably work in the long run, needing continuation, repetition, and consistency in order to implant road safety culture into their daily life. This requires a long-term process, subsidy, and support from the government and private firms as well as the participation of other related agencies and community.


Figure 2-21 Picturesque activity of the community-based approach
in the Suphan Buri Municipality, Suphan Buri Province

# 3. Road Traffic Accident Situation in Suphan Buri and Traffic Safety Activities

**Jatupon THEPMANGKORN**

## 3.1 Overview of traffic accidents and countermeasures

The Suphan Buri Province is located about 100 km north of Bangkok. As shown in Figure 3.1, the National Highway Route No. 340 as a main highway is often used as an alternative route to travel to northern Thailand.

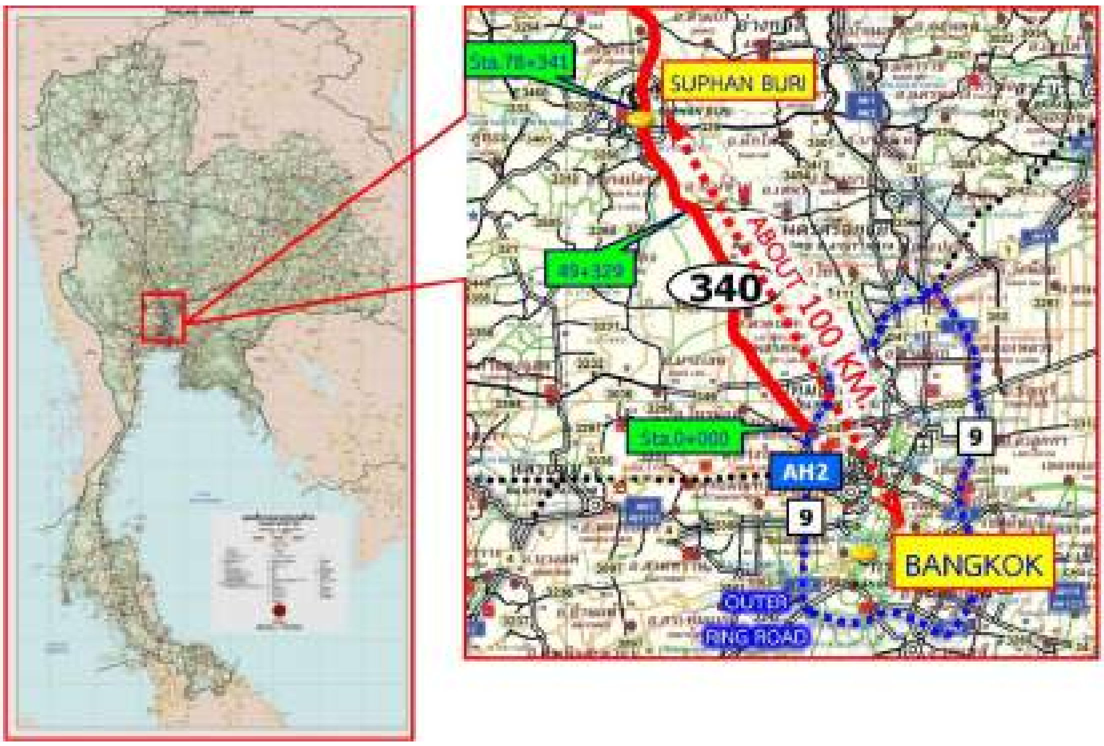



Figure 3-1 the location of the Suphan Buri Province and Highway 340

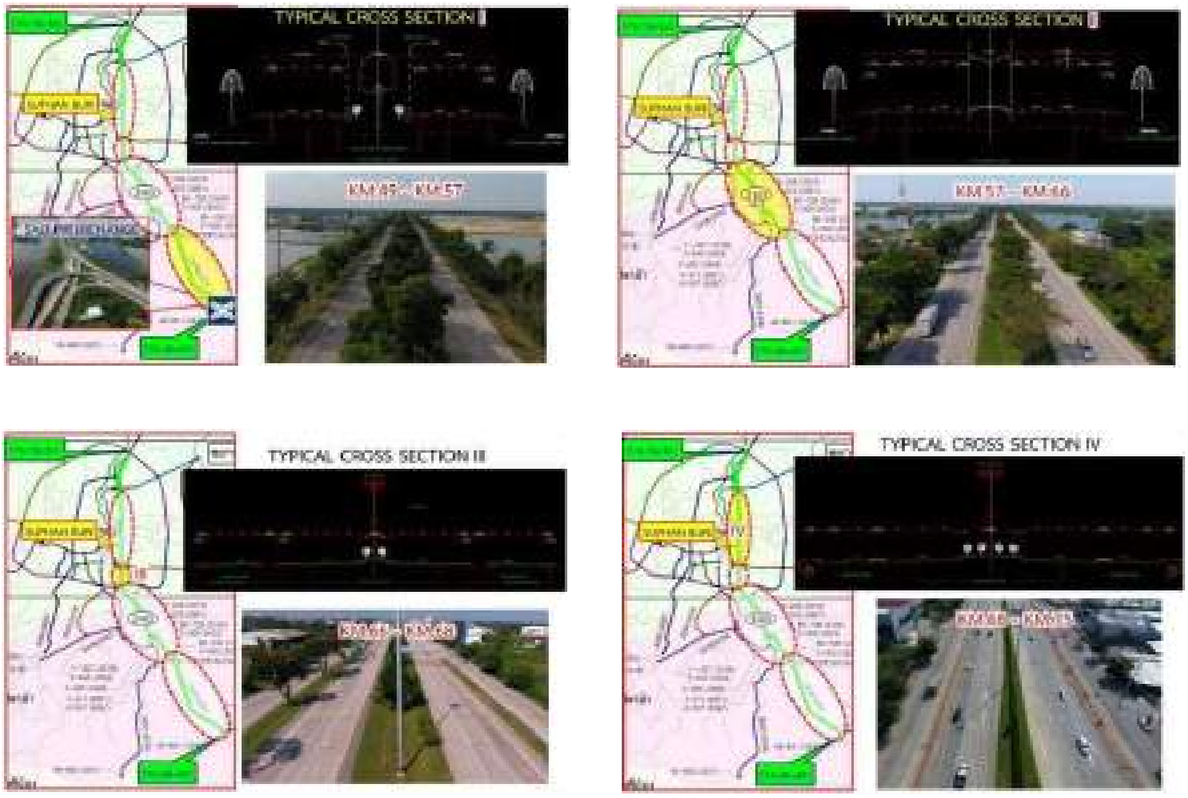
Based on the accident statistics, road traffic accidents often occurred on the National Highway No. 340 section between Sali (Sta. 48+841 Km) and Suphan Buri (Sta. 78+341 Km), in a distance of 29.5 km. The physical conditions of this study section (Figure 3.2) can be summarized as follows:

(1) The road sections from km 49 to km 57 and from km 75 to km 78 are located in suburbs. In those sections, the special road standard that has four lanes with a concrete pavement width of 7.00 m per direction (two lanes) was applied. The width of the depressed median is 10.00 m, the right shoulder is 1.50 m, along with the depressed median, and the left shoulder is 2.50 m.

(2) The road section from Km 57 to Km 66 is on the outskirt of the city. In this section, a road with six lanes and a concrete pavement width of 10.50 m per direction (three lanes) were applied. The width of the depressed median is 10.00 m, the right

shoulder is 1.50 m wide, along with the depressed median, and the left shoulder is 2.50 m.

(3) The road section from km 66 to km 75 is located in the urban area. This section is constructed as a full highway (Ultimate Stage) with a concrete pavement of 10 lanes. The main road is 10.50 m width in each direction (three lanes), the raised median is 5–15 m, and the parallel road is a concrete pavement width of 7.00 m (two lanes) in both directions, with pedestrian paths on both sides of the frontage road. Lighting is installed throughout the whole road section of the 29.5-km distance.




About 29.500 km of this section already have street lighting.

Figure 3-2 The physical characteristics of Highway No. 340, Sali to Suphan Buri (km 48.841 - km 78.341)

Figure 3-3 shows the traffic volume and accident statistics in the years 2012–2015 recorded by the DOH. According to preliminary analysis, it was found that most accidents occurred in two types: rear-end collisions on the road and off-road accidents on the straight section, as shown in Figure 3-4.

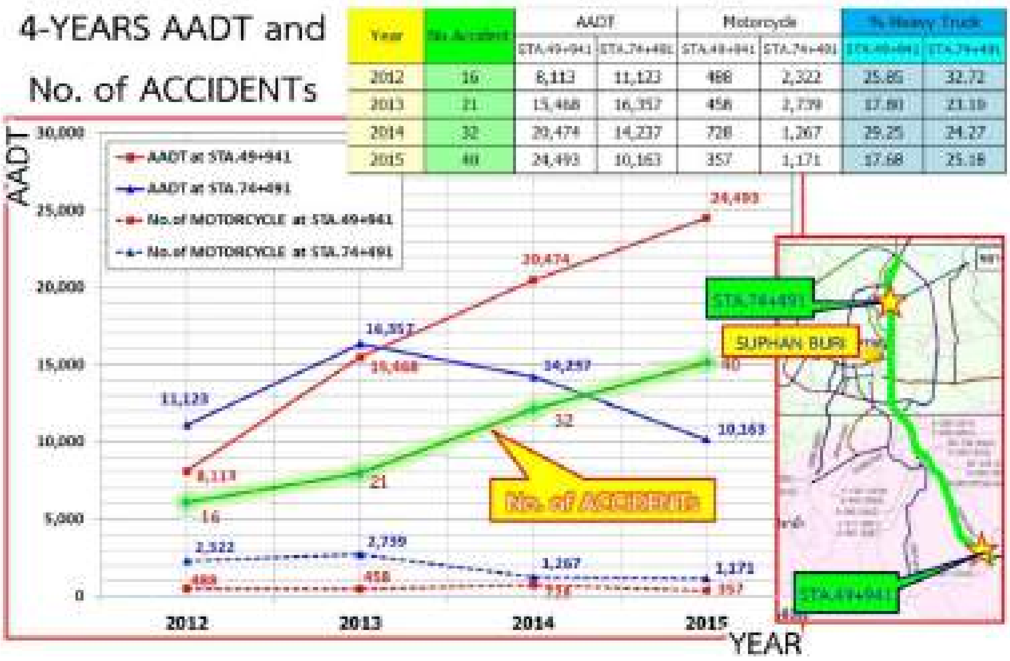



Figure 3-3 Traffic volume and accident statistics in the years 2012–2015

Table 3-1 Traffic volume data and accident statistics from 2012 to 2015

| COLLISION DIAGRAM | No. of ACCIDENTS | No. of FATALITIES | No. of INJURES |
|---|---|---|---|
| Vehicle from opposite direction | 2 | 2 | 2 |
| Vehicle from one direction | 65 | 9 | 57 |
| Overtaking | 5 | 3 | 5 |
| On path | 5 | 0 | 3 |
| Off Path on straight | 51 | 10 | 58 |
| Off Path on curve | 2 | 1 | 2 |
| TOTAL | 150 | 25 | 127 |

When considering the cause of the accidents, five main causes were found, as shown in Table 3-1, which include:

1. Fast driving
2. Driving too close to the front car
3. Driving the wrong way
4. Dozing off
5. Cutting and stopping traffic flow with a U-turn.


Figure 3-4 Causes of accidents on the study section of National Highway Route No. 340

When accident statistics are sorted by kilometer of the accident (every 500 meters), it is possible to frequently identify the location of the accident, as shown in Figure 3-5.

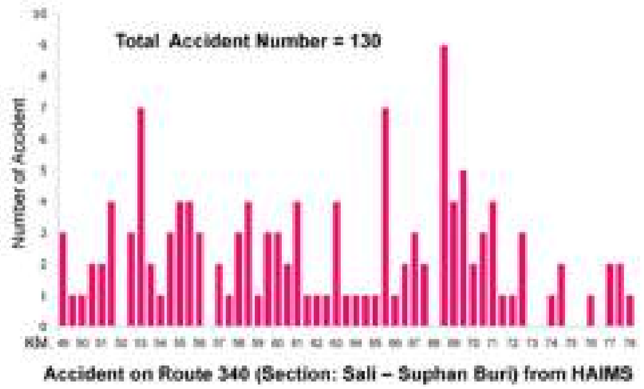



Figure 3-5 Number of accidents on the study section of National Highway Route No. 340


Figure 3-6 Top seven locations in which accidents frequently occurred

At the seven locations selected, various measures were taken to reduce the risk of traffic accidents. These measures were planned and implemented with reference to the advice of experts dispatched by the Ministry of Land, Infrastructure, Transport and Tourism of Japan. The main measures implemented at each location are as follows (the details of the implemented measures will be introduced in detail in Chapter 8—Model Project):

AREA 1
Klong Ban-Huai Bridge: Installation of pavement marking and warning signs such as optical speed bar, rumble strip, and traffic sign
AREA 2
Soongsumam Padungwit School: Installation of traffic marking such as optical speed bar, rumble strip, and text on the road surface, red anti-skid marking, and large warning signs.
AREA 3
Median Opening (Ban Po Koi): Closing the U-turn point and construction of underpass and parallel road.
AREA 4
Median Opening (PTT Station): Closing the U-turn point and opening new U-turn point near the opening.
AREA 5
Median Opening (Tesco Lotus): Installation of concrete barrier on the exit from the highway to the parallel road.
AREA 6
Median Opening (Suphan-Malaiman): Same as above.
AREA 7
Median Opening (Exit to Old 340): Same as above.

## 3.2 Activities by related organization

In the Suphan Buri Province, related organizations have implemented measures to prevent and reduce the number of accidents occurring. That is, the Department of Highway Suphan Buri Office, the Department of Rural Road Suphan Buri Office, the State Railway of Railways Suphan Buri Office, the Department of Land Transport Suphan Buri Office, and also the RTP, Local Government under the Ministry of Interior, their departments, and insurance companies are cooperating.

Activities include providing knowledge of car use and traffic discipline on the road to community pupils, students, and the elderly; setting up a network at the village level to monitor during long holidays; holding parties; and more. In addition, during the Songkran Festival, checkpoints will be set up for speed, alcohol detection, car condition check, public vehicle stopping at checkpoints every 100 km, and monitoring at railway crossings. Figure 3-7 shows an example of measures to prevent and reduce traffic accidents that occur in the region.

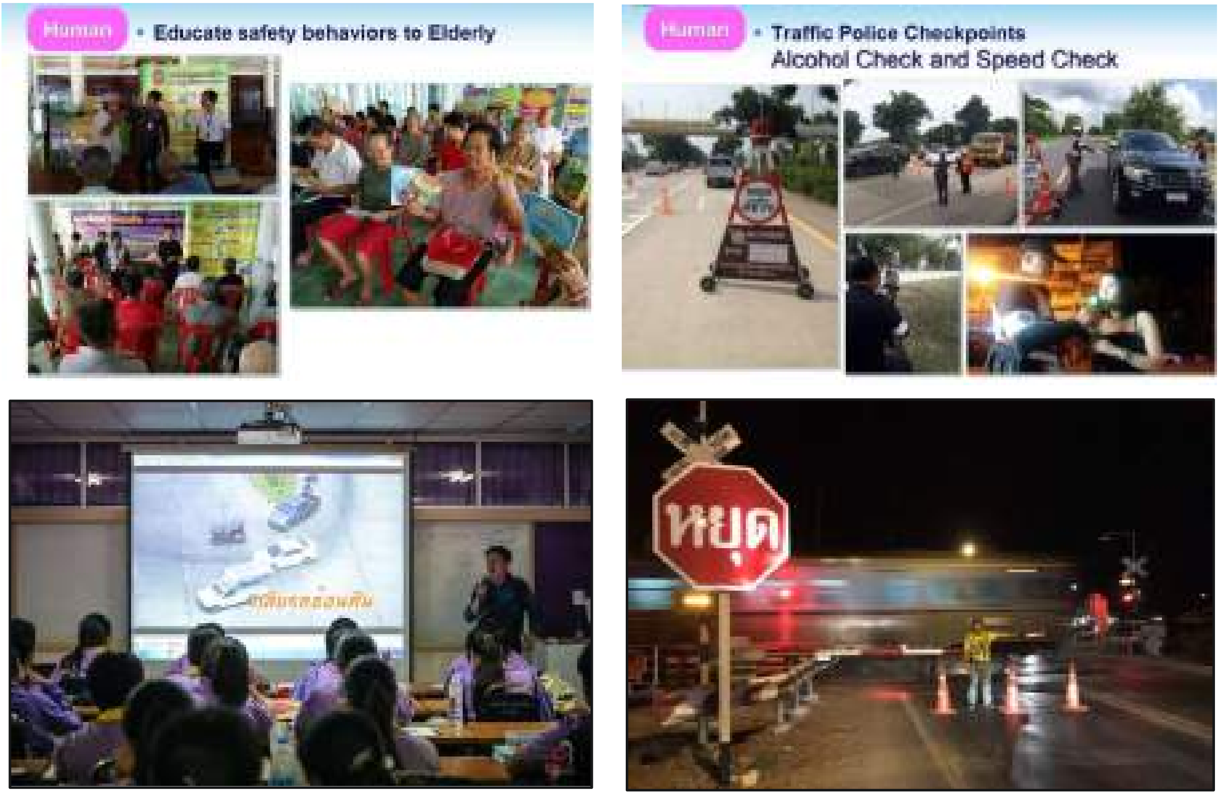
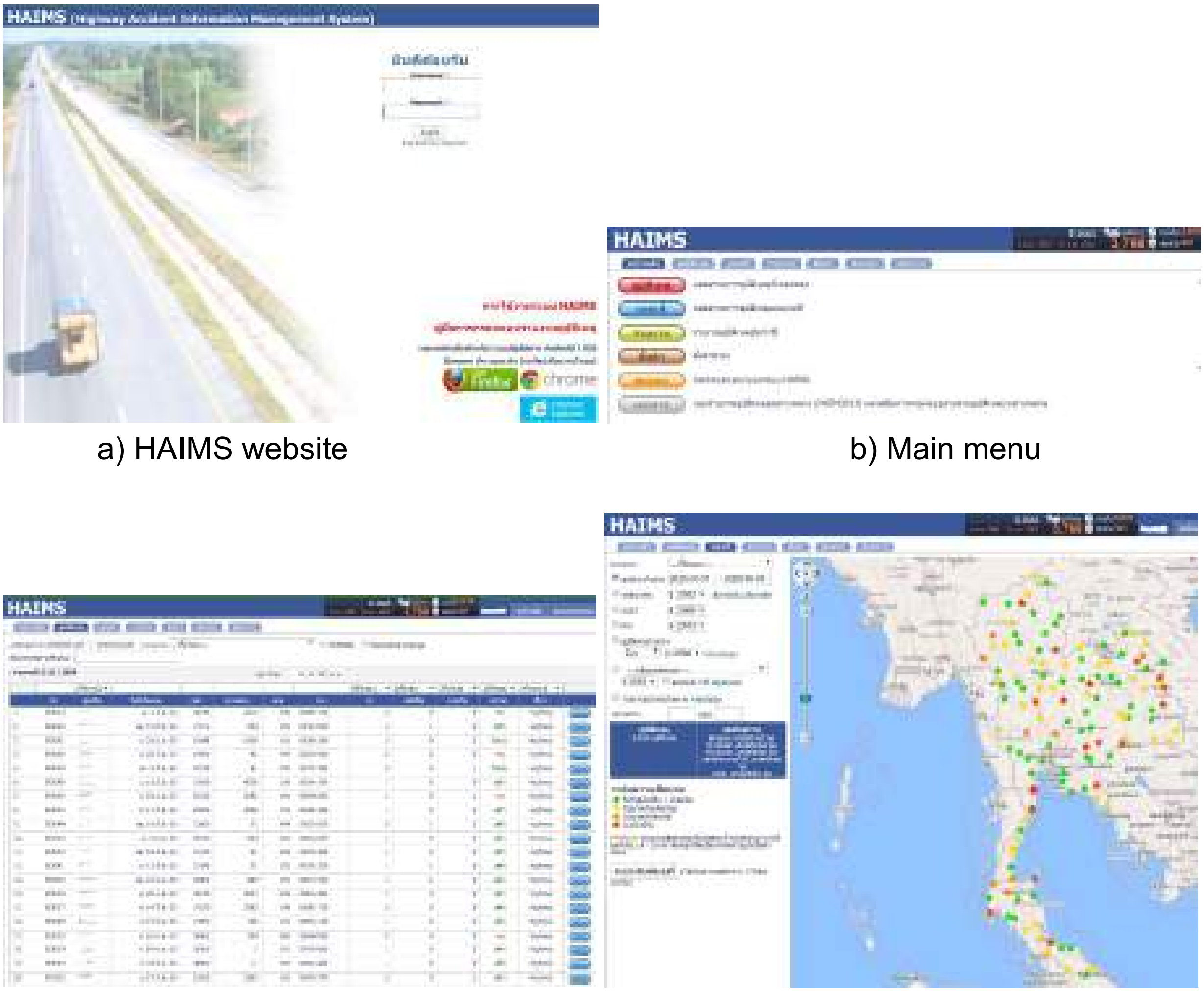



Figure 3-7 Traffic safety education, and supervision of over speeding and alcohol

# 4. Data Collection

## 4.1 Traffic accident data (including HAIMS and others)

In Thailand, traffic accident data have been collected independently by several agencies. In this study, as the study road section is under the DOH, the crash data were mainly obtained from the DOH. The DOH has developed the Highway Accident Information Management System (HAIMS) to collect, analyze, and report the data of crashes occurring on their road network. As seen in Figure 4-1, the system can show the list of crashes reported, the map allows to visualize the crashes occurred on the DOH network in Thailand, and the reporting menu allows a user to retrieve the crash data from various queries.



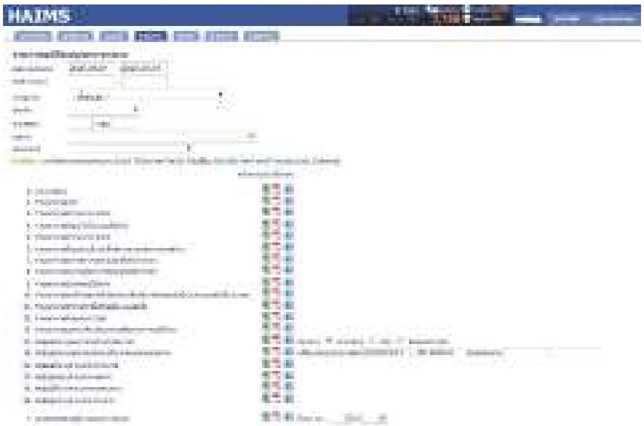
a) HAIMS website

b) Main menu

c) List of the crashes reported

d) Map showing the crashes reported

Figure 4-1 Highway Accident Information Management System (HAIMS)




e) Reporting menu

Figure 4-2(Cont.) Highway Accident Information Management System (HAIMS)
*Source: Department of Highway, https://haims.doh.go.th*

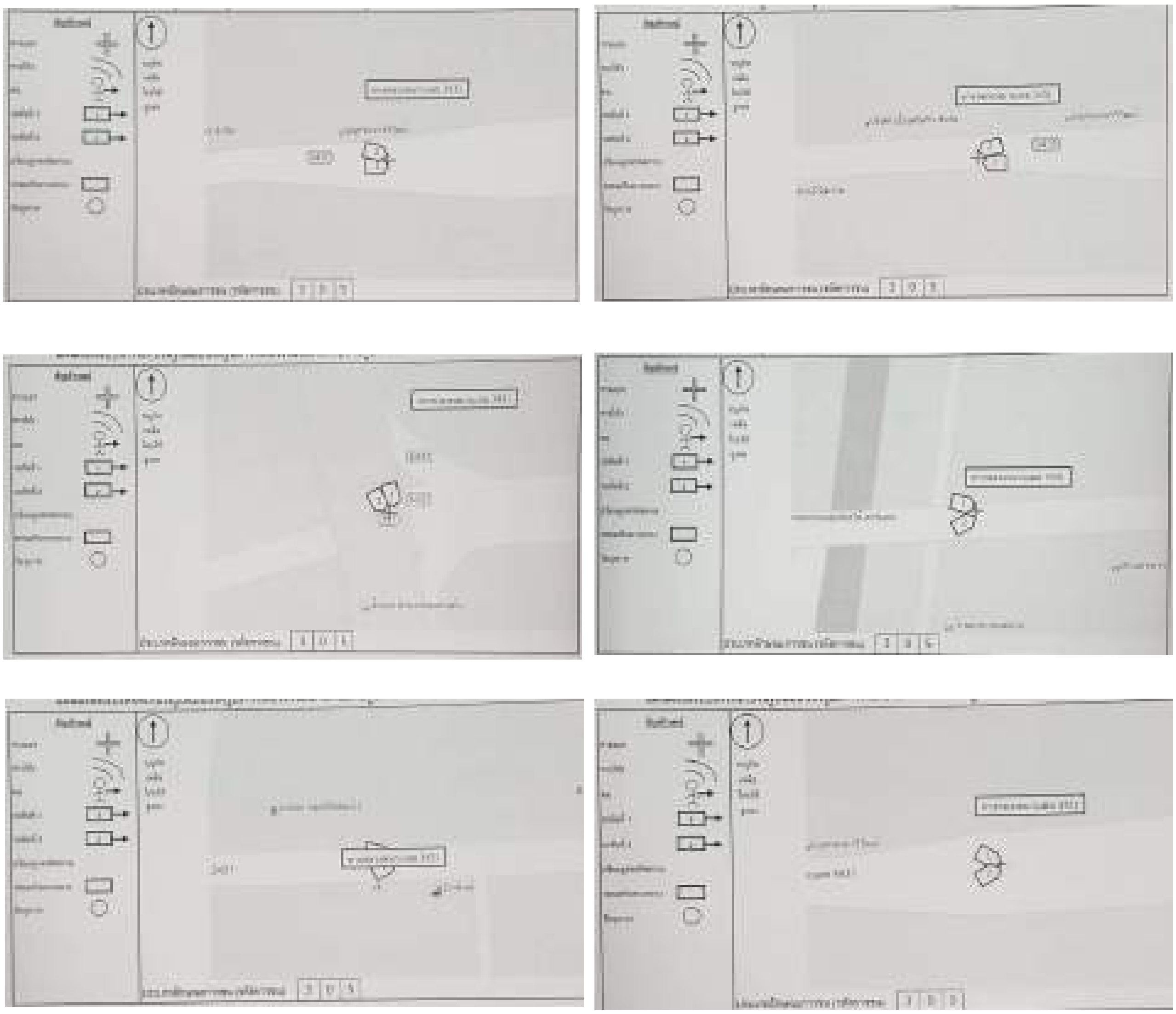


Figure 4-3 Example of corrosion diagram report in HAIMS

## 4.2 Collection of HIYARI-HATTO Experience and Development of the HIYARI Map

### 4.2.1 What is the HIYARI-HATTO experience?

To understand the situation of road traffic accidents, it is necessary to collect and analyze detailed traffic accident data. However, in Thailand, road facility managers, police, insurance companies, and so on only collect relevant traffic accident data, and the reported contents do not always provide a detailed understanding of the situation. Therefore, it is often not possible to analyze road traffic accident data.

In such cases, it is possible to collect and analyze people's HIYARI-HATTO experiences instead. In daily life, we often experience scaring situations when walking, riding a motorcycle, or driving a car—this is HIYARI-HATTO, or the HIYARI-HATTO experience.


Figure 4-4 "HIYARI" means feeling danger and risk

Naturally, the HIYARI-HATTO incident is not a road traffic accident itself; thus, a difference exists between the two. However, it is said that for every large-scale accident that occurs, 29 similar small-scale accidents also occur, behind which further lie over 300 cases of "HIYARI" incidents. These figures alone reveal that we cannot afford to take HIYARI incidents lightly; by collecting and analyzing the HIYARI-HATTO incident, we can expect the type and place of the potential traffic accident.

### 4.2.2 Why do we organize HIYARI map development workshops?

Despite the strongest efforts from the local government and police to find problems in the community, it is challenging to accurately understand local traffic accident problems.
Therefore, we recommend organizing a workshop for HIYARI map development in order to collect the HIYARI-HATTO experiences of members of the local community. It not only provides HIYARI-HATTO data but also gives members of the local community a chance to actively investigate, plan out, and create safety measures for problematic traffic issues together with government agencies.
Most people feel that regulating safety measures is the job of government authorities, including the local police. However, the act of creating a HIYARI map and helping to identify problems in the community is something that its citizens can actively contribute to for ensuring traffic safety in their community.

## What is HIYARI-HATTO?

### The many frightening HIYARI experiences in any neighborhood

Has there ever been a time when you are walking or riding a bike (or even driving a car) and you are not given a scare from a HIYARI on a car or bicycle?

### HIYARI incidents with motorcycles when on foot

A motorcycle comes suddenly around a blind corner.
A motorcycle with headlights off appears suddenly in the dark.
You do not know which way to step aside when a motorcycle suddenly comes from behind.

### HIYARI incidents with cars when on foot

You feel like you are going to be sucked into the road by vehicles traveling too fast.
A vehicle fails to stop and turns right through the crosswalk as you are crossing.

### HIYARI incidents on the street/sidewalk when on foot

You nearly trip over a protruding manhole cover.
You nearly slip and fall on a slippery wet spot.
You have to go out of your way to avoid some obstruction, such as a big telephone pole, only to step into the middle of a narrow street.

### HIYARI incidents when riding a motorcycle

You nearly run headlong into a car as you are trying to come out from around the corner of an intersection.
A car passing by with little room on a narrow road almost knocks you down.

### HIYARI incidents when driving a car

Children suddenly run out into the road from behind a telephone pole.
A motorcycle, without slowing at all at the street corner, rides straight into the road.

Surely, you have many frightening and surprising HIYARI experiences in addition to those listed here.

### 4.2.3 How to organize HIYARI map development workshops?

Below, as an example of the workshop implementation method, the contents of the HIYARI map development workshop conducted in Suphan Buri are introduced.
Participants include the staff of DOH, DRR, DLT, Suphan Buri Provincial Police and City Hall, local residents, junior and senior high school students, hospital staff, rescue team, and so on.

At the workshop, the administrative staff in charge first introduced the situation of road traffic accidents in Suphan Buri and its countermeasures.
Next, the member of the International Association of Traffic Safety and Sciences introduced the Kamagaya model as a successful case in Japan, and a member of ATRANS presented Thai road safety culture and traffic safety measures in the community.

After that, we distributed the A3 Suphan Buri map and questionnaire to the participating members and asked them to put stickers on the map indicating where they experienced the HIYARI-HATTO incident and to respond in detail about the experiences that seemed to be particularly serious among them with a questionnaire. The stickers used different colors to signal the participants' experience on foot, motorcycle, and car. In response to the questionnaire, we asked the participants to draw the situation of the HIYARI-HATTO experience on a collision diagram.

After the participants completed the map and the questionnaire, we gathered them and recorded the locations of the stickers all over a large map to summarize the HIYARI-HATTO points. The questionnaire was organized after the workshop and analyzed at a later date.

Representatives selected from the participants explained their experience at the places that were pointed out most frequently in the compiled HIYARI map in front of all the participants and shared the experience with them.

Afterward, they selected a few of those places and actually visited the site, pointing out concrete problems such as road structure, road marking, traffic sign, roadside environment, and so on and discussed improvement measures.

Eventually, they returned to the workshop venue and summarized the problems and countermeasures shared by all members at the HIYARI-HATTO incident.

Figure 4-5 Example of materials for workshop

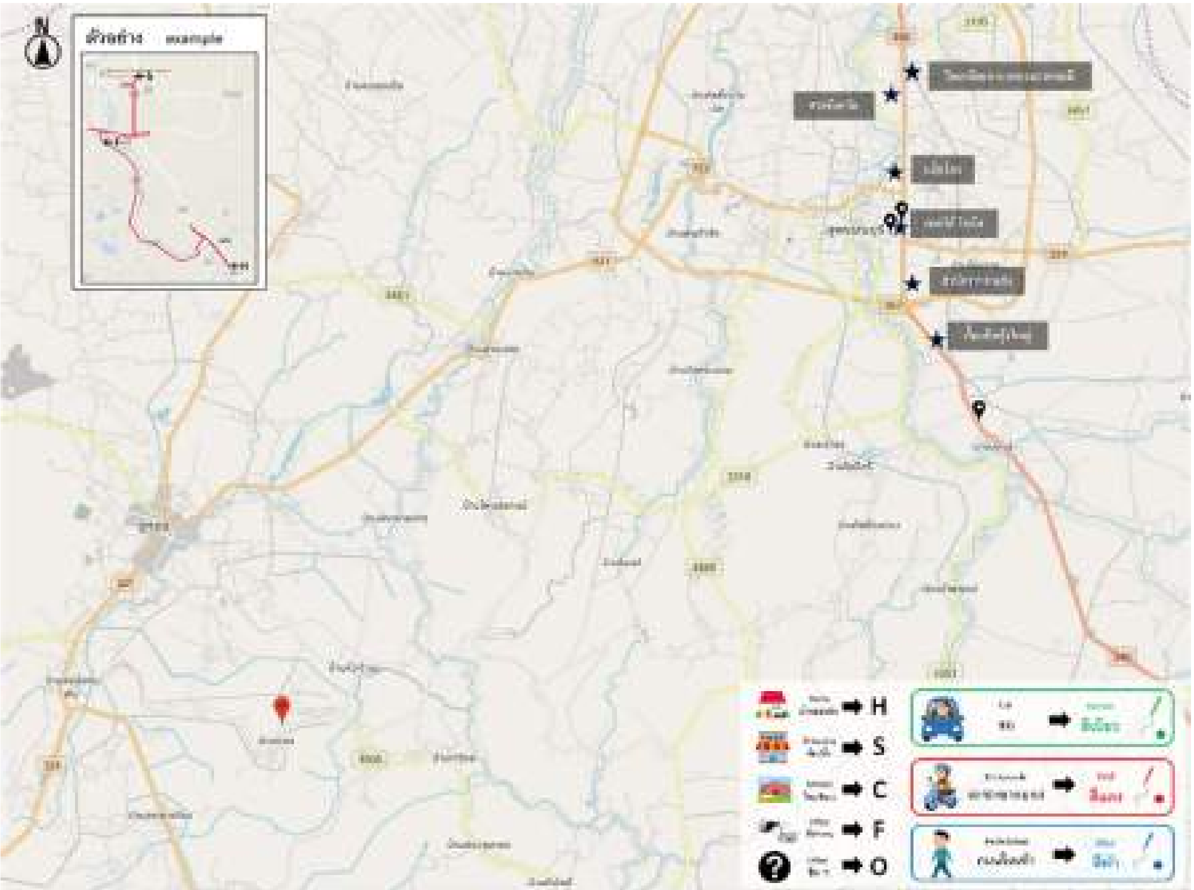



Figure 4-6 HIYARI map developed by each participant in A3 form

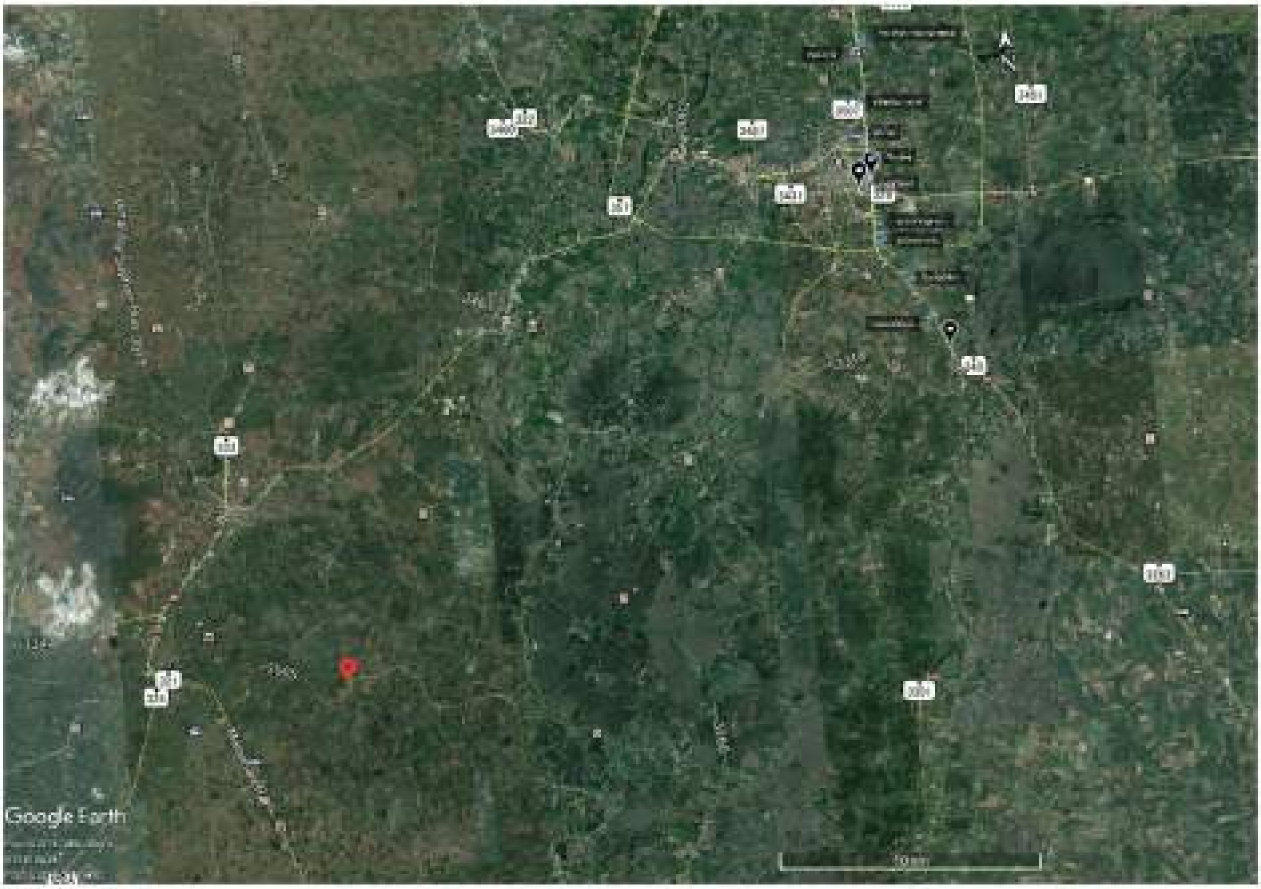



Figure 4-7 Summarized HIYARI map in A0 form

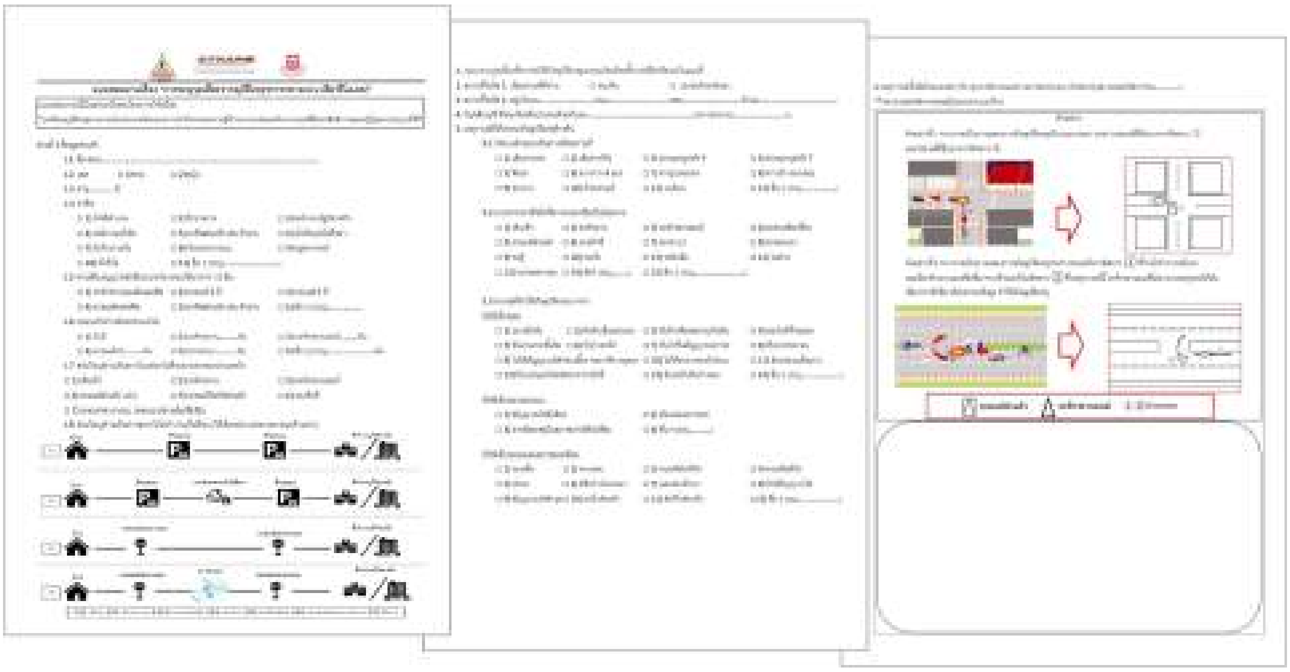


Figure 4-8 Questionnaire sheet

# How to organize
## Hiyari Map Development Workshop

**Step 1**

### Introducing HIYARI-HATTO and traffic safety activities in the community

Explain to participants the importance of traffic safety activities in the community and how to proceed with the near-miss mapping workshop

**Step 2**

### Plot HIYARI-HATTO point on A3 map

For each participant, put the HIYARI-HATTO points on the HIYARI map. Use different colored stickers [Car (Green), Bike (Red), Pedestrian (Blue)] for different modes of transportation.
Also, plot the location of the illustration using yellow stickers.

**Step 3**

### Answer for Questioner

Let the participant draw an illustration about selected HIYARI-HATTO experienced out of the points plotted on the HIYARI map.

### Aggregate individual HIYARI maps

The location of the sticker that the participant pasted on the HIYARI map is copied on A0 map of Car, Bike and Pedestrian and aggregated.

**Step 4**

### Description of near miss point and sharing between participants

Description of near-miss point and sharing between participants – Select the spot where HIYARI-HATTO was most frequent and ask the representatives to explain what happened and how dangerous the situation was.

**Step 5**

### Site visits to locations with many HIYARI-HATTO

All participants visit the spot where the most HIYARI-HATTO occurred and analyze the cause of the HIYARI-HATTO at that point.

Figure 4-9 Process of HIYARI map development workshop


Figure 4-10 Opening ceremony


Figure 4-11 Explanation of HIYARI-HATTO


Figure 4-12 Answering questionnaires


Figure 4-13 Creation of HIYARI Map


Figure 4-14 Understanding HIYARI locations


Figure 4-15 Field survey

## 4.3 Data collection by utilizing ATRANS Safety Map Application

**Paramet LUATHEP**

### 4.3.1 What is ATRANS Safety Map?

ATRANS Safety Map is a mobile application that can be downloaded from the Apple Store, Google Play Store, or by directly visiting the website https://www.atrans-safety.com/safetymap/index.html. The application consists of four main functions, which include (1) crash location data, (2) risk location data, (3) data analysis report, and (4) navigation.


Figure 4-16 Main Menu of ATRANS Safety Map

### 4.3.2 How to collect the data

For the case of crash data, authorized users (e.g., police, recue staff) can click on the first function (crash location data). They are required to input some related data—for example, GPS location, crash scene photo(s), basic crash data, collision diagram, and road victim data.


Figure 4-17 Steps to collect crash data

For the case of risk location data, the users (anyone) are required to upload photo(s) of risk location, identify types of road users, and report the risk factor(s).


Figure 4-18 Steps to collect risk location data

### 4.3.3 How to utilize the report

The public can access the application to review several reports analyzed from the crash data and risk data stored in the database. Some reports include overview of crash data analysis, risk locations and top risk factors, hazardous locations, and estimated losses.

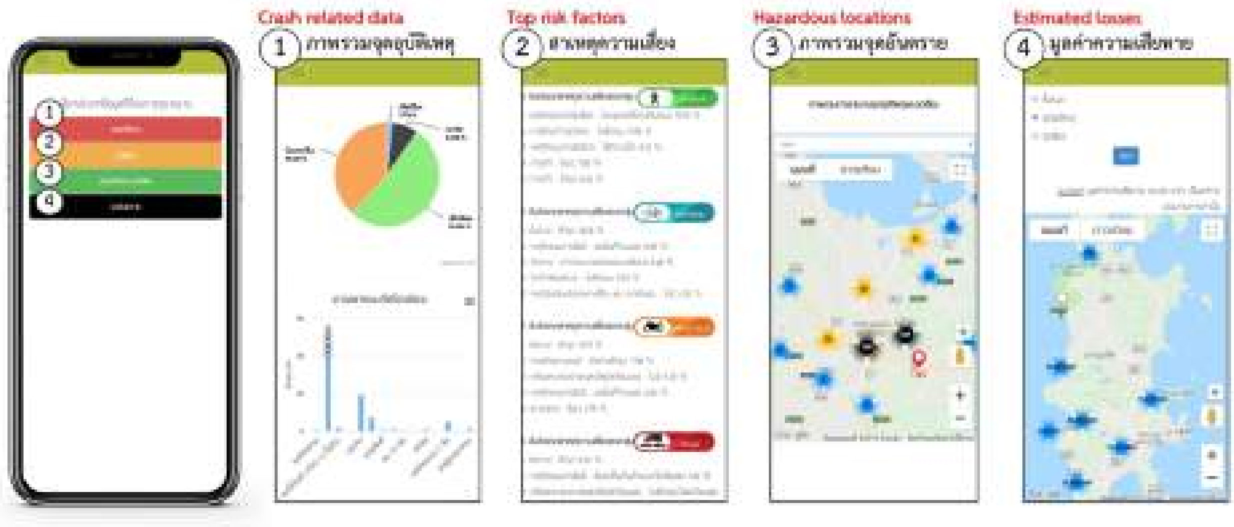



Figure 4-19 Some reports generated from ATRANS Safety Map application

## Treatment of Hazardous Location based on accident data and/or HIYARI-HATTO data collected by ATRANS Safety Map

In Phuket, 5 hazardous location was selected based on traffic accident data collected by ATRANS Safety Map. Then, the Prince of Songkla University team proposed countermeasures to reduce risk at five locations as follows.

Treatment was conducted on a model route based on HIYARI-HATTO data.

# 5. Data Analysis (Statistical Analysis)

## 5.1 Outline of data analysis

The analysis is conducted as shown in Fig. 5-1. Then, we will show how to analyze potential black spots using HIYARI-HATTO data collected around the HIYARI map development workshop and ATRANS Safety Map Application. Obviously, if detailed road traffic accident data are available, it is possible to perform the exact same analysis using road traffic accident data instead of HIYARI-HATTO data.

As explained in the previous chapter, in the HIYARI map development workshop, a HIYARI map was created to determine the locations of HIYARI-HATTO experiences, whereas the questionnaire indicated the contents of typical HIYARI-HATTO experiences. Therefore, in the analysis using these data, the occurrence point of HIYARI-HATTO incidents is first obtained; next, by applying the details of the HIYARI-HATTO experience answered in the questionnaire to the Collision Type Classification Table, the type of traffic accident that may have occurred is analyzed.
The ATRANS Safety Map app also reports the location of the HIYARI-HATTO incident, with the reporter selecting the details from the Collision Type Classification Table.

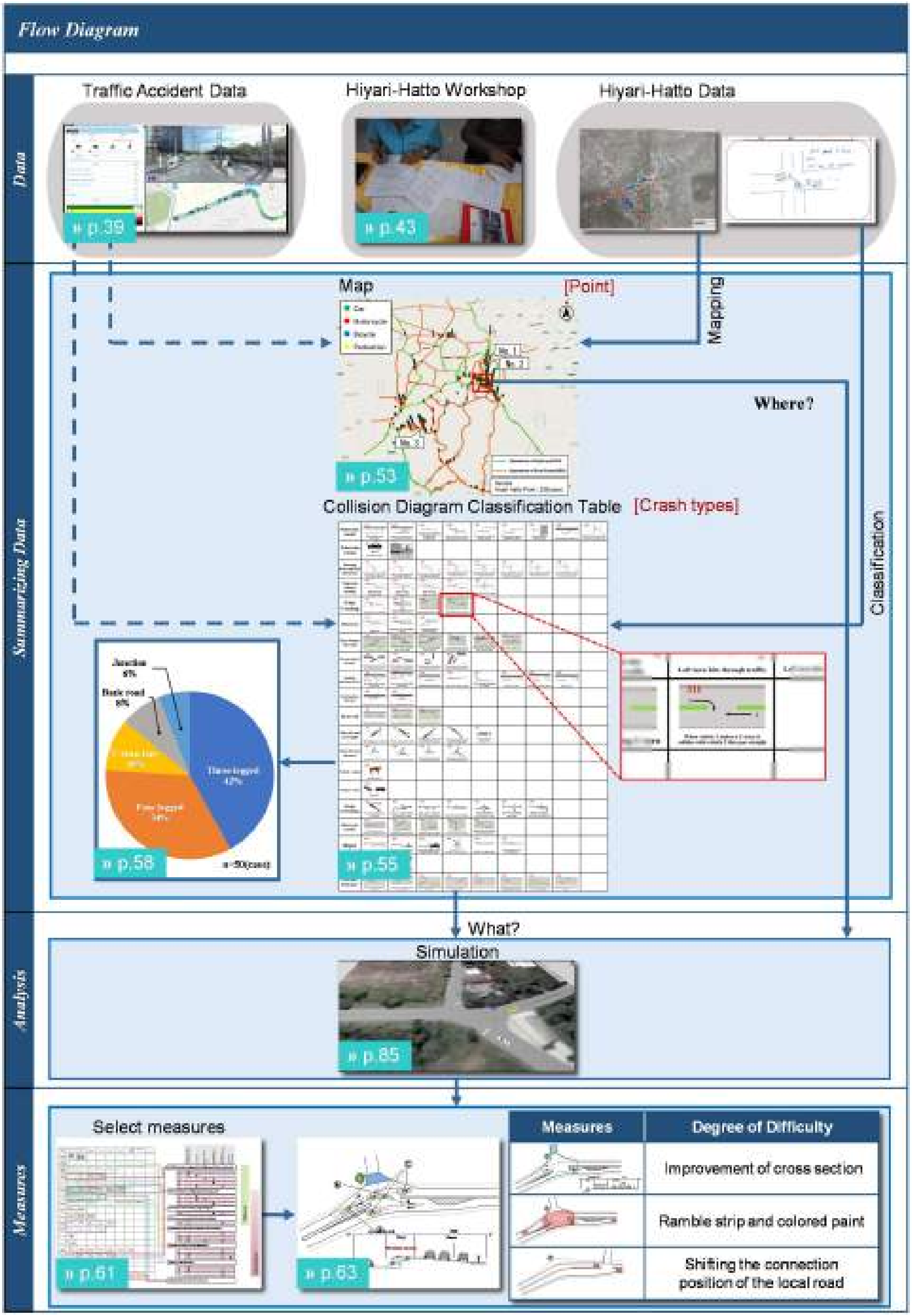



Figure 5-1 The process for analyzing HIYARI-HATTO data

## 5.2 Analysis of HIYARI-HATTO locations

The spot where a HIYARI-HATTO incident has been experienced is indicated by sticker. The number of stickers attached to the map varies by participants; for example, aggressive participants will stick many, and those who are not will only stick a few. Therefore, although the number of stickers is not objective information, if many stickers are concentrated in one place, it means that many HIYARI-HATTO incidents occur at that location. It is reasonable to digitize this information using a geographic information system to analyze potential black spots. By digitizing the map, it is possible to easily add other information—such as information on road surface maintenance and road administration—and analyze how various factors relate to the HIYARI-HATTO incident.

Figure 5-2 shows the HIYARI-HATTO experience obtained from the workshop in Suphan Buri as a bar graph on the map. By considering this diagram, you can discern whether such a point is an intersection, a U-turn, or a junction of roads. In addition, by overlaying road administrators, it is possible to clarify that many HIYARI-HATTO incidents occur at locations where different administrators cross different roads.

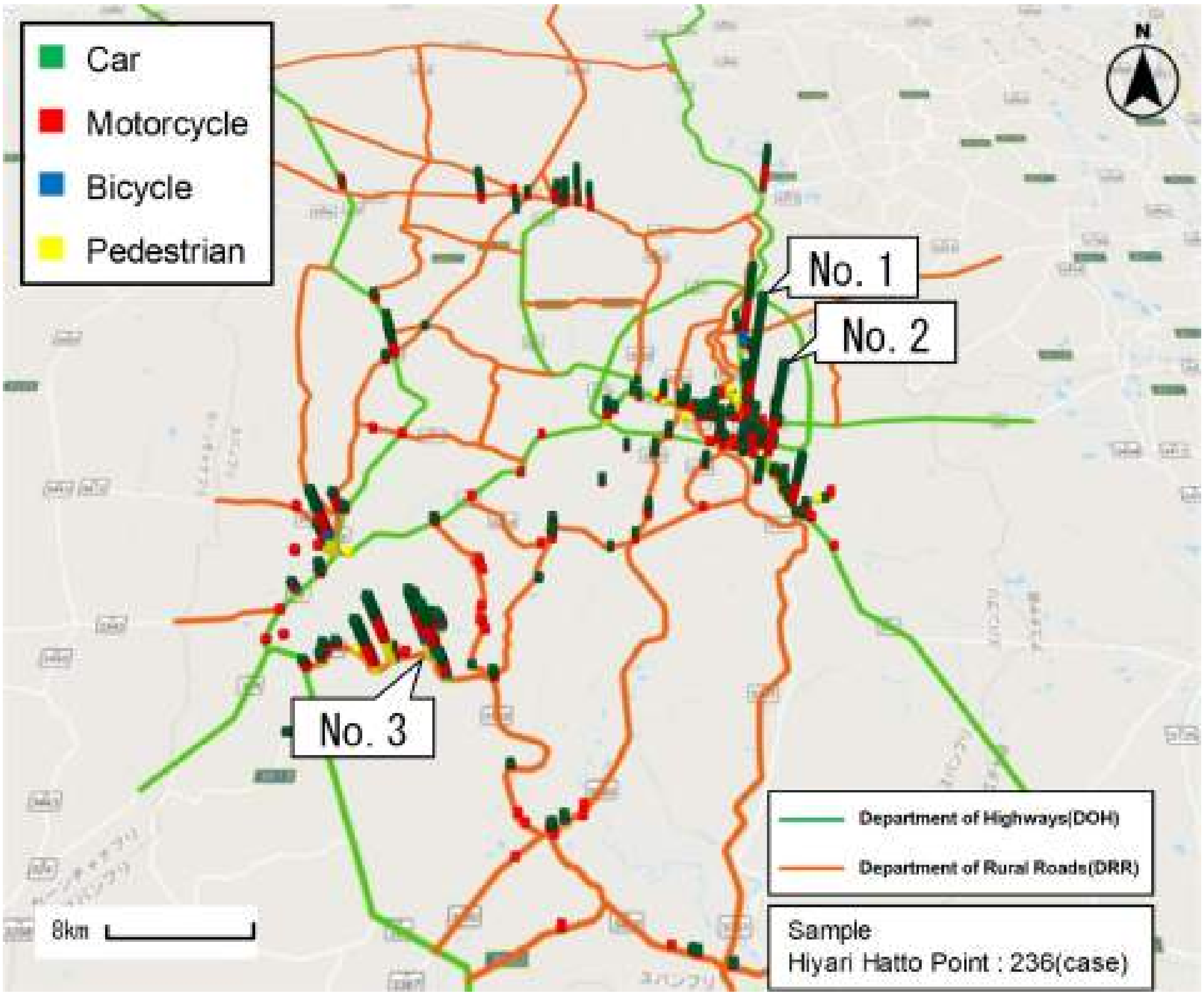



Figure 5-2 Developed HIYARI-HATTO Map in Suphan Buri

Furthermore, by asking the participants to answer their daily travel routes in a questionnaire and overlaying them on this map, it is possible to determine the relationship between points with many HIYARI-HATTO incidents and the movement of people. In particular, it is very useful to understand how HIYARI-HATTO incidents are often caused by reverse running and unreasonable crossing.

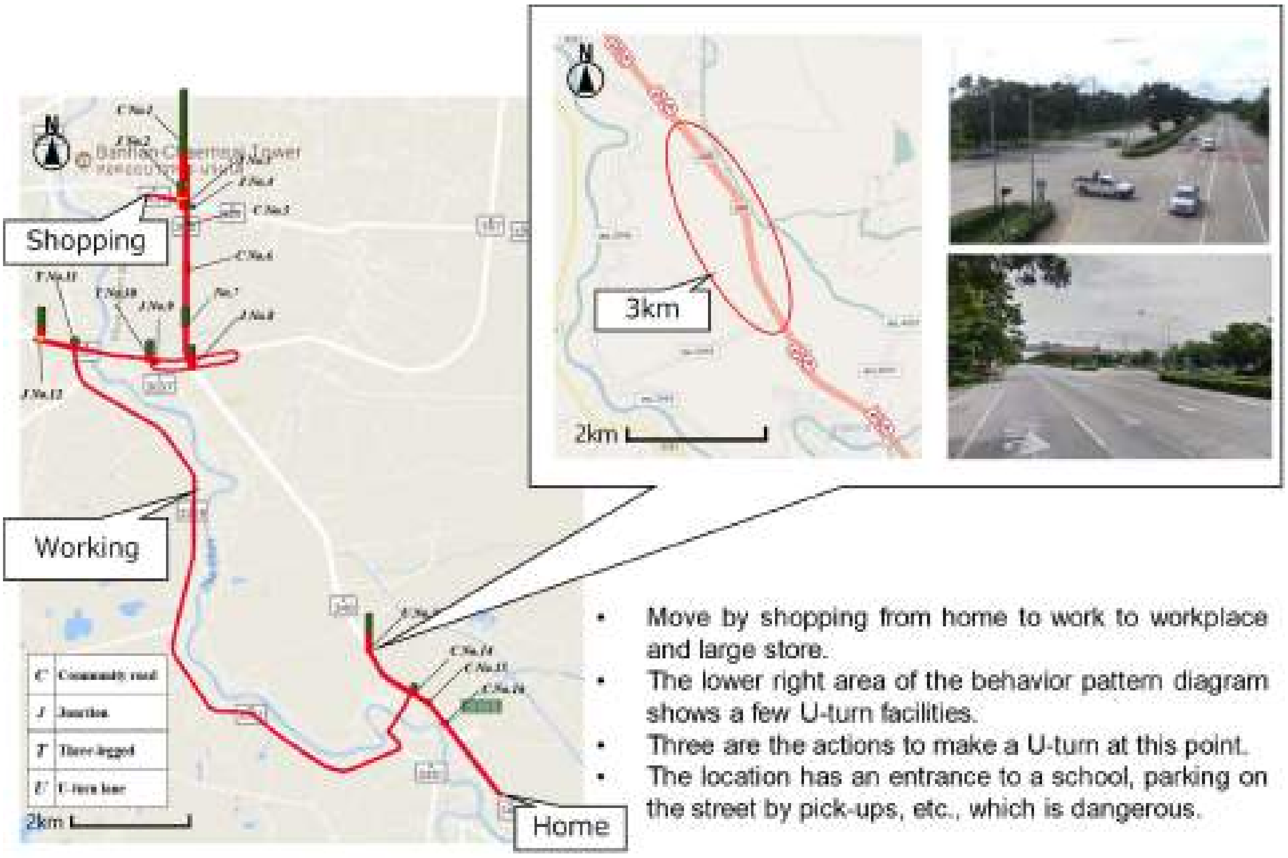



Figure 5-3 Relationship between HIYARI-HATTO location and daily activity

## 5.3 Analysis of types of HIYARI-HATTO experiences

Even though the analysis of the HIYARI map will suggest some reasons for HIYARI-HATTO experiences, it is hard to reveal its causes in detail. Thus, we recommend analyzing each HIYARI-HATTO experience based on the situation drawn in the questionnaire. For this analysis, we first describe the drawing; then, we classify it into the Collision Type Classification Table.

The Collision Type Classification Table was basically developed by OTP, MOT to classify road traffic accidents into particular types. This time, the study team of IATSS and ATRANS revised the table to reflect the actual situation of traffic accidents in Thailand and select appropriate countermeasures. For example, collisions by motorcycles were newly included.

### 5.3.1 Classification using collision diagram

The procedure for classifying HIYARI-HATTO experiences based on a drawing of the situation by using the Collision Type Classification Table is explained.

Step 1: Rewrite the completed questionnaire into a simple illustration.

Step 2: Organize the near-miss experience from simple illustrations. For example, confirm the subject (car, bike, pedestrian) where the near-miss incident occurred and the road characteristics (U-turn lane, three-legged).

Step 3: Using the collision diagram, select the collision No. that matches Step 2. In this example, 202 "Right turn hits through traffic" is selected.

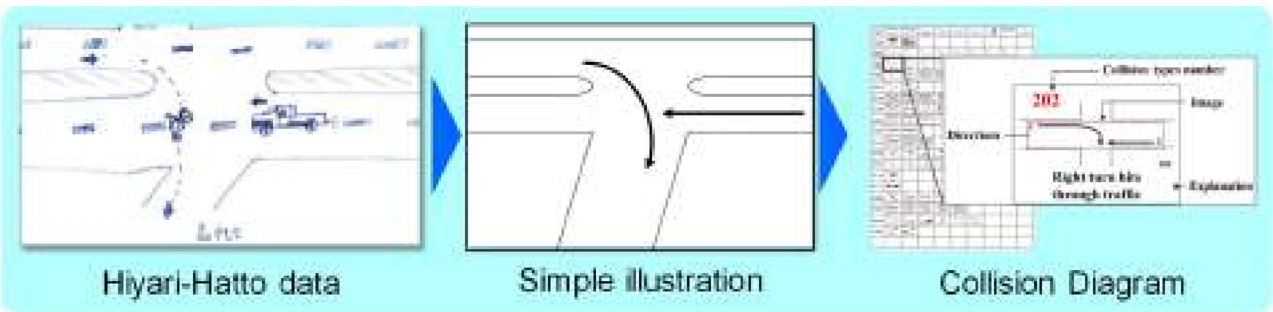



Figure 5-4 Process to identify collision type

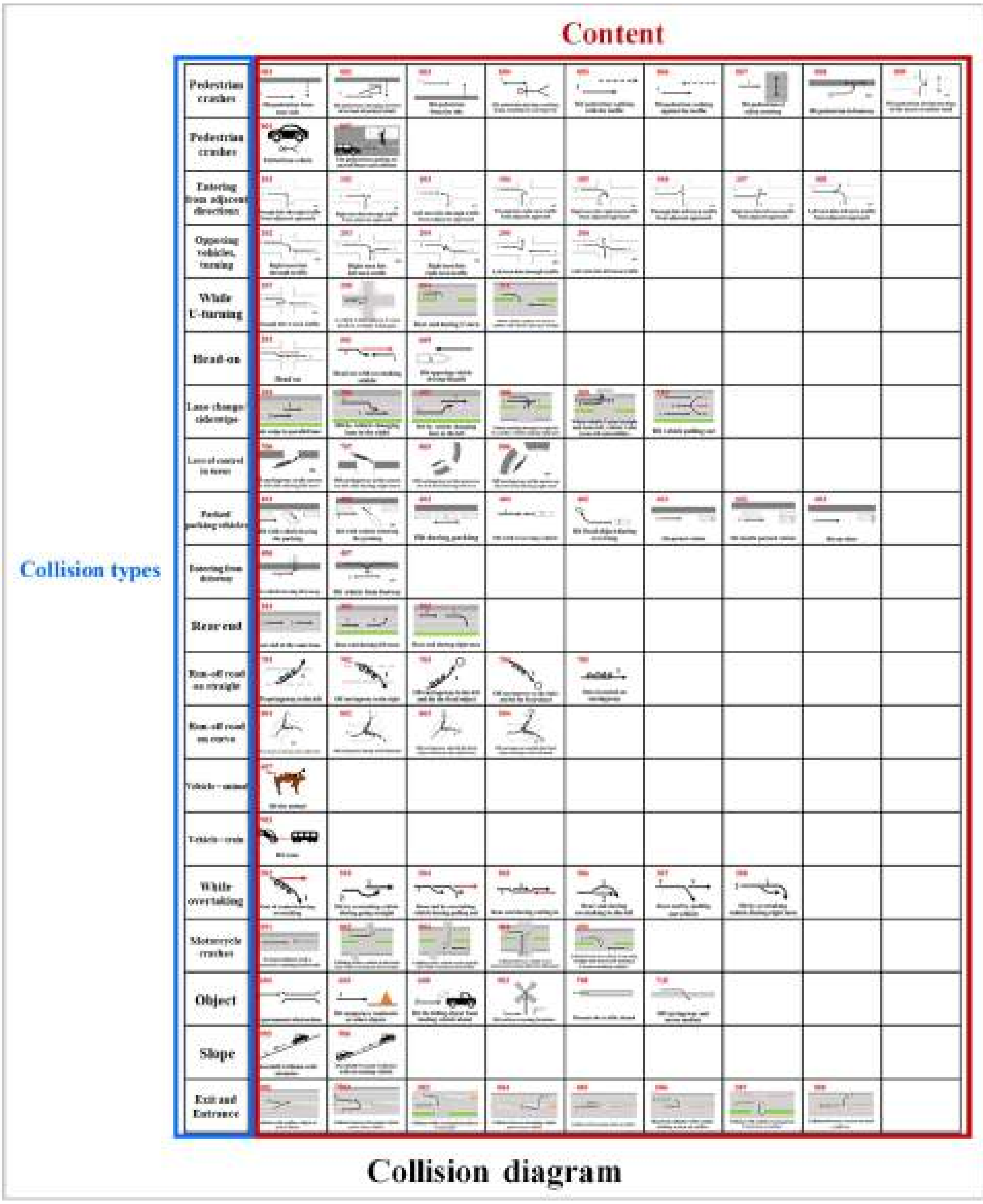



Figure 5-5 Modified collision diagram

# Questionnaire analysis report

## Suphanburi (No.0001-0010)

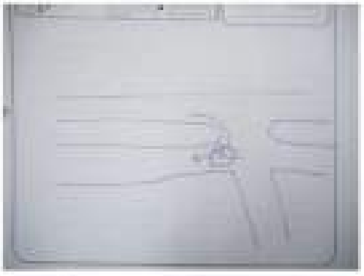
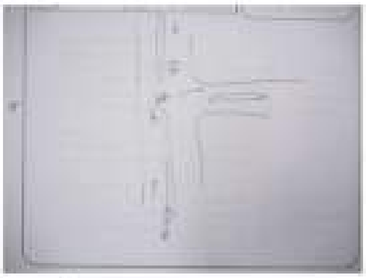
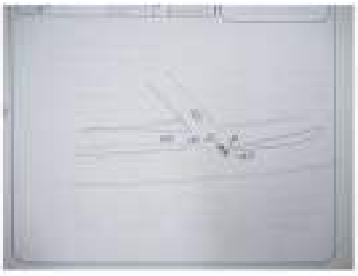
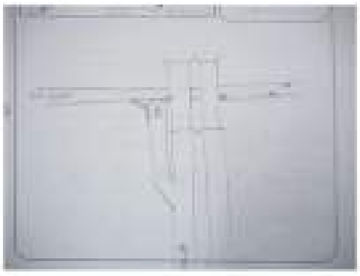
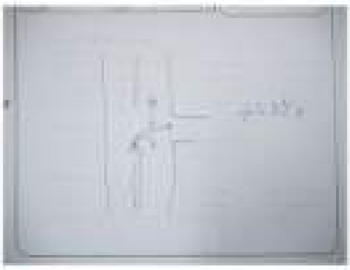
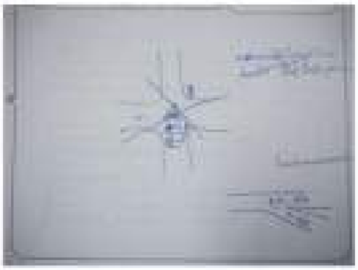
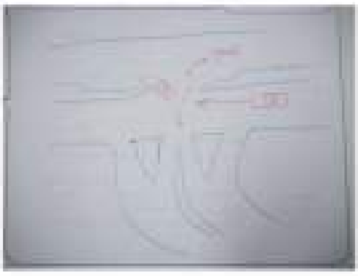
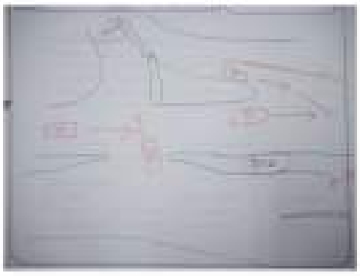
| | | | |
|---|---|---|---|
| Suphanburi<br>0001<br>311 | Road characteristics：Three-legged, U-turn lane<br>Type of accident in question：Rear-end collision<br>Target：Vehicle-on-vehicle | Suphanburi<br>0002<br>202 | Three-legged<br>When turning right<br>Vehicle-on-vehicle |
|  | |  | |
| Suphanburi<br>0003<br>202 / 207 | Three-legged<br>When turning right・Rear-end collision<br>Vehicle-on-vehicle | Suphanburi<br>0004<br>101 | Three-legged<br>When turning right<br>Vehicle-on-vehicle |
|  | |  | |
| Suphanburi<br>0005<br>202 / 207 | Three-legged<br>When turning right・Rear-end collision<br>Vehicle-on-vehicle | Suphanburi<br>0006<br>306 | Junction<br>Rear-end collision<br>Vehicle-on-vehicle |
|  | |  | |
| Suphanburi<br>0007<br>202 | Three-legged<br>When turning right<br>Vehicle-on-vehicle | Suphanburi<br>0008<br>202 / 306 | Three-legged, Junction<br>When turning right・Rear-end collision<br>Vehicle-on-vehicle |
|  | |  | |

Figure 5-6 Summary of collision types

### 5.3.2 Understanding the characteristics of HIYARI-HATTO experiences in Suphan Buri

Figure 5-7 shows the result of totalizing the situation of HIYARI-HATTO incidents drawn by the questionnaire and classified into collision types. The graph shows the percentage by number of HIYARI-HATTO incidents categorized by type on the outside and the percentage by number of incidents classified by traffic accident type on the inside. First, the most common type of traffic accidents was that of accidents caused by vehicles coming from the opposite direction when entering the intersection. Next, many HIYARI were caused by the car coming from the opposite direction when entering the intersection, at the U-turn lane, and during the lane change.

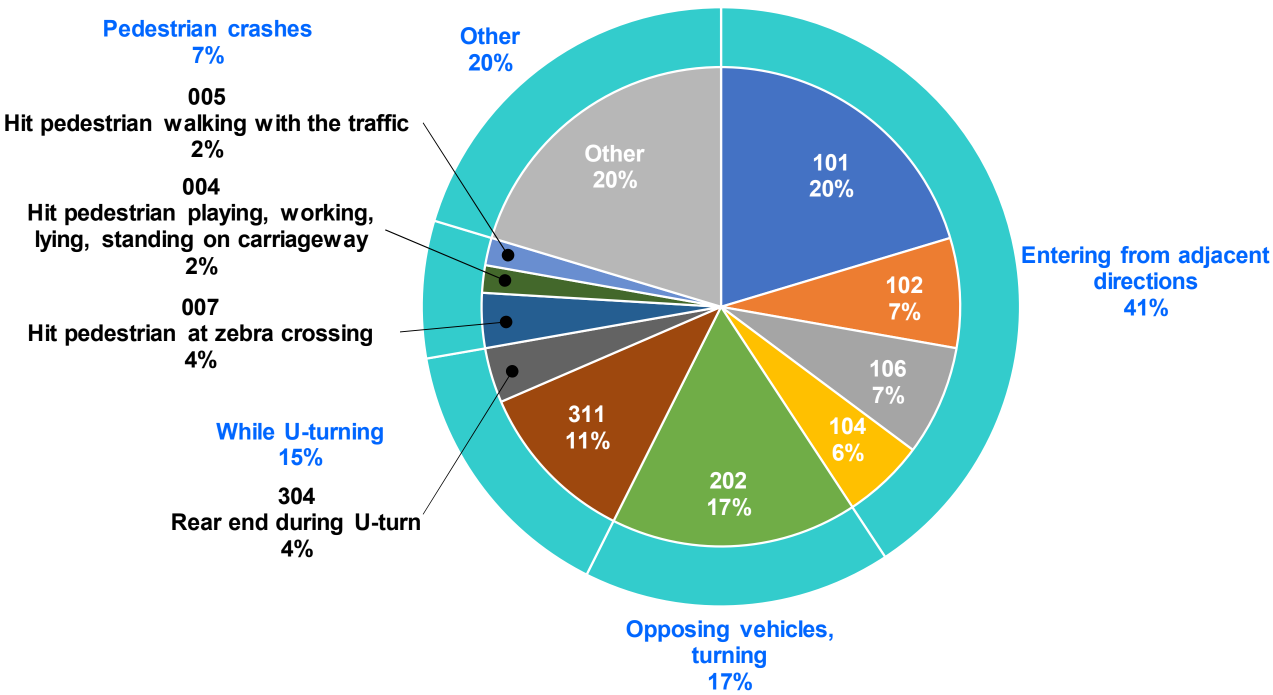



Figure 5-7 Result of questionnaire survey

### 5.3.3 Selection of points where measures must be taken by overlapping data

By superimposing, on a single map, the point of the HIYARI-HATTO experience and the form with high potential danger obtained from the contents pointed out by the HIYARI-HATTO, it is possible to efficiently select the point that requires measures.

Further, by adding information such as the measures currently being taken and the road administrator, the problem location can be identified as more diversified. Figure 5-8 is an example showing a U-turn case.

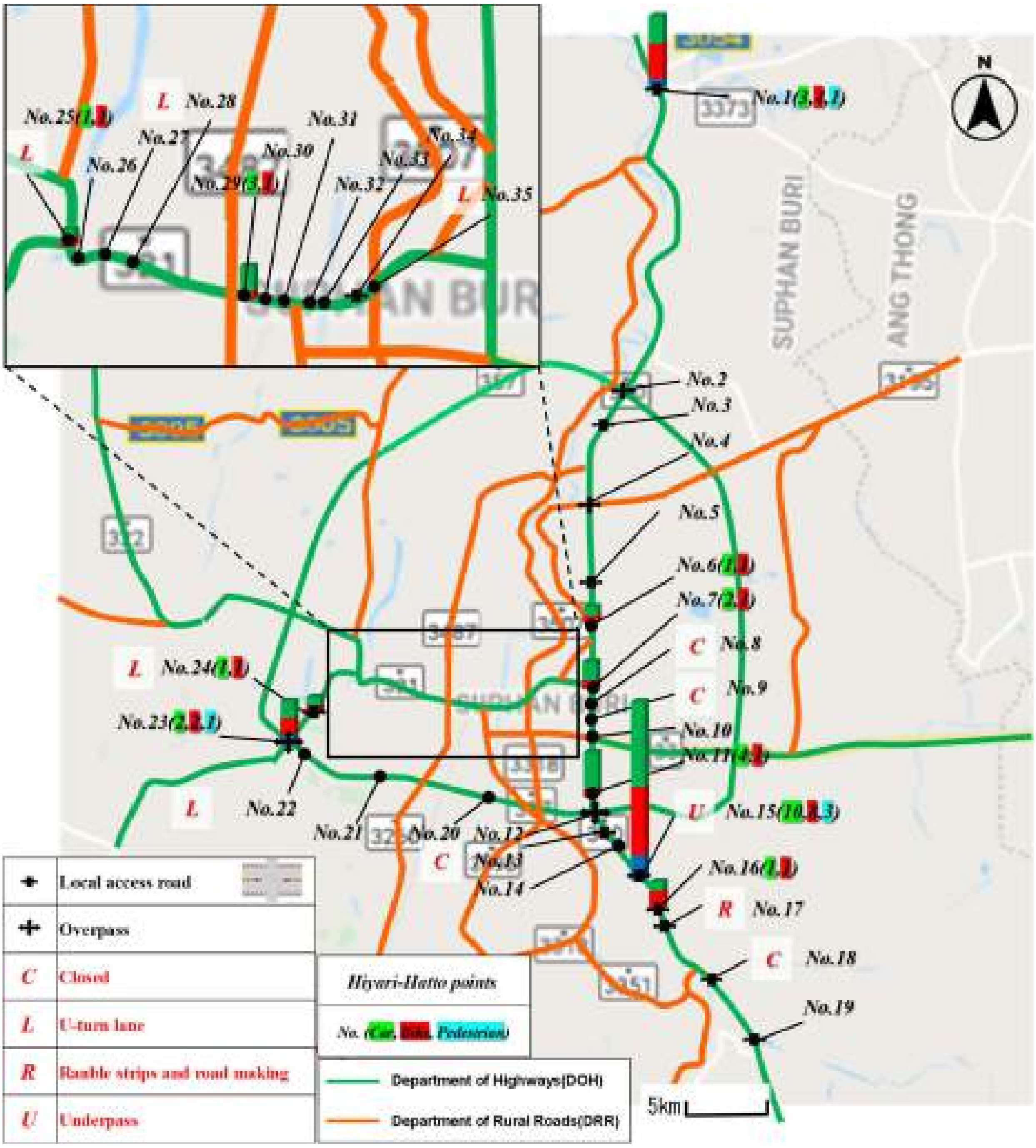



Figure 5-8 Map with the analyzed data superimposed

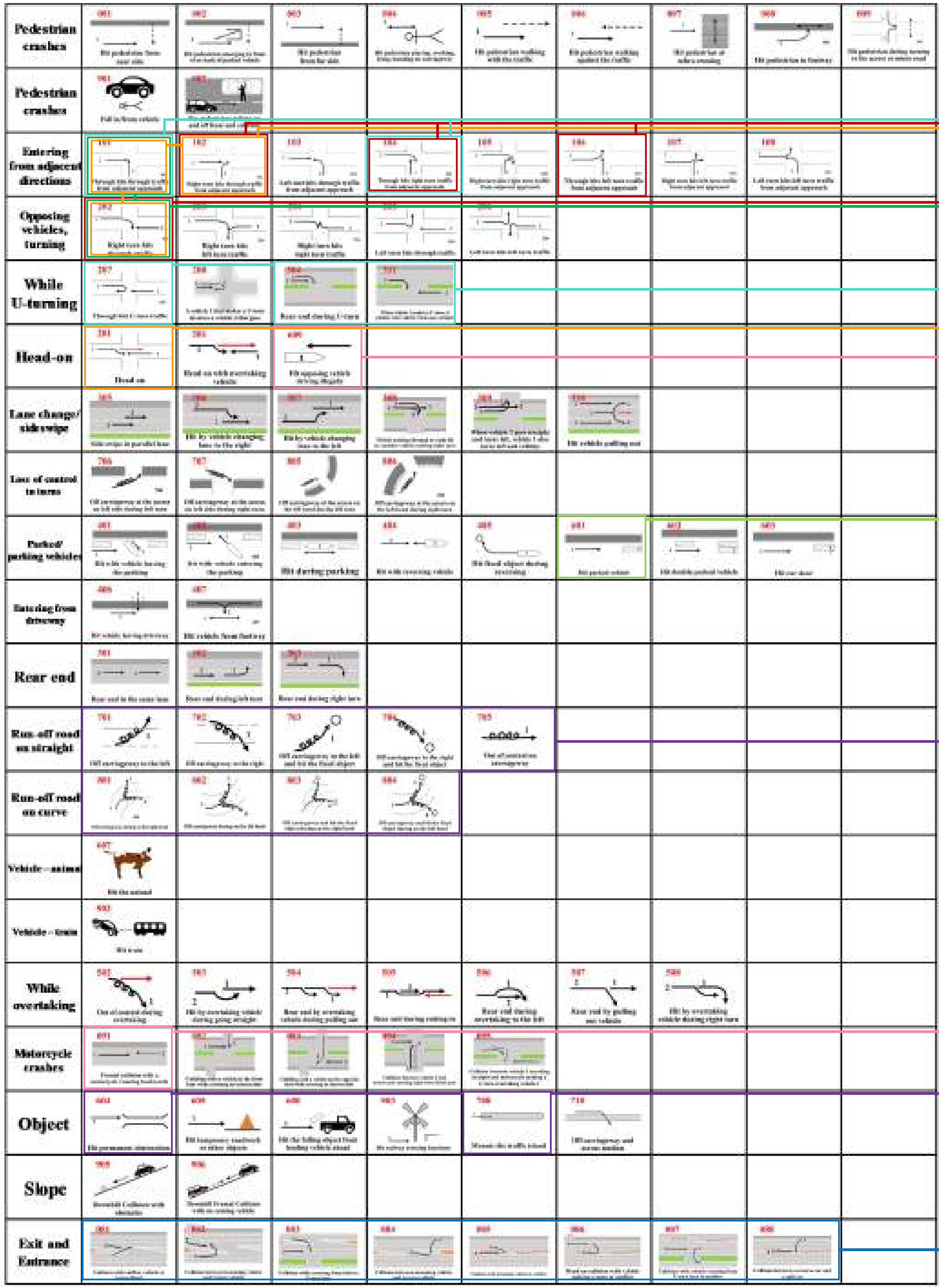
## 5.4 Selection appropriate countermeasures

After identifying the points at high risk of traffic accidents and their causes, it is necessary to select measures to address the causes and reduce the risk of traffic accidents.

Countermeasures range from early measures such as the installation of road signs and road markings to large and costly measures such as improving road structures, installing traffic lights, and installing under/overpasses.

Therefore, the kind of countermeasures to be implemented are those that can be expected while considering the size of the risk and the traffic conditions in the budget constraints. As shown in the next page, in the traffic accident type classification table described above, when the type of the traffic accident risk is selected, a typical countermeasure plan corresponding thereto can be adopted. The specific contents of typical measures are explained in detail in the next chapter. Please note that each measure is not necessarily implemented alone but is a combination of various measures.

Furthermore, more comprehensive and regional countermeasures can be considered. Although some of them are explained in the next chapter, they are not tied to a specific accident type.




◎High priority
○Priority

| | Installment of Traffic Signe/Road Painting | Lane Control | Lane/Access Road Closing | Construction of Under-pass/Over-pass | Improvement of Alignment/Cross Section | Installment of Traffic Signal |
|---|---|---|---|---|---|---|
| **6.1 U Turn Section on Typical Rural Highway with No-access Control** | | | | | | |
| (A) | ◎ | | | | | |
| (B) | ○ | ◎ | | | | |
| (C) | | | ○ | ○ | | |
| (D) | | | | ◎ | | |
| (E) | | ◎ | | | ○ | |
| **6.2 Junction between a highway and a frontage road** | | | | | | |
| (A) | | ◎ | | | | |
| (B) | | ◎ | ○ | | | |
| (C) | | | | ◎ | | |
| **6.3 Illegal median crossing on Typical Highway** | | | | | | |
| (A)(B) | | | | ◎ | ○ | |
| **6.4 Entrance from Roadside Facilities to Highway** | | | | | | |
| (A)(B) | ○ | | | | ◎ | |
| **6.5.1 T Intersection at Curved Section with Local Road** | | | | | | |
| (A) | | | | | ◎ | |
| (B)(C) | ◎ | | | | | |
| (D) | ○ | | ○ | | ◎ | |
| **6.5.2 Three Legs Intersection (Y-Shaped)** | | | | | | |
| (A) | | | | | ○ | |
| (B) | ◎ | | | | ○ | |
| (C) | ○ | | | | ○ | ◎ |
| **6.6 Four Legs Intersection** | | | | | | |
| (A) | ◎ | | | | | |
| (B) | ◎ | | | | ○ | |
| (C) | | | | | ◎ | |
| **6.7, 6.8, 6.9 Measures for the entire route** | | | | | | |

Highway

Local Road

# 6. Proposals of Countermeasures at Typical Black Spots

Once potential hazardous locations are selected and course of risk is analyzed, then appropriate countermeasures could be identified by the methods explained in Chapter 5.
In this section, typical measures are described to improve for each identified road accident risk factor.

## 6.1 U-turn section on typical rural highway with no-access control

### A: Situation of HIYARI-HATTO occurrence

(a) Since the U-turn is performed in the passing lane on a highway, a rear-end collision occurs due to a car coming from behind at a high speed.
(b) A collision accident with a car coming from the opposite lane during the U-turn also occurs.
(c) When the community road is connected to the U-turn section on a highway, the risk that vehicles entering the community road from the U-turn lane or crossing a highway road using the U-turn will collide with others.
(d) When multiple cars or motorcycles make a U-turn or cross, some may enter the blind spot and cause unexpected collisions.

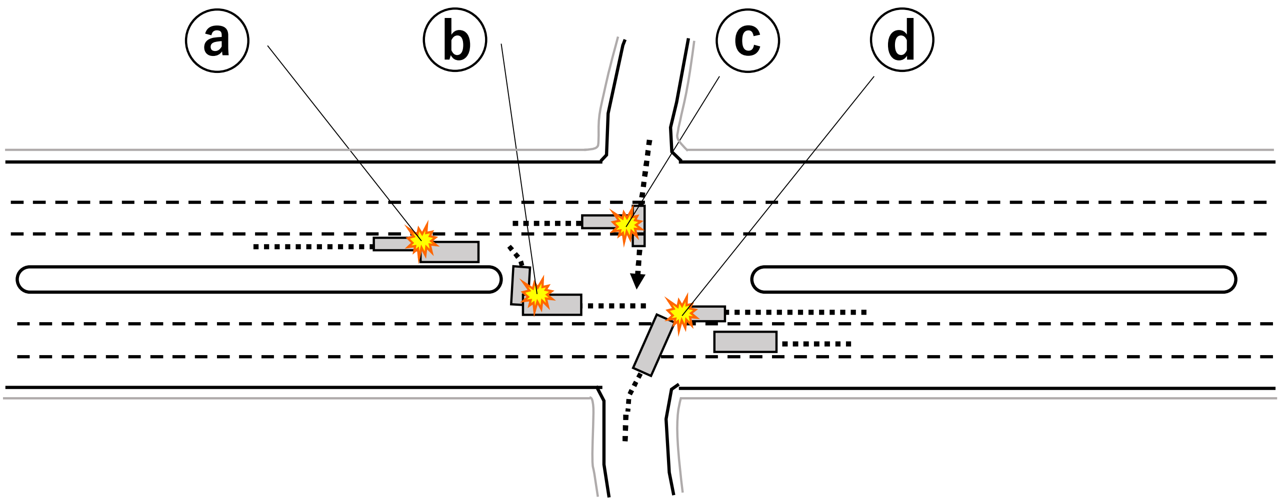



Figure 6-1 Main courses of traffic accidents at U-turn section with local road

## B: Courses and countermeasures

(A) Running speed on a highway is too high; introducing countermeasures to alert visually and/or appeal to the physical experience such as rumble strips road markings.

(B) U-turn section is not visible; setting up U-turn lane and/or making colored pavement.

(C) Local traffic can cross a main highway by using U-turn section; if demand is not high, U-turn should be closed. However, another U-turn sections are required near this place.

(D) No-access control to a main highway; if demand to cross this section is high, underpass or overpass should be provided. Moreover, a frontage road paralleled with a highway should be provided to access to this underpass or overpass easily.

(E) In the case of (C) and (D); instead of a closing U-turn section, a J turn system can be introduced. Only traffic from the main highway can access a local road.

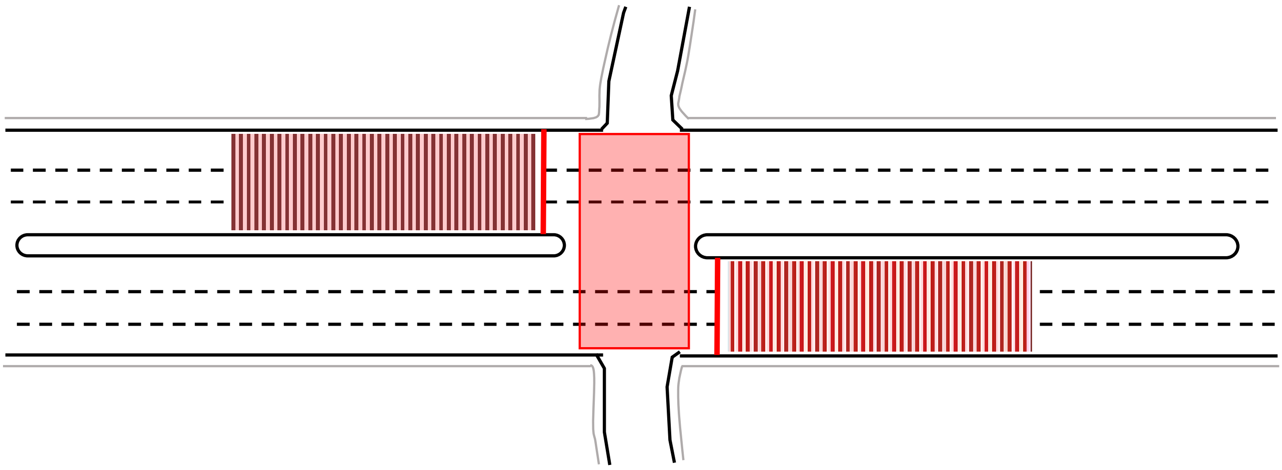


Figure 6-2 (A) Rumble strips and road markings

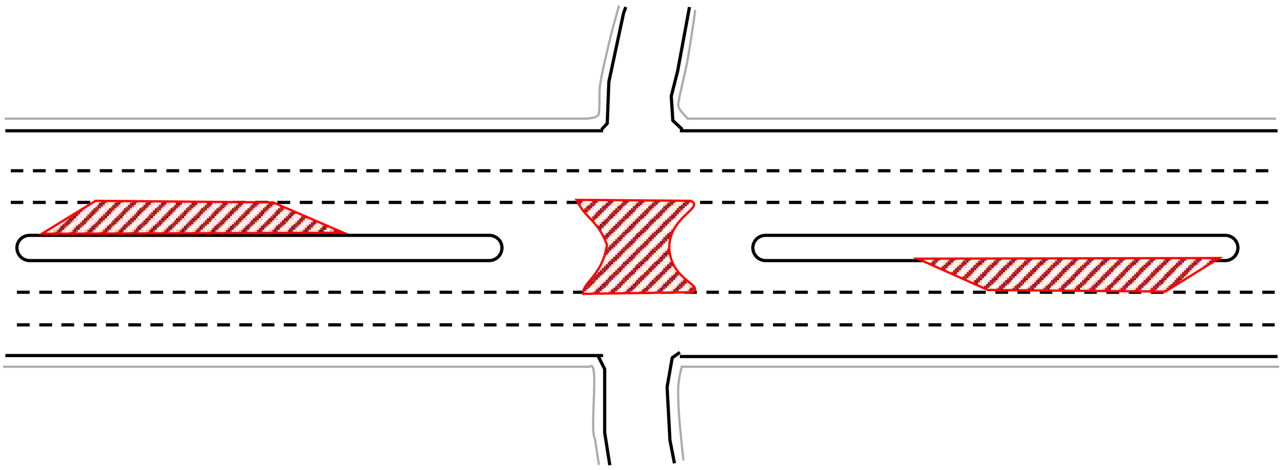


Figure 6-3 (B) Setting up U-turn lane and road marking

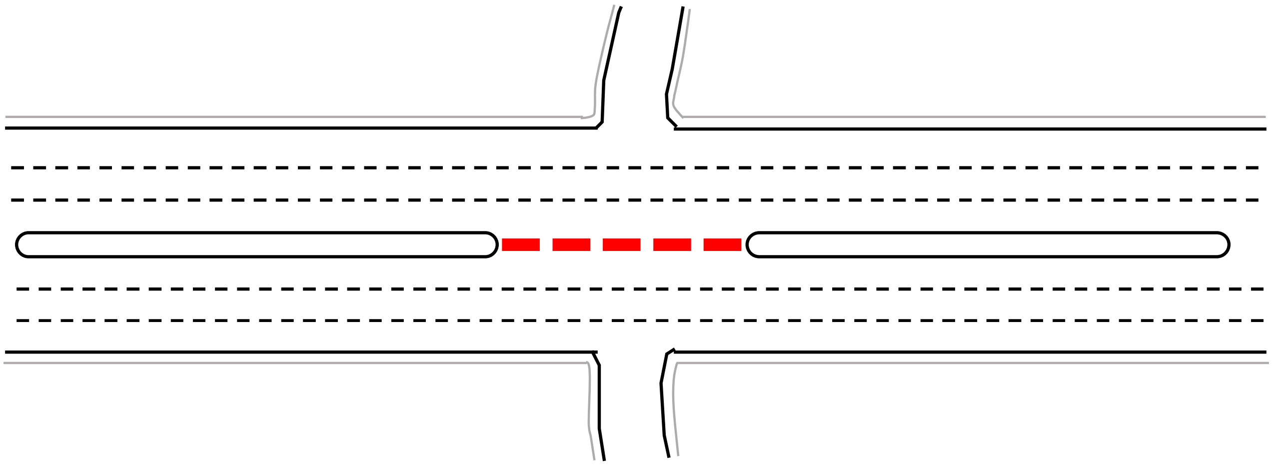


Figure 6-4 (C) Closing U-turn section

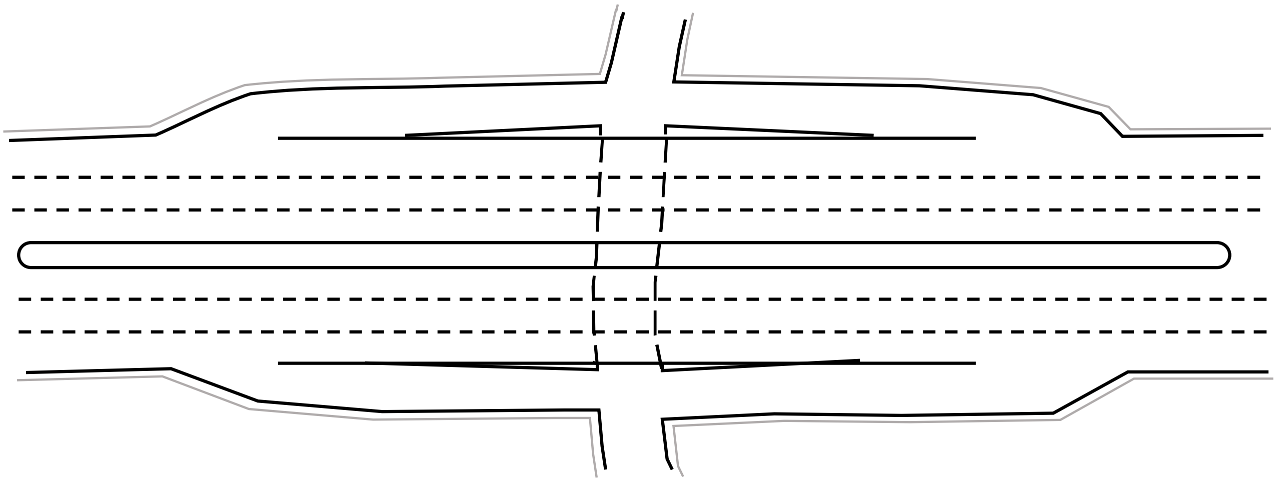


Figure 6-5 (D) Setting up a frontage road paralleled with a highway and closing U-turn section

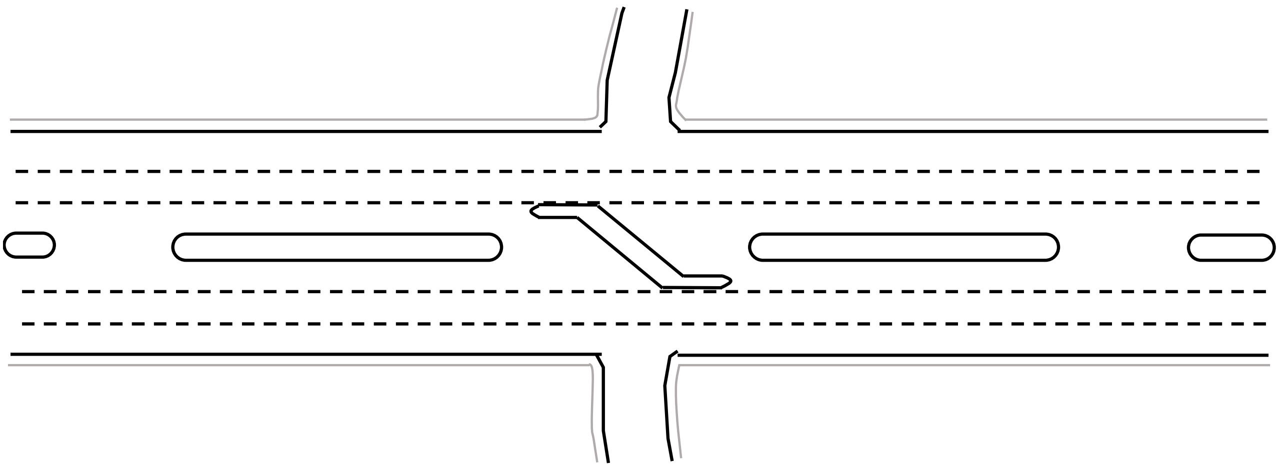


Figure 6-6 (E) Introducing J turn system

## 6.2 Junction between a highway and a frontage road

### A: Situation of HIYARI-HATTO occurrence

(a) Making a U-turn from the highway to the frontage road on the opposite side illegally, collision with a vehicle in the opposite lane on the highway occurs.
(b) Making a U-turn from the frontage road to the opposite highway illegally, collision with a vehicle on the highway occurs.
(c) The decision to get off the highway to the side road is delayed and collides with the separator.

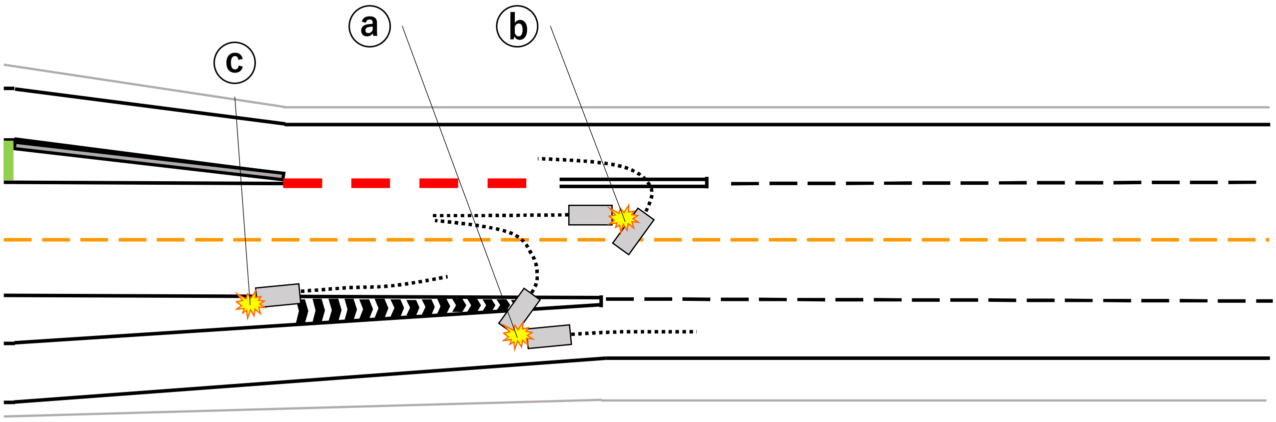



Figure 6-7 Main courses of traffic accidents at the junction on the highway

### B: Courses and countermeasures

(A) The vehicles on the highway cannot expect the car to make a U-turn at the junction illegally and collision can happen; installing a Pole Cone on the median of the highway and suppressing a U-turn.
(B) Under the above situation; installing the median strip on the highway and suppressing a U-turn.
(C) Under the above situation; constructing U-turn bridge near the junction and avoiding a U-turn on the highway.
(D) Due to incorrect judgment, a driver delays the operation and collides with the separator; installing the cushion drum in front of the separator to reduce the impact of a collision.

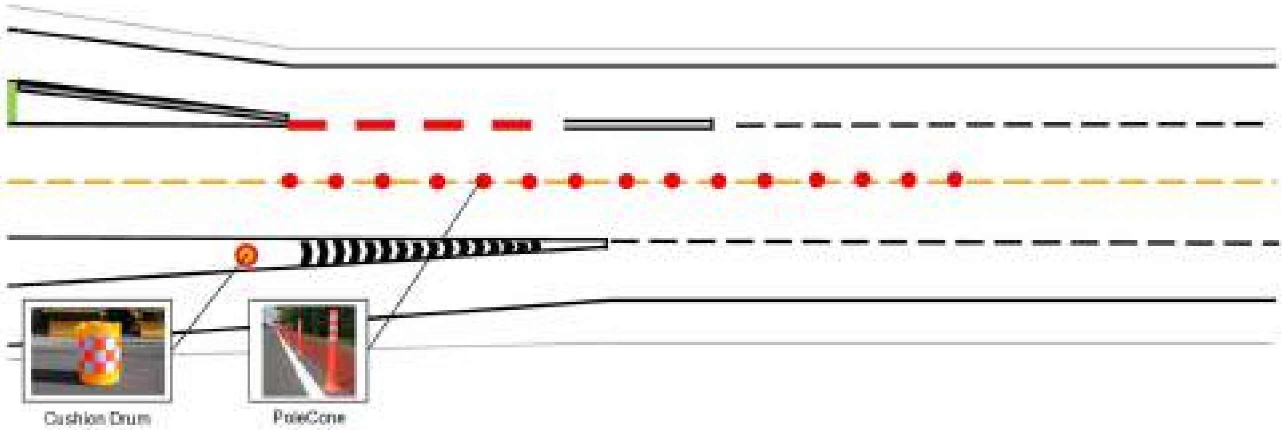



Figure6-8 (A) Installing the Pole Cone on median and (D) the cushion drum to the separator

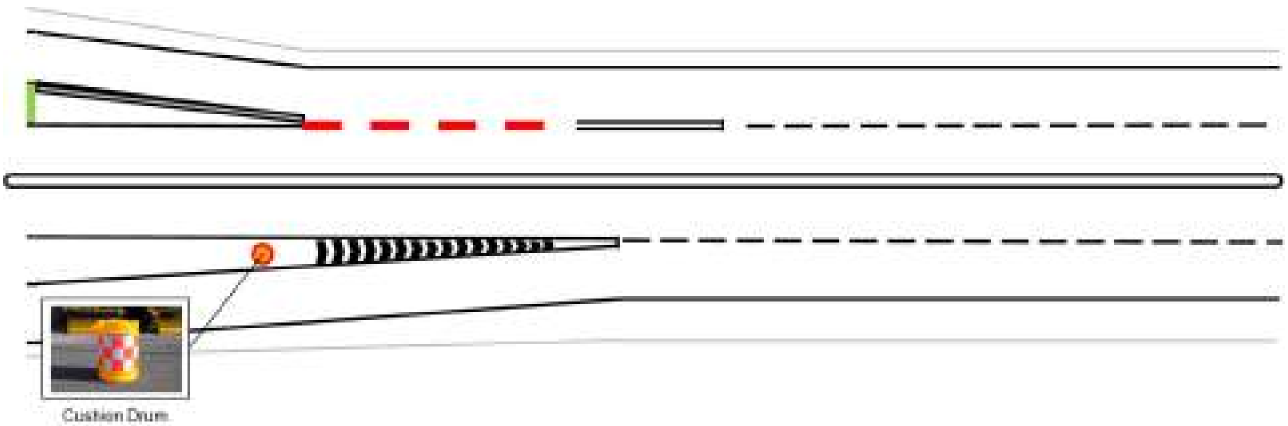



Figure 6-9 (B) Installing the median strip

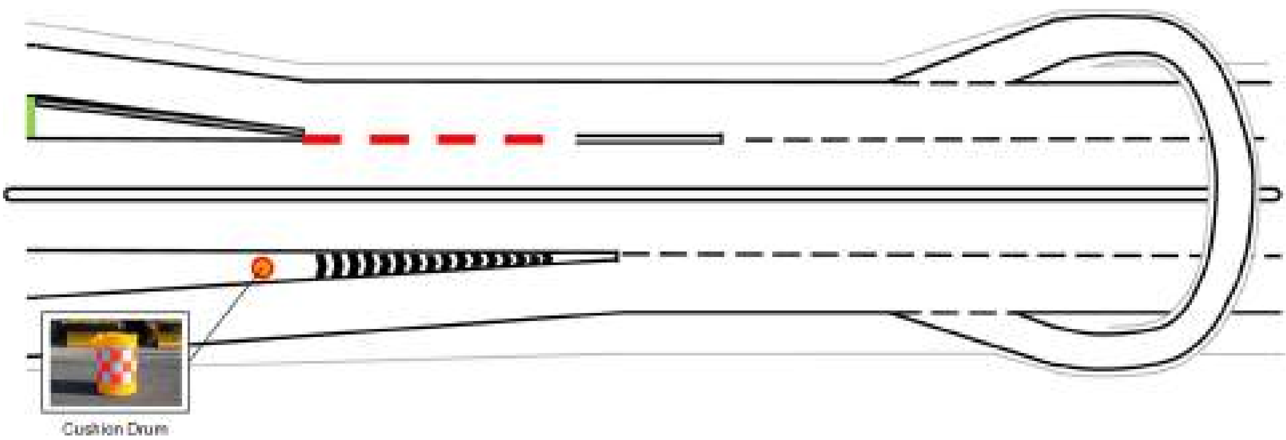



Figure 6-10 (C) Installing U-turn bridge

## 6.3 Illegal median crossing on typical highway

### A: Situation of HIYARI-HATTO occurrence

(a) A collision occurs because the vehicle crosses the median strip of a highway from a connected local road or roadside.

(b) Collision occurs due to a reverse run to access the connected local road from the side of the highway.

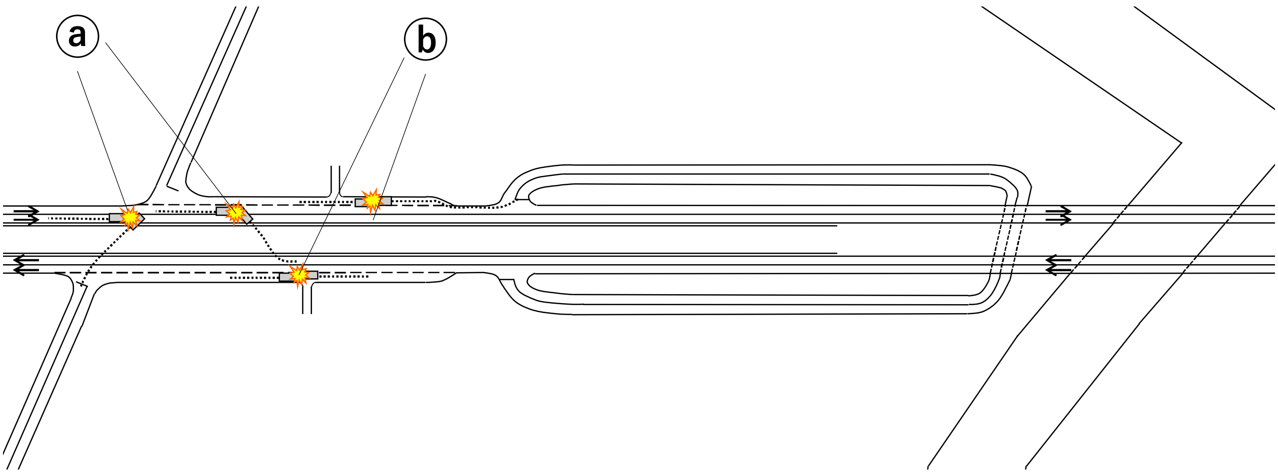



Figure 6-11 Main courses of traffic accident at median opening

### B: Courses and countermeasures

(A) Crossing on the highway ignoring regulations; by extending the parallel road and connecting to the underpass U-turn section, it is not necessary to cross the expressway and reduce risk.

(B) A reverse run ignores the regulations; by allowing traffic in both directions on the extended parallel road, it is possible to access both directions from the roadside, eliminating the need for a reverse run.

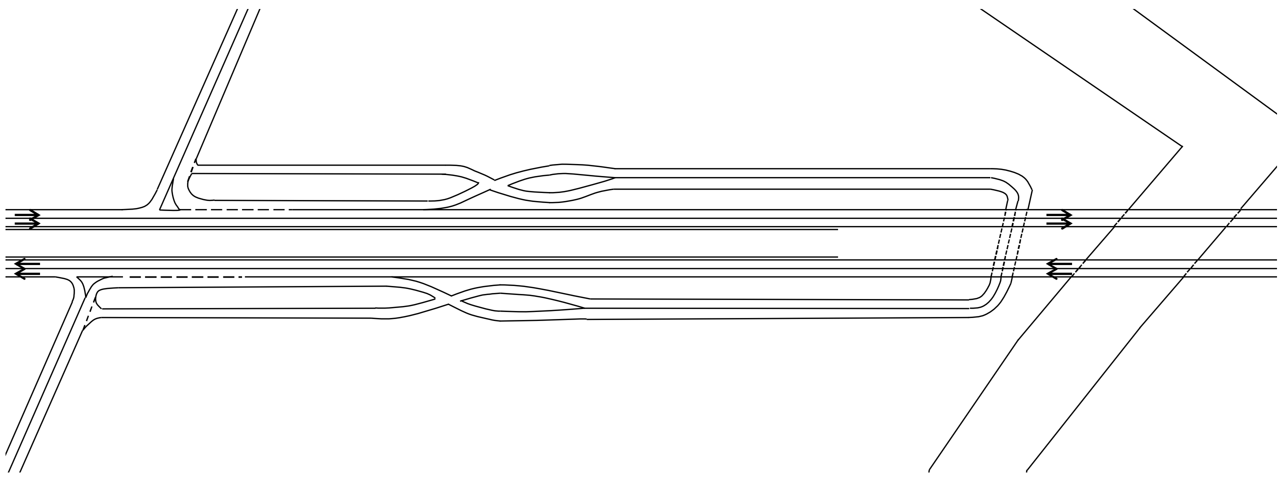


Figure 6-12 (A)(B) Extension of parallel road connected with underpass U-turn

## 6.4 Entrance from roadside facilities to highway

### A: Situation of HIYARI-HATTO occurrence

(a) If the entrance and exit from the roadside facilities are directly connected to the highway, and the car entering must stop once on the highway, there is a high risk that cars and motorcycles coming from behind will collide.

(b) In addition, if the shoulder of the highway is not wide enough, the risk of collision is high.

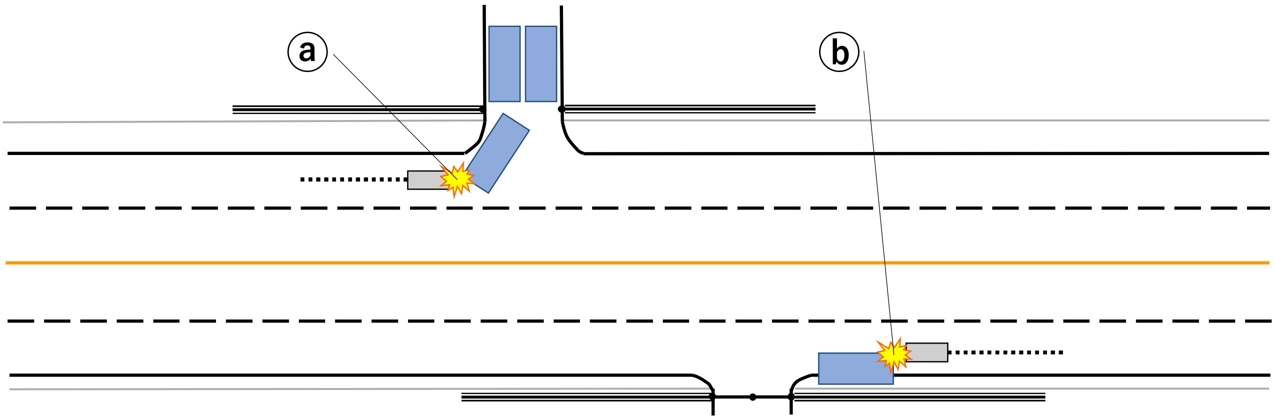



Figure 6-13 Traffic accident at the highway entrance and exit from the roadside facilities

### B: Courses and countermeasures

(A) Since the entrance of the roadside facility is in direct contact with the highway, no place is available for the car to stop once when entering, which may cause a rear-end collision of the following car. Therefore, enough space should be provided to ensure that this is possible.

(B) Because the entrance of the roadside facility is not visible from the car running on the highway, the driver of the following car cannot predict risk, and a collision occurs. Therefore, road markings and road signs are installed or improved so that the entrance of the roadside facility can be visually recognized.

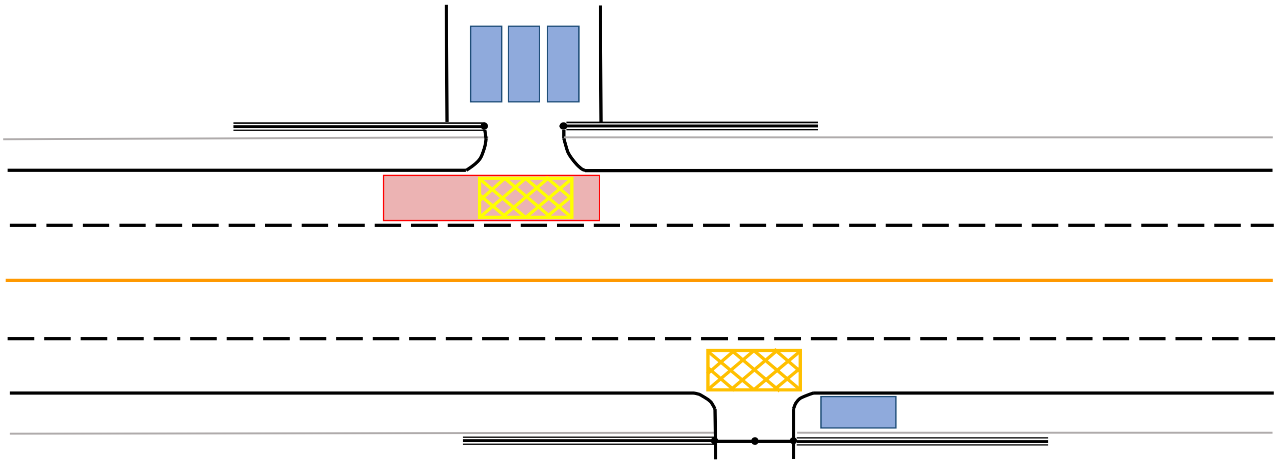


Figure 6-14 (A)(B) Enough space and road markings and road signs

## 6.5 Three legs intersection

### 6.5.1 T Intersection at curved section with local road

### A: Situation of HIYARI-HATTO occurrence

(a) With the cant for the curve section of the main road, visibility of the main road from the local road accessed is poor, and a collision with a car from the main road occurs.

(b) In addition, a collision occurs when the car speed on the main road is high due to the cant of the curve section, and the driver does not notice the oncoming car turning right.

(c) Poor visibility in a curved section may cause a rear-end collision with a car coming from behind.

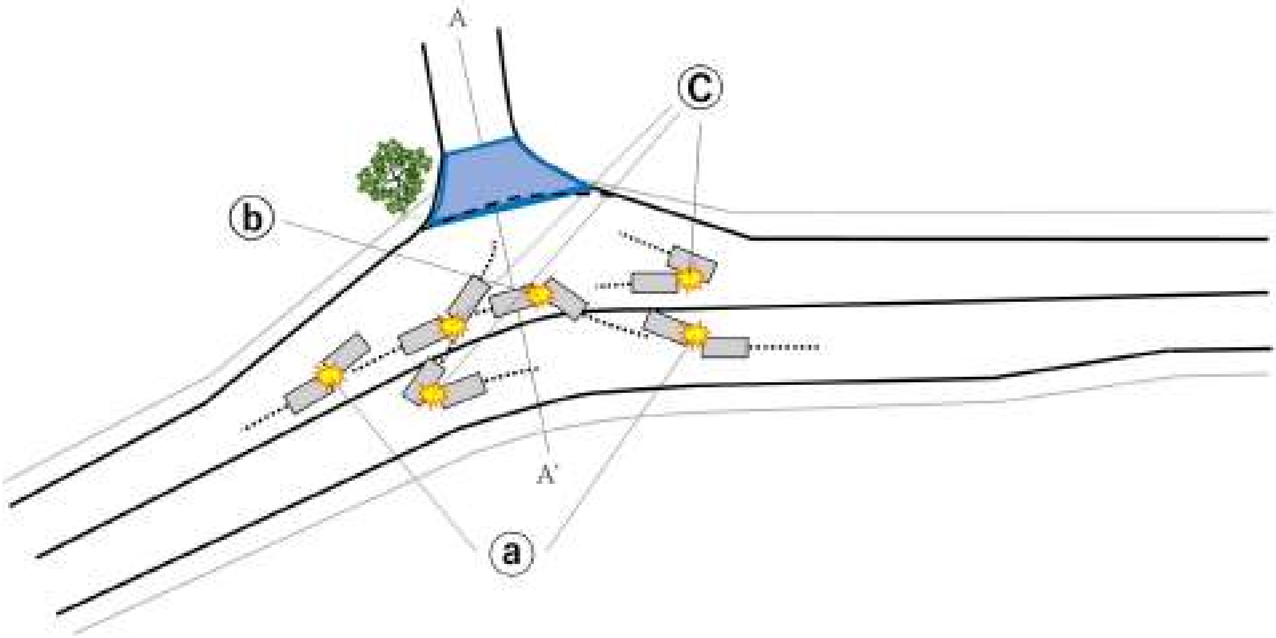



Figure 6-15 Main courses of traffic accidents at the hazardous location


Figure 6-16 Cross section of curve section (existing condition) invisible

## B: Courses and countermeasures

(A) Because there is a cant in the curve section, the outside of the main road becomes higher, and the connecting local road becomes a slope; improving the cross section by filling the road so that the local road connecting to the main road is horizontal, and securing visibility.

(B) The speed of the passing car increases because there is a cant in the curve section; by setting the rumble strip before entering the curve section, the speed of the car can be suppressed sufficiently.

(C) The connecting local road is not visible from the main road; a colored pavement is installed to ensure visibility by informing the driver that there is a local road to connect.

(D) It is dangerous that a local road is connected to the curve section; the connection position of the local road from the curve section must be shifted to ensure safety.

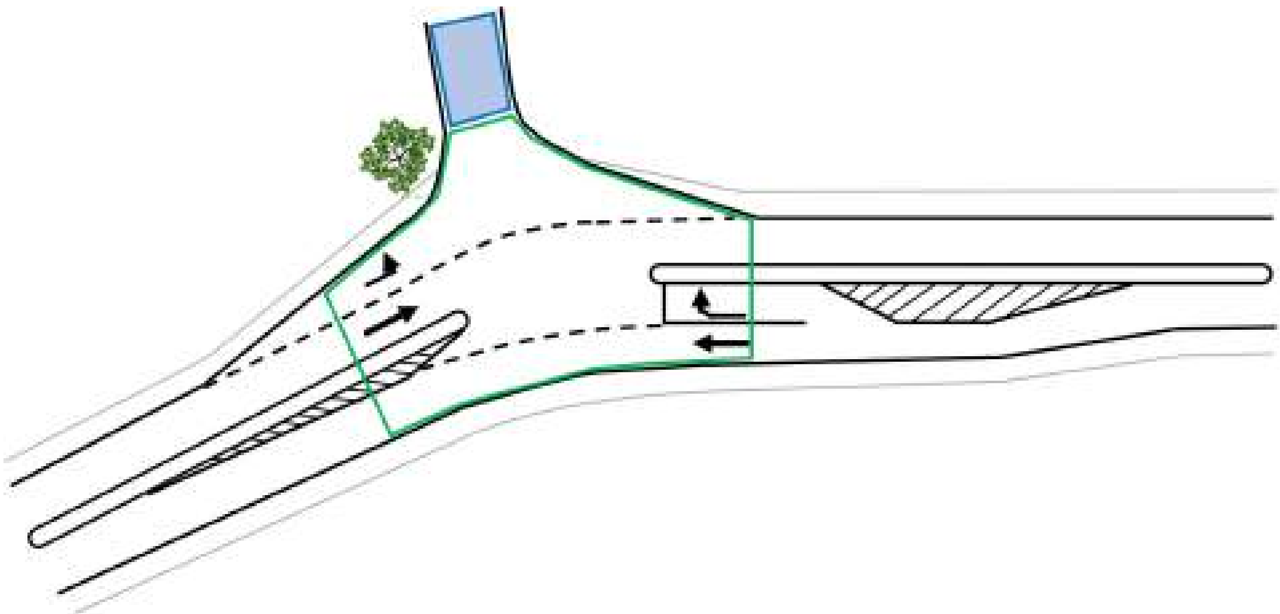


Figure 6-17 (A) Improvement of cross section

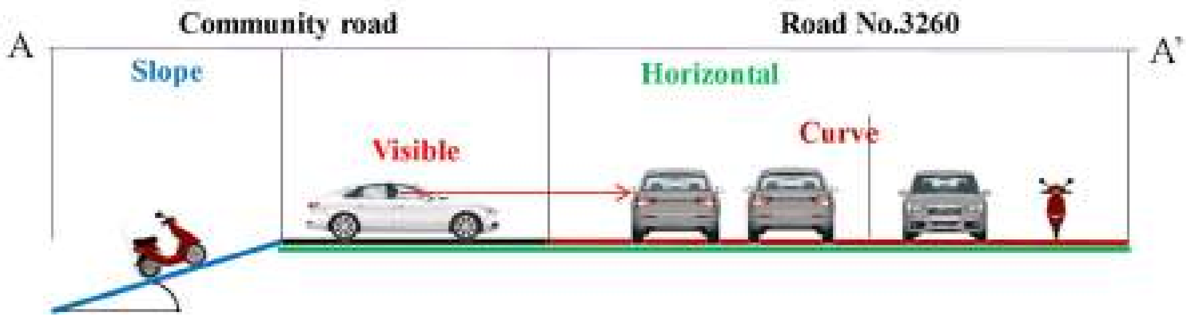



Figure 6-18 (A) Proposed cross section

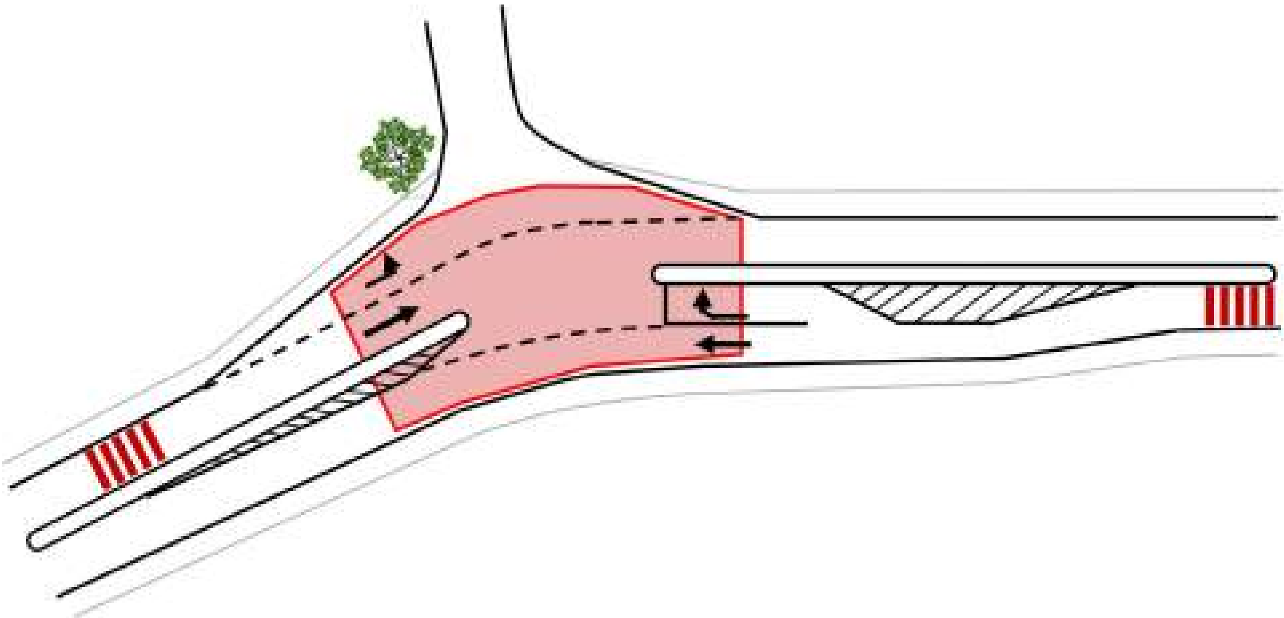


Figure 6-19 (B) (C) Ramble strip and colored paint

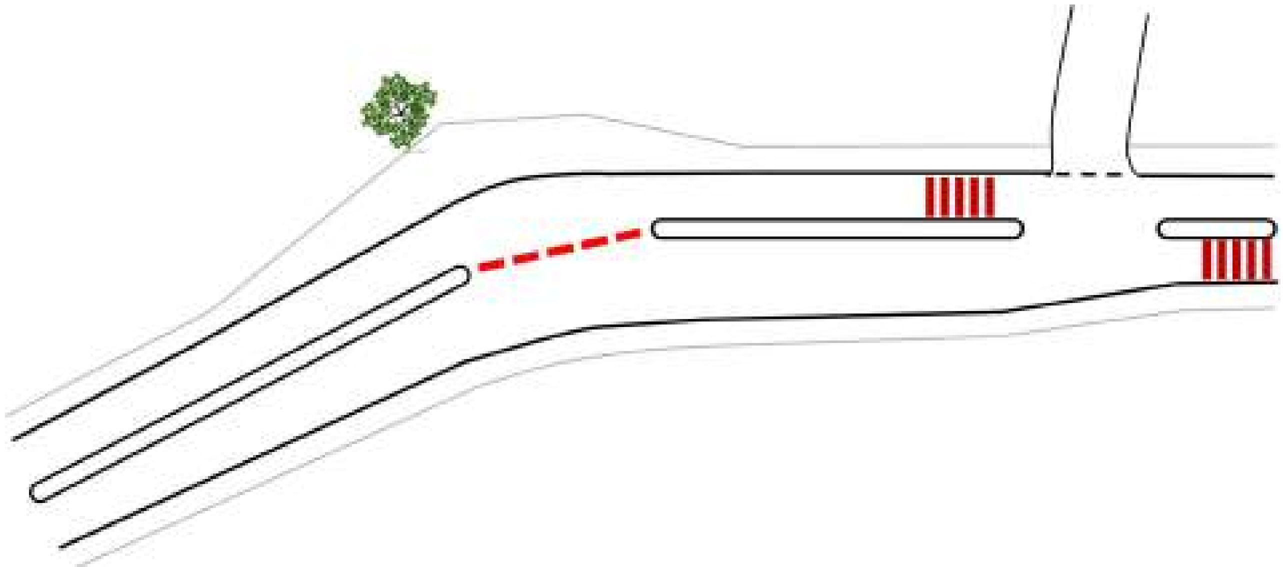


Figure 6-20 (D) Shifting the connection position of the local road

### 6.5.2 Three legs intersection (Y-shaped)

### A: Situation of HIYARI-HATTO occurrence

(a) At the y-shaped intersection, visibility is poor when looking in direction 3 from direction 2, and a head-on collision occurs with a car coming from direction 3.

(b) In addition, because the visibility of the intersection is poor, a collision may occur without noticing the right-turning vehicle facing from direction 3.

(c) Due to the large area of the intersection, the driving route is undetermined, and vehicles coming from direction 2 or direction 3 cannot predict each other's trajectory and may collide head-on.

(d) The car in front tries to make a right turn, but the car behind misunderstands that the car in front is going to slow down, then overtakes, and collision occurs.

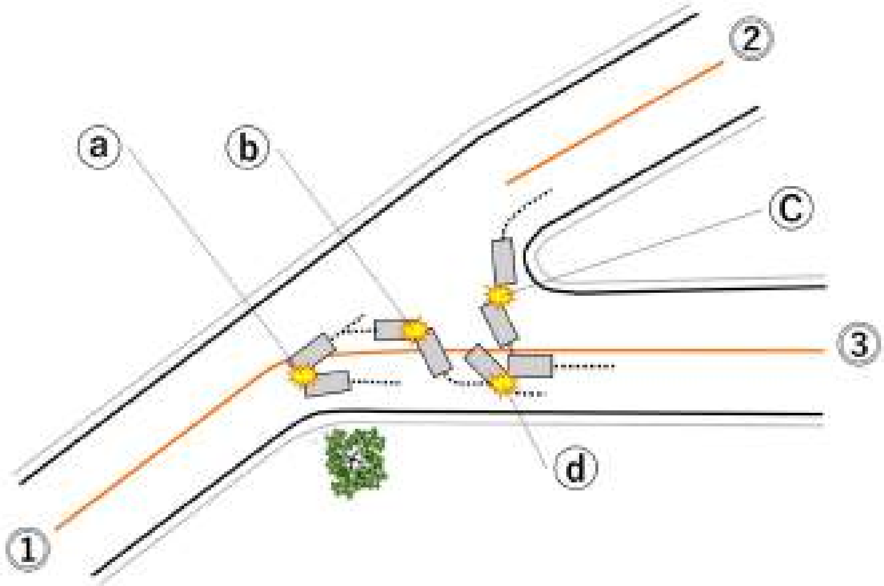



Figure 6-21 Main courses of traffic accidents at the hazardous location

## B: Courses and countermeasures

(A) At a Y-shaped intersection, where a local road intersects at a shallow angle, the main direction is unclear; draw a sideline and use zebras or other road markings to make the intersection into a T-shaped one and clarify the direction of the main direction.

(B) It is difficult to recognize that there is an intersection, and the speed does not decrease; make the intersection into a T-shaped one, then the intersection part into a color pavement, and draw a mark indicating the center of the intersection so that it can be identified as such. Further, by installing a rumble strip on the road at the entrance of the intersection, the speed will be reduced before entering.

(C) If traffic volume is high, it is necessary to install a traffic light.

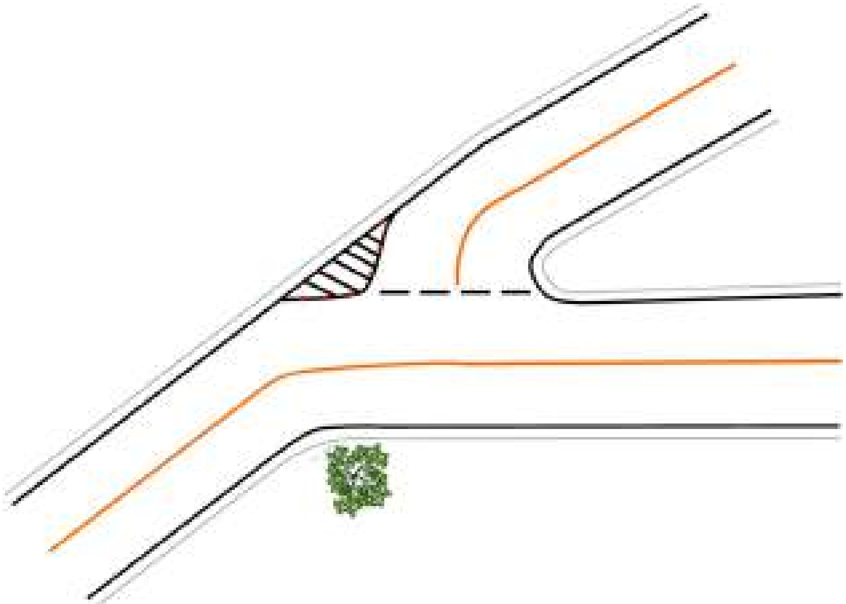


Figure 6-22 (A) Draw a sideline and zebras

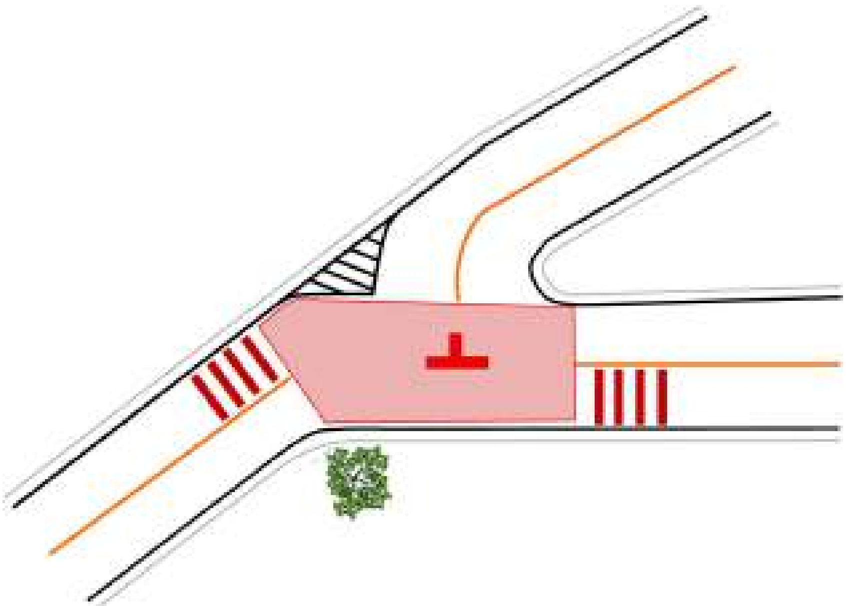


Figure 6-23 (B) T-shape with colored pavement, center making, and rumble strip

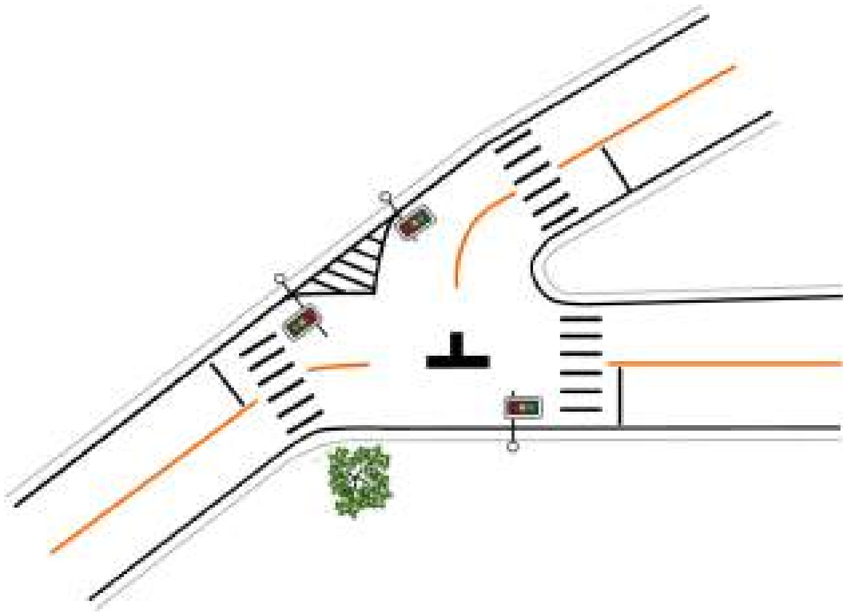


Figure 6-24 (C) Installing a traffic light

## 6.6 Four legs intersection

### A: Situation of HIYARI-HATTO occurrence

(a) Because the visibility from direction 2 is poor, a collision may occur with the car from directions 3 and 4.

(b) Due to the large area of the intersection, the driving route is undetermined, and vehicles coming from direction 2 or direction 4 cannot predict each other's trajectory and may collide head-on.

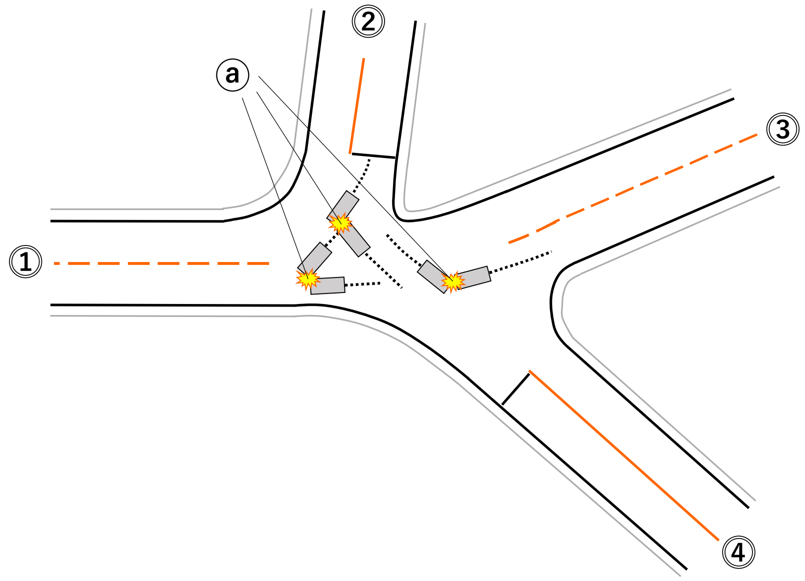



Figure 6-25 Main courses of traffic accidents at the hazardous location

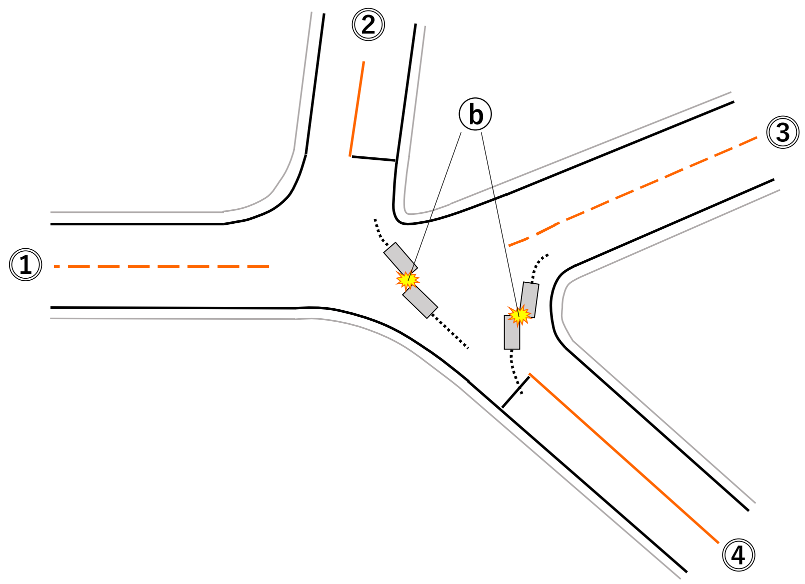



Figure 6-26 Main courses of traffic accidents at the hazardous location

## B: Courses and countermeasures

(A) Due to the large area of the intersection, the driving route is undetermined; Zebra road markings will be installed, the intersection area will be properly sized, and the driving route will be clear.

(B) It is difficult to recognize the intersection; make the intersection into a T-shaped one, then the intersection part into a color pavement, and draw a mark indicating the center of the intersection so that it can be identified as such.

(C) In the case above, changing road alignment so that each road intersects at right angles as much as possible.

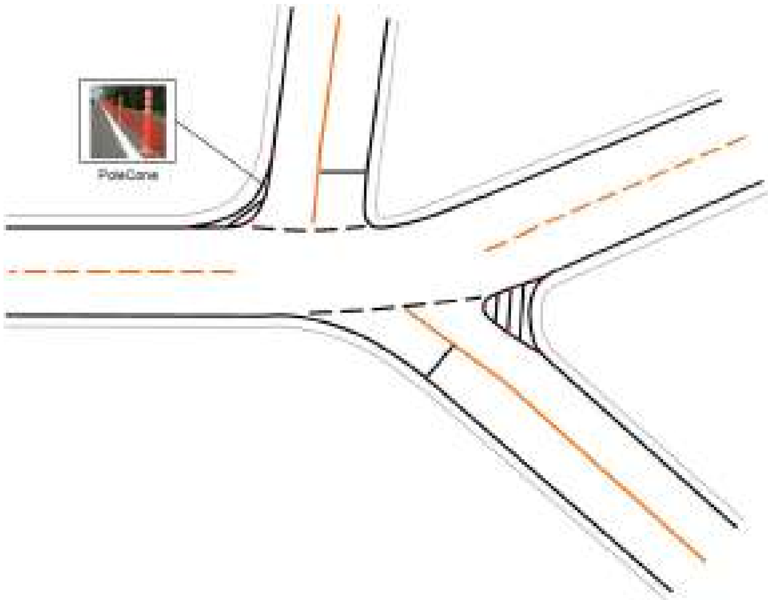



Figure 6-27 (A) Draw a sideline and zebras

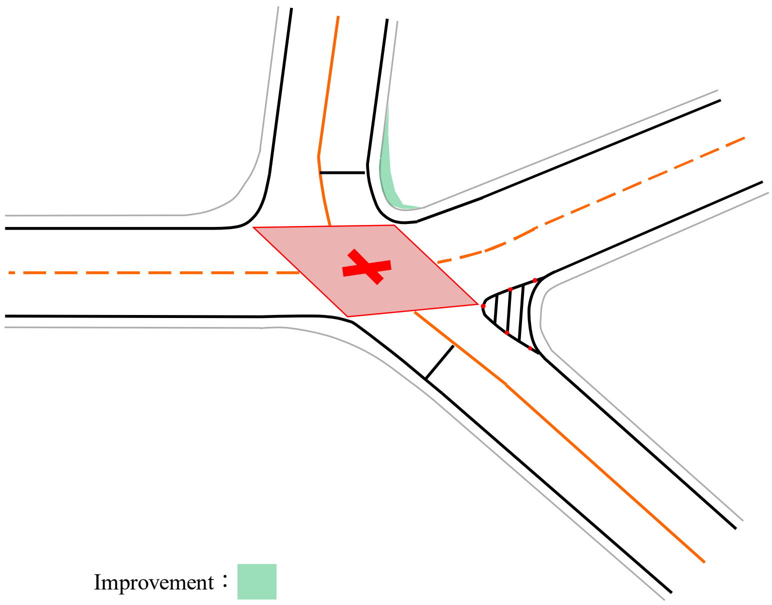



Figure 6-28 (B) T-shape with colored pavement, center making, and rumble strip

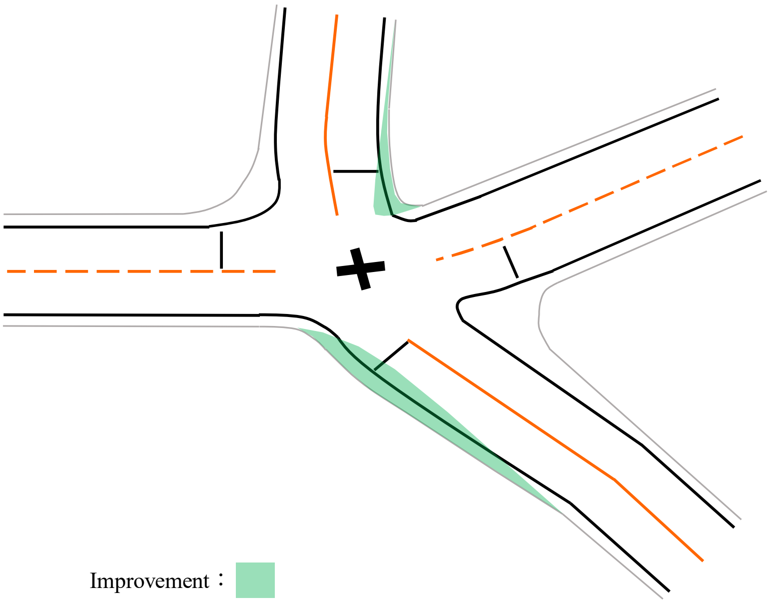



Figure 6-29 (C) Changing the road alignment

## 6.7 Violation near the exit from the highway and the entrance from the parallel roads

### A: Situation of HIYARI-HATTO occurrence

(a) Near the exit of a side road parallel to the highway, a car that wants to make a U-turn at nearest place on the highway as much as possible, violates traffic regulations and forcibly enters the highway, causing a traffic accident.
(b) Near the exit of the side road parallel to the highway, a car exiting the highway makes a reverse run to access the roadside facilities before the exit, causing a traffic accident.
(c) Near the entrance to the highway from a side road, a car which wants to access a nearby roadside facility, violates traffic regulations, and gets off the highway, causing a traffic accident.
(d) Near the entrance from a side road parallel to the highway, a car that wants to make a U-turn at the place nearest to the highway makes a reverse run to access the roadside facilities before the exit, causing a traffic accident.
(e) A car that makes a U-turn on a highway is forced to cross multiple lanes to get off the highway from a nearby exit, causing a traffic accident.
(f) A car entering a highway from a side road forcibly crosses multiple lanes to make a U-turn as close as possible, causing a traffic accident.

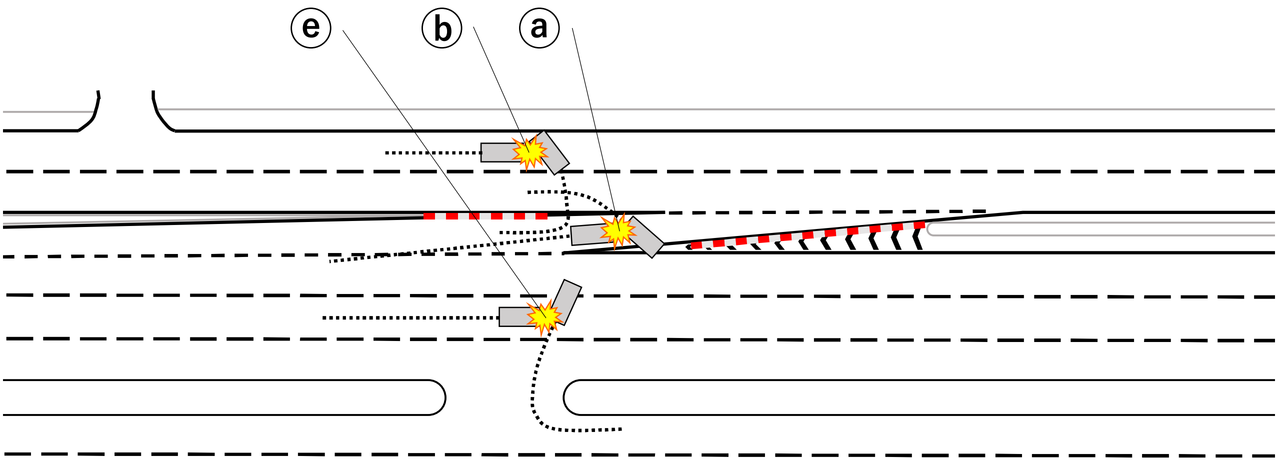


Figure 6-30 Main courses of traffic accidents at the highway exit

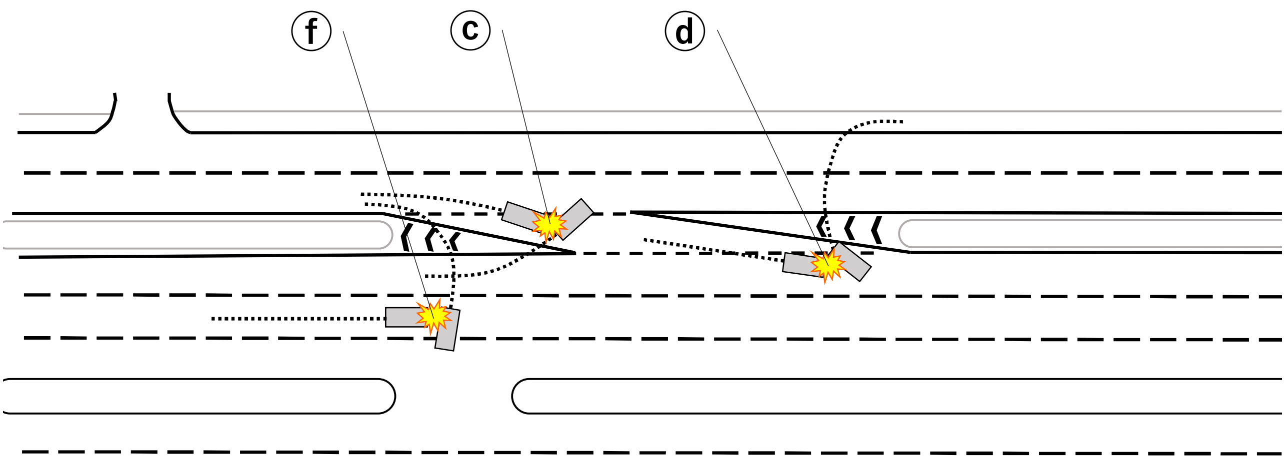


Figure 6-31 Main courses of traffic accidents at the entrance from the parallel roads

## B: Courses and countermeasures

(A) Since traffic violations occur due to unspecified driving violations, the risk of traffic accidents is reduced by properly installing traffic islands and lane separators, chevrons, etc. to suppress driving violations.

(B) By properly locating entrances and exits from expressways and U-turns to prevent unspecified driving and reverse running, reducing the risk of traffic accidents.

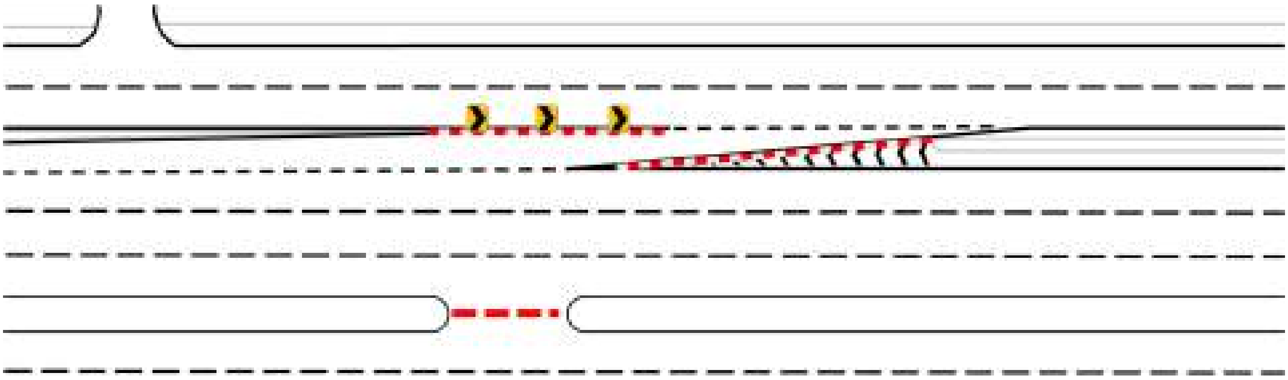


Figure 6-32 Measure plan the exit from the highway

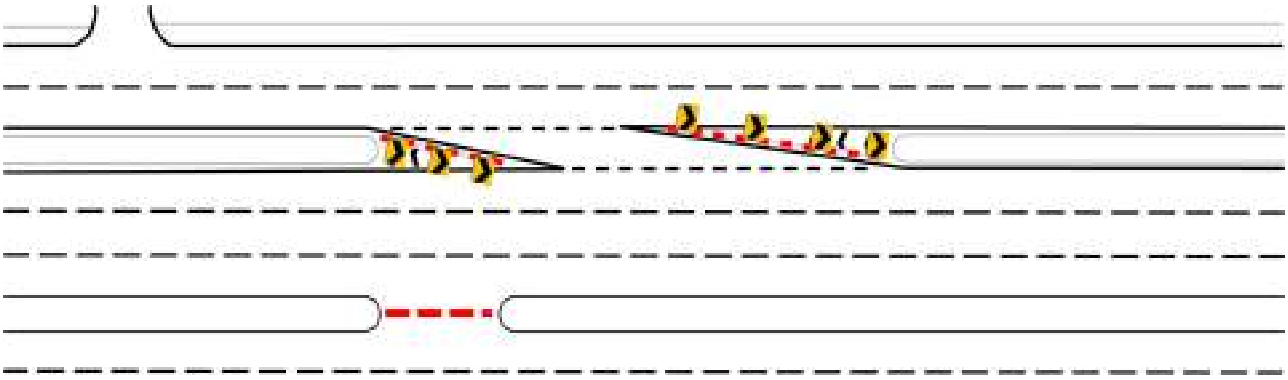


Figure 6-33 Measure plan at the entrance from the parallel roads

## 6.8 Single vehicle crash

### 6.8.1 Over speeding on a highway passing in a local city

### A: Situation of HIYARI-HATTO occurrence

(a) A collision may occur due to the carelessness of the driver traveling over the speed limit.

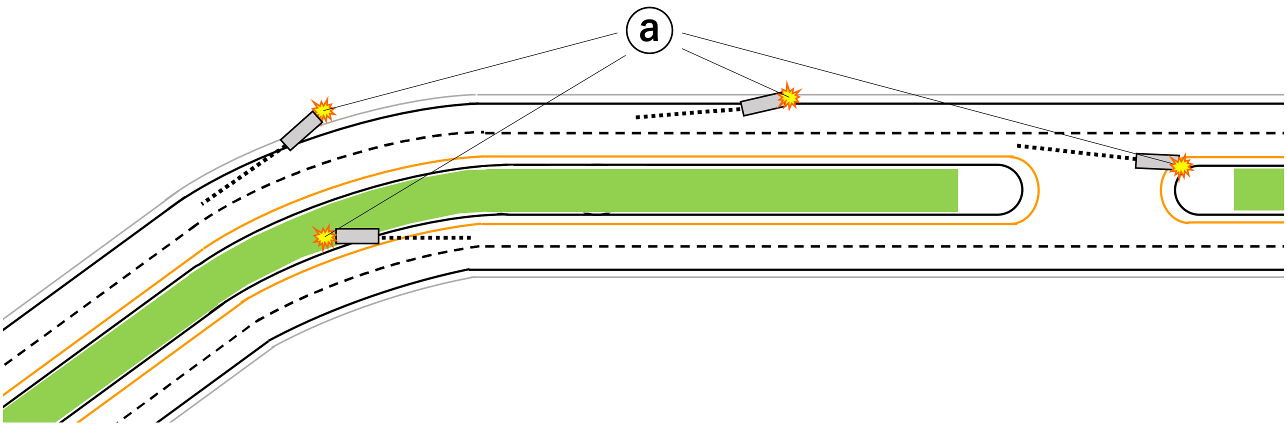



Figure 6-34 Main courses of traffic accidents at single vehicle crash

### B: Courses and Countermeasures

(A) Due to over speeding, a vehicle becomes uncontrollable and deviates from the lane; introducing countermeasures to alert visually and/or appeal to the physical experience such as rumble strips road markings, and installing a guard rail to prevent lane departure.

(B) Due to over speeding, a driver delays the operation and collides with the central island of a U-turn; installing the cushion drum in front of the central island to reduce the impact of a collision.

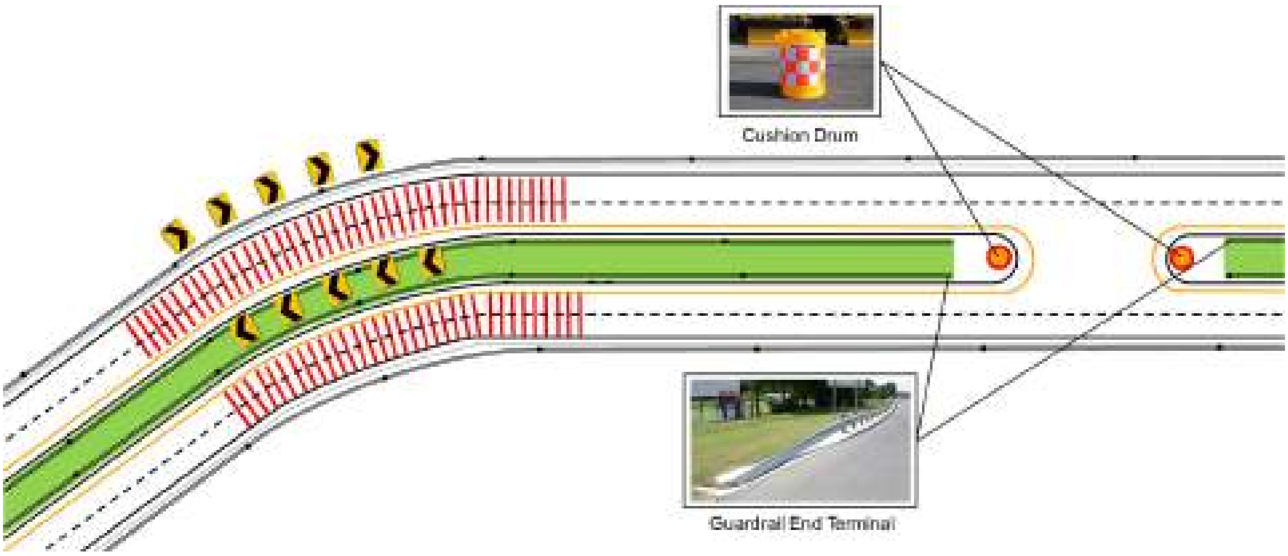



Figure 6-35 (A) (B) Rumble strip and guardrail, cushion drum

## 6.8.2 Accident at the bridge entrance

### A: Situation of HIYARI-HATTO occurrence

(a) Because there is no frontage road on the bridge, vehicles traveling on the frontage road at high speed may collide.

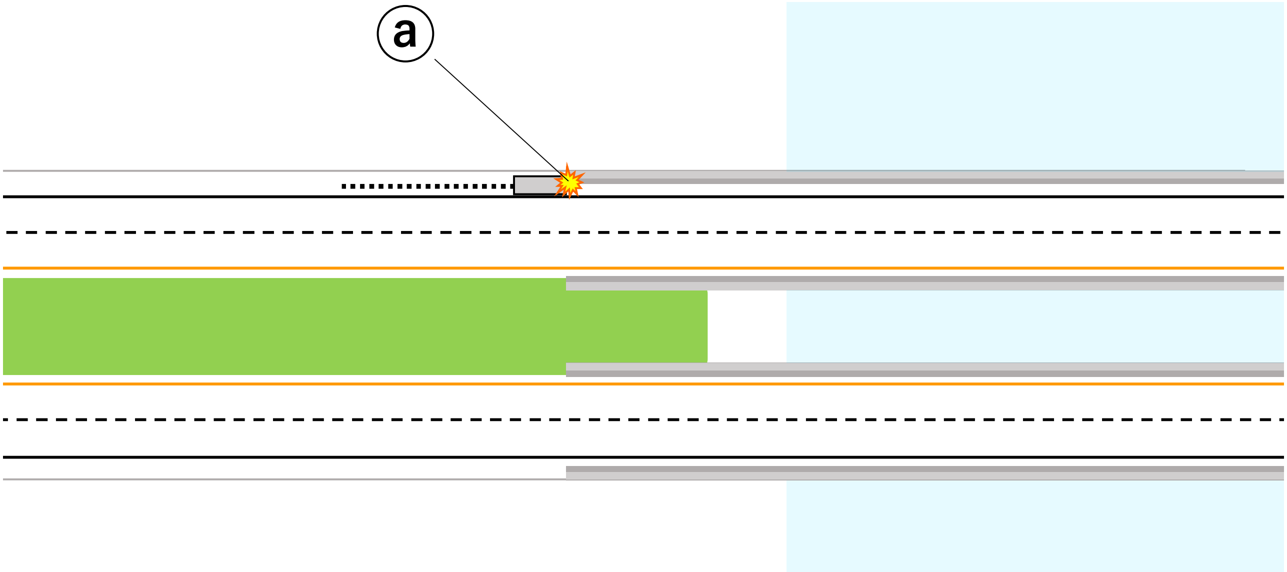



Figure 6-36 Crashed into concrete bridge barrier.

### B: Courses and Countermeasures

(A) To reduce collisions, achieve road width expansion of the Guardrail End Terminal, and provide countermeasures, reducing the risk of traffic accidents.

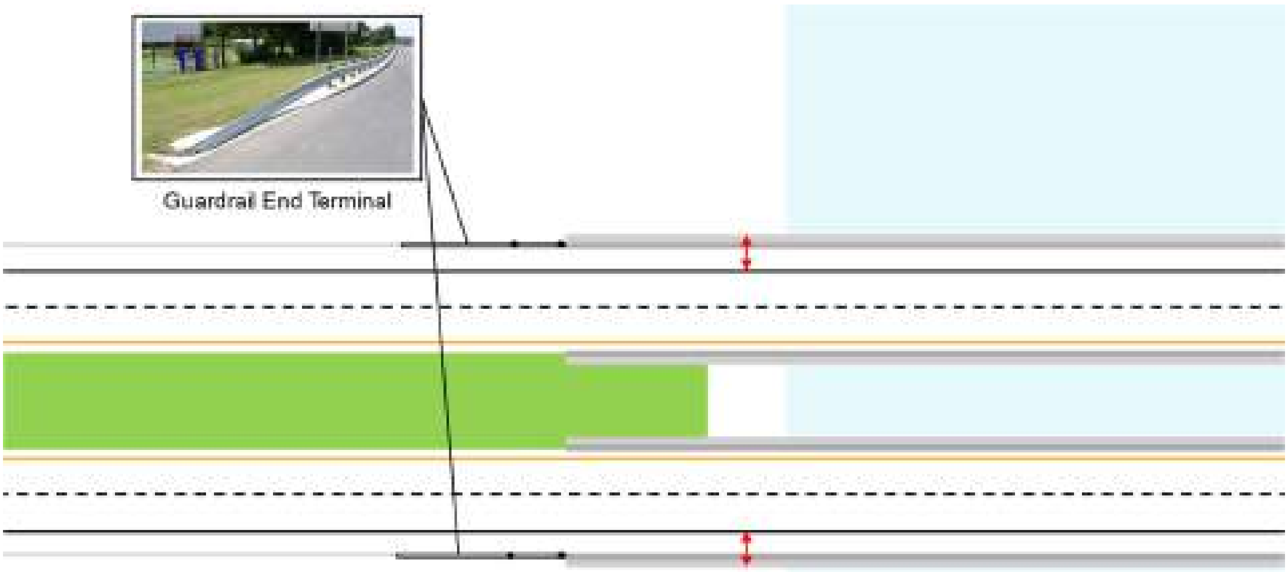



Figure 6-37 Road width expansion and countermeasures of Guardrail End Terminal

## 6.9 Overspeeding on a highway passing through urban areas in a local city

### A: Situation of HIYARI-HATTO occurrence

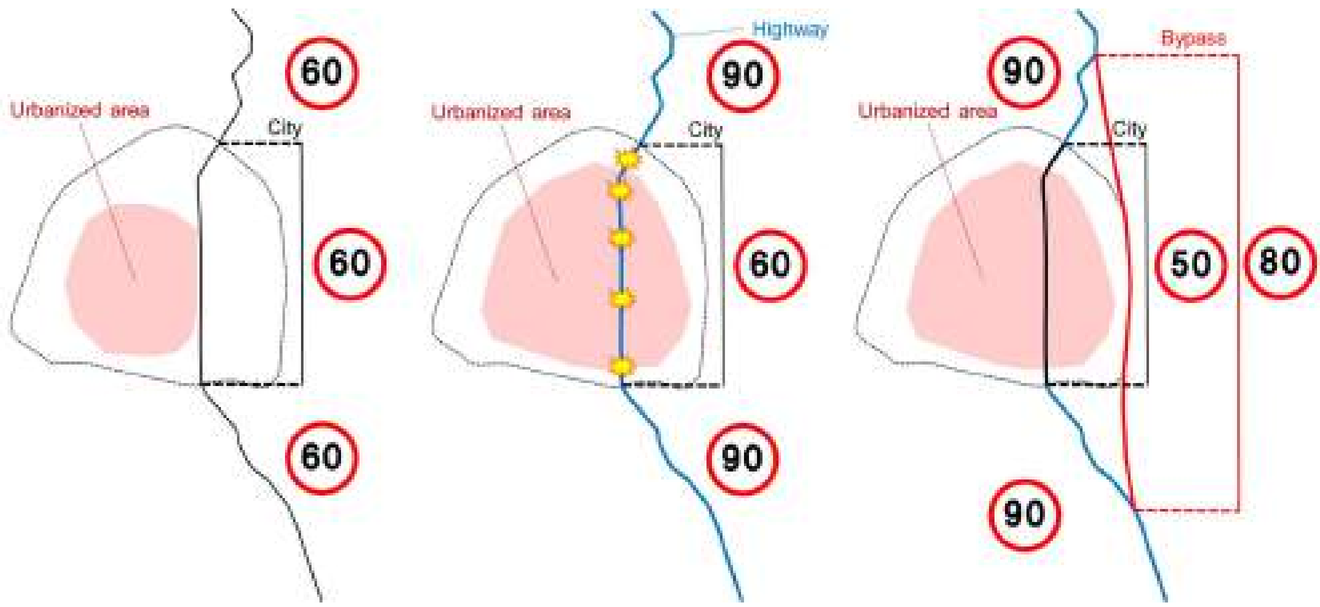
(a) In the local cities, as a result of the high standardization of highways, roadside urbanization has progressed, the amount of traffic flowing into the highway has increased, and the amount of traffic crossing the highway has also increased. However, since the speed regulation on the highway is not sufficient, many traffic accidents occur with local traffic.

(b) In order to strictly regulate the speed on the highway passing through the city, it is effective to install an intersection, a speed camera, and so on. However, since the actual speed in the suburbs is very high, stricter regulations could increase the number of rear-end collisions and other types of traffic accidents.

### B: Courses and Countermeasures

(A) Inability to adequately regulate speed on highways in urban areas; constructing a bypass to eliminate traffic from highways in the city, then working to limit speed on highways in urban areas. Flowing to the ring road is effective, but if the distance is long, it will not be selected by the driver. It is important to select a location to construct a bypass.

(B) There is a lot of traffic crossing the highway in the city area; as shown in 7.1, it is necessary to install underpasses and overpasses and to comprehensively study the inflow points, outflow points, and U-turn points.




Former situation

Current situation (After widening of a highway)

Bypass and Speed Control

Figure 6-38 Fundamental idea of speed control by wide area

# 7. Estimation and post-evaluation of impact of countermeasures

## 7.1 Estimation of the impact of implementation of countermeasures with "Micro Traffic Simulation"

Traffic simulation is the mathematical modeling of transportation systems (e.g., freeway junctions, arterial routes, roundabouts, intersections, and so on) through the application of computer software to better help plan, design, and operate transportation systems. It is now an important area in traffic engineering and transportation planning because it can produce attractive visual demonstrations of present and future scenarios. Hence, various national and local transportation agencies, academic institutions, and consulting firms use traffic simulations to analyze the impacts of implementing countermeasures on traffic safety. In this guideline, the "PTV Vissim" of micro traffic simulation is used for the estimation of that impact, and it can be effective as a powerful presentation tool of traffic accident countermeasures for decision-makers and local residents by advanced 3D animation capabilities.

To evaluate the impact of countermeasures, a simulation of the current situation at the black spot for traffic accidents in Suphan Buri was first created with input values such as traffic volume and road width, which were obtained by analyzing video data of the current situation at the black spot (Figure 7-1).

Figure 7-1 Simulation of current situation at the intersection

Figure 7-2 is the simulation that implemented the countermeasures for traffic accidents at the same spot as the figure above. At present, the deformed intersection with no traffic light has a large area inside the intersection. Additionally, the driving lanes of vehicles are not known. As the countermeasures, a traffic island is installed to reduce the area inside the intersection, which has red and road markings. Vehicles from non-preferred roads of both sides are stopped temporarily; hence, the driving lanes are delineated for the drivers, and it is possible to prevent vehicles from colliding.

Figure 7-2 Simulation at the intersection after the implementation of countermeasures

As mentioned above, the micro traffic simulation is an effective tool to evaluate the countermeasures before they are implemented. The key to implementing more effective countermeasures is to develop an accurate simulation model; however, in order to develop an accurate simulation model, accurate data such as traffic volume, road width, and so on are needed. These are generally obtained through traffic volume surveys and motion image analysis.

## 7.2 Post-evaluation of implementation of countermeasures

Once implemented, traffic safety measures do not end. They may not always have the expected effect, or the traffic conditions may change significantly after implementation, and the measures may not be compatible with the current situation. Therefore, when implementing them, it is necessary to conduct the study by comparing before and after—not only data on traffic accidents such as the number of traffic accidents, fatalities of traffic accidents, and the number of serious injuries but also traffic situation data such as traffic volume and average speed.

If the expected effects are not obtained, it is necessary to conduct an analysis again and take further measures. In addition, even if the effect is obtained, it is necessary to conduct a survey as regularly as possible to confirm whether it has been established; if the effect decreases, it is necessary to implement new measures.

In this way, traffic safety measures must be implemented steadily and must always be adapted to the situation. In that sense, it is particularly important to monitor the risk of traffic accidents in accordance with HIYARI-HATTO and other methods.

# 8. Model Projects

As introduced in Chapter 3, road safety measures were implemented for three years from 2017 to 2019 at seven high-risk road accidents on Route 340. In the following, we will introduce details of these measures, including the background and the ex post-evaluation.

### (1) AREA 1 (from 53+000 km to 53+200 km: Klong Ban-Huai Bridge)


| Accident Type | Number (3 yr.) |
|---|---|
| Rear-end Collision | 2 |
| Side Swipe | 1 |
| Off Carriageway to Median | 1 |
| Hit Obstruction | 2 |

Figure 8-1 Physical characteristics at AREA 1
(from 53+000 km to 53+200 km: Klong Ban-Huai Bridge)

Physical improvements, such as adjusting the bridge and shoulder levels that have collapsed with asphalt concrete, have been conducted for Suphan Buri Highway 1. Additional safety equipment such as traffic line paint (by making an optical speed bar, rumble strip, and traffic sign symbols), larger warning signs, dangerous railings (in the area where car statistics are off the surface) were installed as shown in Figure 8.2.


Figure 8-2 Installment plan of safety equipment

Installation of pavement markings

“SLOW DOWN”

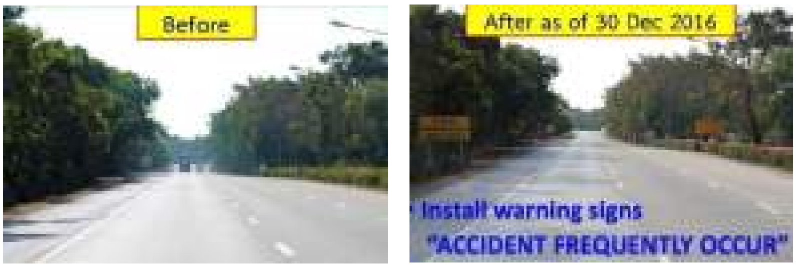
Installation of warning signs

“REDUCE SPEED”


Installation of warning signs

“ACCIDENTS FREQUENTLY

OCCUR”




Installation of warning signs

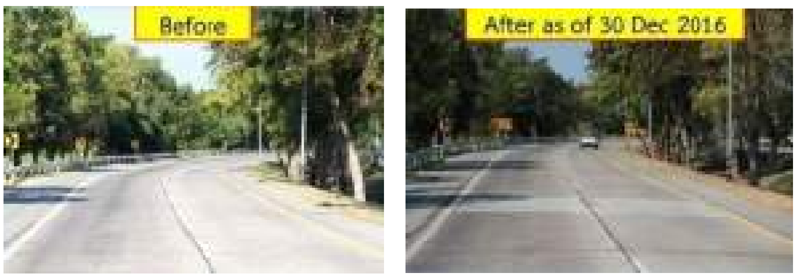
“REDUCE SPEED”


Installation of warning signs and

Markings

“CHEVRON, REDUCE SPEED,

And Rumble Strips”




Only CHEVRON

Figure 8-3 Installation of warning singe and road marking

Figure 8-4 Installing work of warning signs and road marking

The optical speed bar (OSB) marking is intended to make the driver feel as if the traffic lane was squeezed, and the speed is reduced. According to statistics, collected before/after the installation of OSB on Suphan Buri Highway 1, it was found that OSB signs make the driver to reduce 5–10% of the driving speed in the initial stage. However, once the driver becomes accustomed to them, they do not help reduce the driving speed as expected.

An interesting result from OSB marking is that there was a marked decrease in lane changes after the installation of OSB marking (63% reduction), as shown in Figure 8-5.

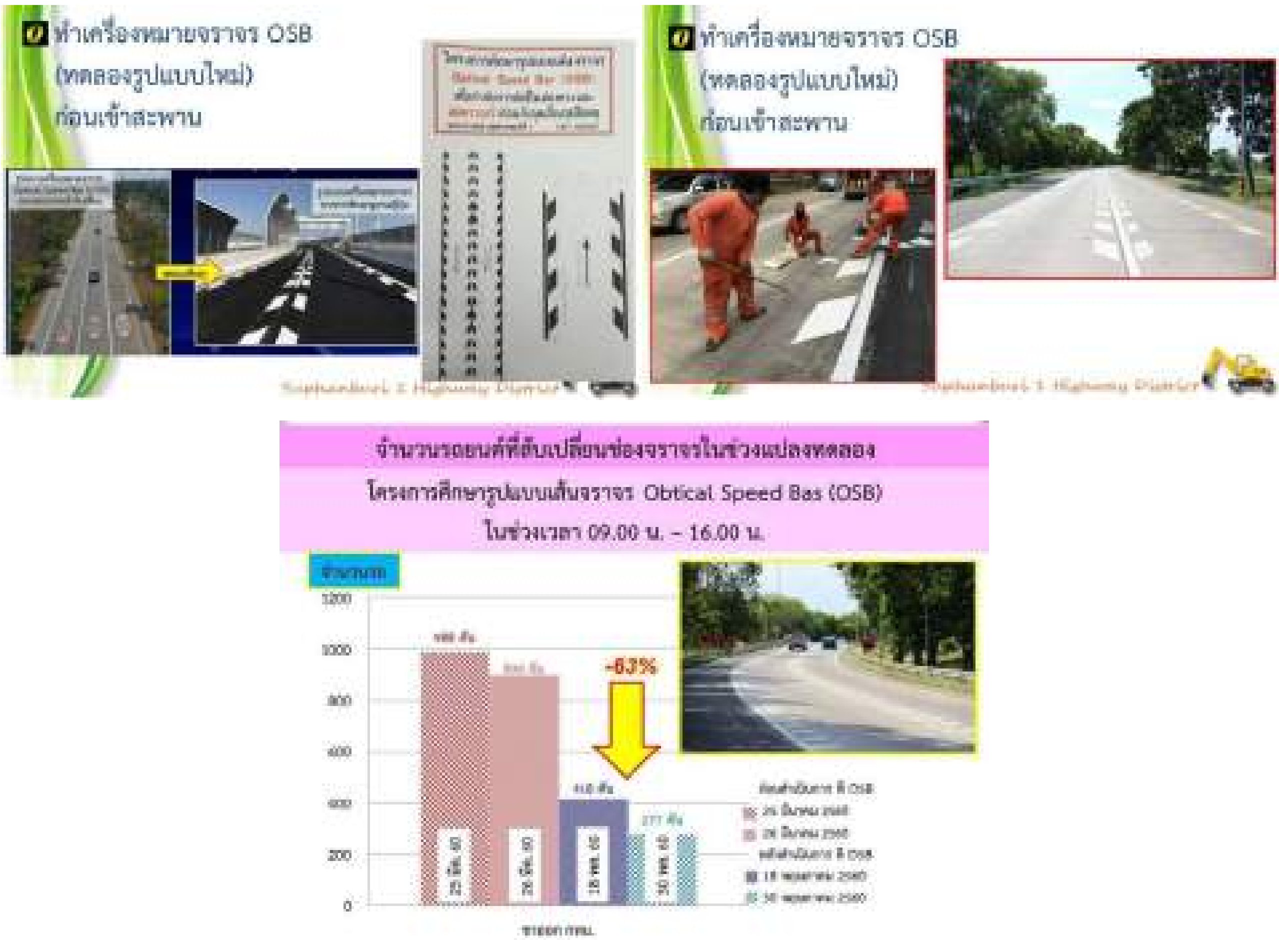



Figure 8-5 The optical speed bar (OSB) marking and data collection of the number of cars changing traffic lanes in the operation area

### (2) AREA 2 (from 61+250 km to 61+600 km: near Soongsumarn Padungwit School)

Another target location (the road section from 61+250 km to 61+600 km) is near Soongsumarn Padungwit School (the number of students is about 2,000). A U-turn is located in front of this secondary school and not far from the end of the curve. Thus, traffic accidents as shown in figure 8.7 used to occur.


Figure 8-6 Physical characteristics of the road section from 61+250 km to 61+600 km in front of Soongsumarn Padungwit School

On the national highway route No.340, measures warning drivers to reduce speed were implemented. As shown in Figure 8.8, various safety devices such as traffic marking (optical speed bar marking, rumble strip, and text on the traffic surface), red anti-skid marking (to be aware that it is an area to be extra careful), warning signs larger than the standard on both sides, and flashing lights above the head were installed.

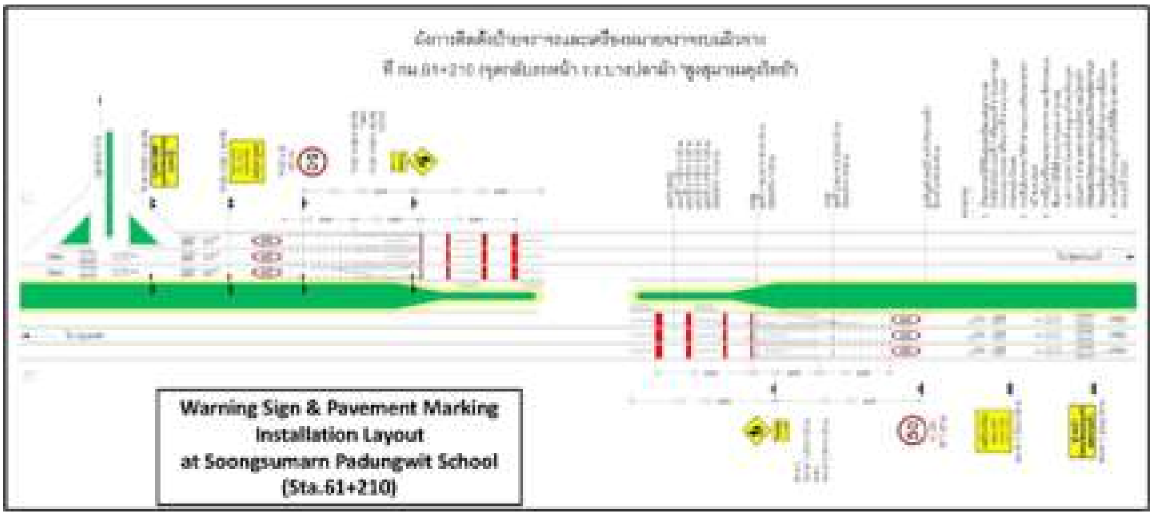



Figure 8-7 The increase of various safety equipment warning the driver to reduce speed


Figure 8-8 The increase of various safety equipment warning the driver to reduce speed

Similar to OSB marking, the installation of various warning devices makes the driver reduce driving speed by 5–10%. However, the driver becomes accustomed to it, and this measure does not help reduce driving speed as expected (Figure 8-9).


Figure 8-9 Comparison of speed data before/after applying warning devices

After the measures have been implemented, a survey of satisfaction of all relevant sectors has been conducted to obtain more comments, with the aim to improve various measures to get effective results and meet more expectations in the future. The details are shown in Figure 8-10.

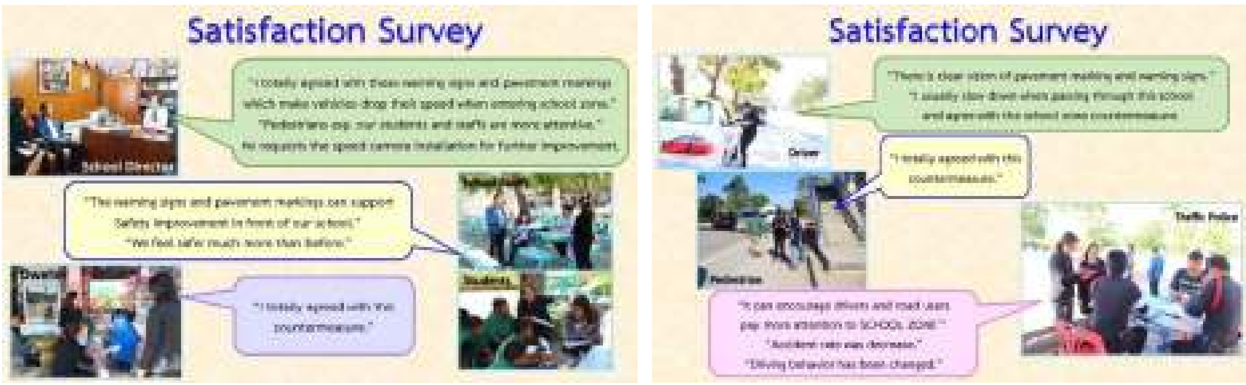



Figure 8-10 The result of the satisfaction survey among all relevant sectors

### (3)AREA 3 (from 63+110 km to 63.650 km: On Ban Po Koi)

On Ban Po Koi, the road section from 63+110 km to 63+650 km, median was opened at an intersection between Highway 340 and local road. Before the construction of Highway 340, villagers in the Bang Pla Ma District and Muang District of Suphan Buri Province used this local road as the main route of travel. The construction of Highway 340 caused problems with traveling between communities on both sides of the road. Especially with the elderly living there and using motorcycles, the ratio of severe accidents to deaths is relatively high, as shown in Figure 8-11.


| Accident Type | Number (3 yr.) |
|---|---|
| Off Carriageway to Median | 3 |
| Hit by Vehicle Changing Lane | 2 |

Figure 8-11 Median opened on Ban Po Koi (from 63+110 km to 63+650 km)

In the past, when traffic volume increased during the festival, the highway U-turn points were closed, thereby reducing traffic accidents at intersections/U-turn points. Next, a larger than normal warning sign was placed to allow the driver to carefully decelerate, as shown in Figure 8-12.


Figure 8-12 The process of shutting down a U-turn by the festival during long holiday

In order to improve safety at the Po Koi intersection/U-turn point, the traffic volume in all directions at the intersection shown in Figure 8-13 and the number of fatalities and serious injuries in traffic accidents shown in Tables 8-1, 8-2, and 8-3 were analyzed, and the countermeasures were examined.

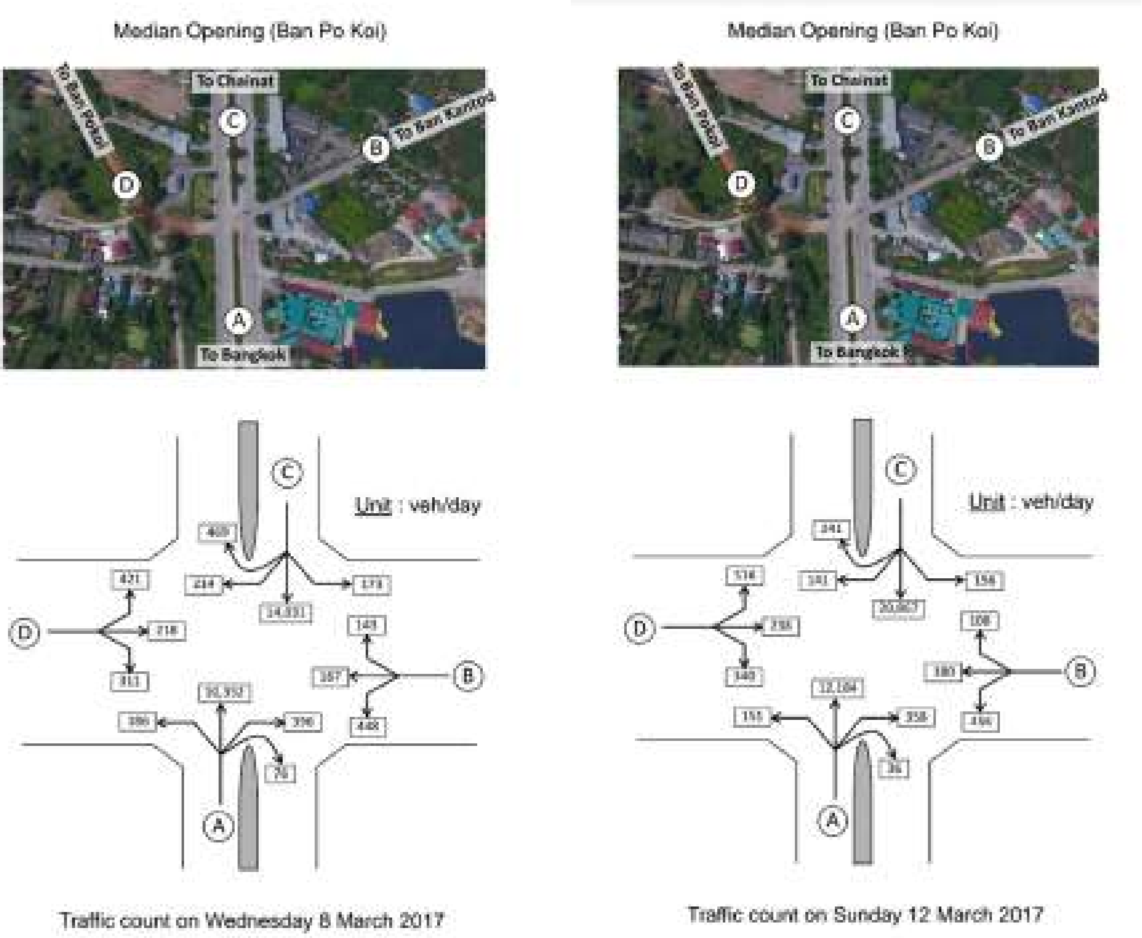



Figure 8-13 Traffic volume at the intersection/U-turn point

Table 8-1 Accident statistics at Po Koi junction between 2013 and 2017

| Year | Number of accident (time) | Death (people) | Junction (people) | |
|---|---|---|---|---|
| | | | admit | little |
| 2013 | 7 | 3 | 2 | 2 |
| 2014 | 2 | - | 1 | 1 |
| 2015 | 4 | 2 | 5 | - |
| 2016 | 3 | 1 | 2 | 2 |
| 2017 | 11 | - | 8 | 2 |
| Total | 27 | 6 | 18 | 7 |

Table 8-2 Fatalities in the Po Koi intersection between 2013 and 2017

| No | Date | Sex | Age | Vehicle type | | Risk behavior |
|---|---|---|---|---|---|---|
| | | | | 1st vehicle | 2nd vehicle | |
| 1 | 11/06/2013 12:00 | M | 64 | Motorcycle | - | Unsafe motorcycles |
| 2 | 12/10/2013 01:20 | NA | 54 | Car 4 wheels | Mini truck (6 wheel) | Not wearing a seat belt<br>Excessive Speed |
| 3 | 10/11/2014 01:47 | M | 19 | Motorcycle | Pickup | Use a mobile phone while driving |
| 4 | 30/01/2013 21:00 | F | 31 | Pickup | Car 4 wheels | Not wearing a seat belt<br>Excessive Speed |
| 5 | 10/03/2013 | M | 18 | Motorcycle | - | Not wearing a helmet<br>No driver's license<br>Excessive Speed |
| 6 | 12/10/ 2013 07:30 | M | 77 | Motorcycle | Pickup | Not wearing a helmet<br>Cutting someone off |

Table 8-3 Details of seriously injured admitted to the hospital between 2013 and 2017

| No | Date | Seriously injured at Po Koi Junction or admitted to hospital | | |
|---|---|---|---|---|
| | | Sex | Age | Location |
| 1 | 16/03/2013 17:00 | N/A | 56 | Tha Rahat, Mueang, Suphan Buri |
| 2 | 1/5/2013 7:00 | N/A | 25 | Suphan Buri |
| 3 | 3/12/2013 20:00 | M | 30 | Khlong Khlung, Khlong Khlung, Kamphaeng Phet |
| 4 | 30/012013 21:00 | N/A | 40 | Tha Rahat, Mueang, Suphan Buri |
| 5 | 30/012013 21:00 | N/A | 4 | Wang Yang, Si Prachan, Suphan Buri |
| 6 | 30/012013 21:00 | N/A | 20 | Wang Yang, Si Prachan, Suphan Buri |
| 7 | 24/02/2013 16:00 | N/A | 20 | Tha Rahat, Mueang, Suphan Buri |
| 8 | 28/06/2013 09:00 | F | 51 | Tha Phi Raeng, Mueang, Suphan Buri |
| 9 | 13/03/2013 11:30 | F | 18 | Sanam Chai, Mueang, Suphan Buri |
| 10 | 13/03/2013 11:30 | M | 19 | Tha Rahat, Mueang, Suphan Buri |
| 11 | 7/02/2013 17:20 | M | 20 | Tha Rahat, Mueang, Suphan Buri |
| 12 | 9/02/2013 02:30 | N/A | 13 | Sanam Chai, Mueang, Suphan Buri |
| 13 | 9/02/2013 02:30 | F | 18 | Sanam Chai, Mueang, Suphan Buri |
| 14 | 9/02/2013 02:30 | N/A | 19 | Suphan Buri |
| 15 | 2/04/2013 15:40 | M | 28 | Tha Rahat, Mueang, Suphan Buri |
| 16 | 2/04/2013 15:40 | N/A | 13 | Suphan Buri |
| 17 | 5/10/2013 10:00 | N/A | 49 | Tha Rahat, Mueang, Suphan Buri |
| 18 | 29/10/2013 17:00 | N/A | 40 | Khok Khram, Bang Pla Ma, Suphan Buri |

Considering the statistics on the Po Koi intersection as shown in Table 8-1, Table 8-2 and Table 8-3, accidents did occur at the Po Koi intersection, although not very frequently. However, quite severe is the ratio of deaths and serious injuries to hospitalization, which is the ratio of the number of accidents that have turned into fatalities (22 percent in total) and that of the number of accidents with severe injuries to hospitalization per number of times. Accidents are 49 percent of all deaths carefully considered between 2013 and 2017, as shown in Table 8-2 and through the details of seriously injured and hospitalized people. As shown in Table 8-3, it was found that the dead and seriously injured, who lived in the area near the Po Koi intersection (including the sub-district adjacent to it), were up to 71 percent.

The Suphan Buri 1 Highway District sent information and discussed with experts from the consulting company that MLIT sent to the area, receiving suggestions on two ways to improve the Po Koi intersection/U-turn point: the first one is improving the geometry of the road by separating the main road and the secondary road, and the second one is the installation of traffic lights, as shown in detail in Figure 8-14.

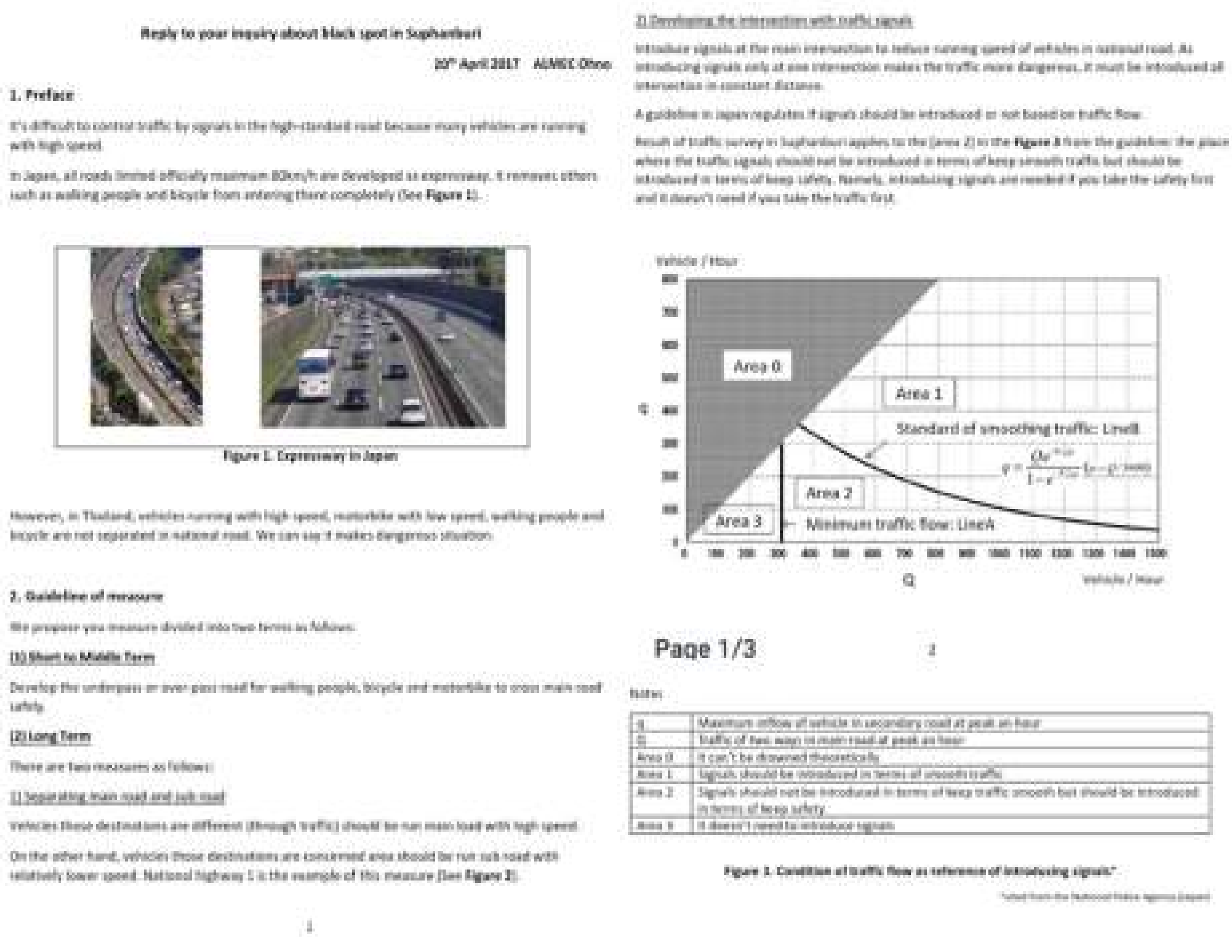



Figure 8-14 Recommendations for improving the intersection/U-turn point from the experts sent by MLIT

In order to improve the intersection/U-turn point on Suphan Buri Highway, it was considered to set up a side road and then set up an underpass under the expressway. Although few large vehicles use this area road, high-roof vans were assumed to pass; therefore, when installing the underpass, the expressway was raised, and the underpass was lowered from the beginning so that vehicles taller than 2.4 m could pass, which steepened the mounting but did not affect local traffic. During the design process, we talked with villagers, confirming drainage guidelines, and prepared the first meeting with community leaders before designing the details to propose the idea, as shown in Figure 8.15.

Figure 8-15 Public hearing with local people

After designing the details and improving on the recommendations that had been concluded with the community, we made an appointment to publicize the project and officially receive public opinions, as shown in Figure 8-16.


Figure 8-16 Picture of the public relations project meeting and listening to public opinion on 17 August 2017

After the meeting, the design department completed the detailed design. Completed construction form and traffic patterns, including drainage, are shown in Figure 8-17.

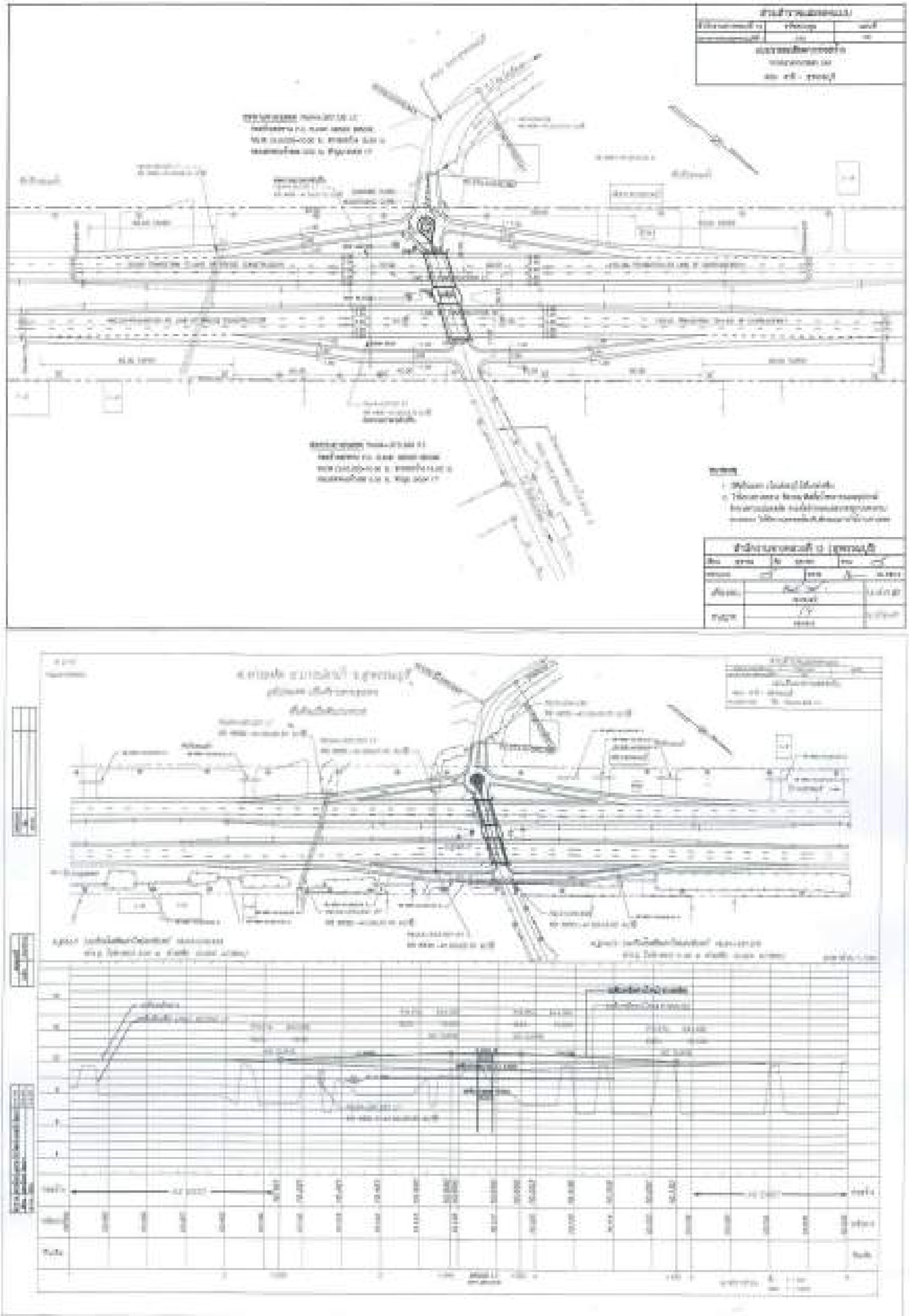
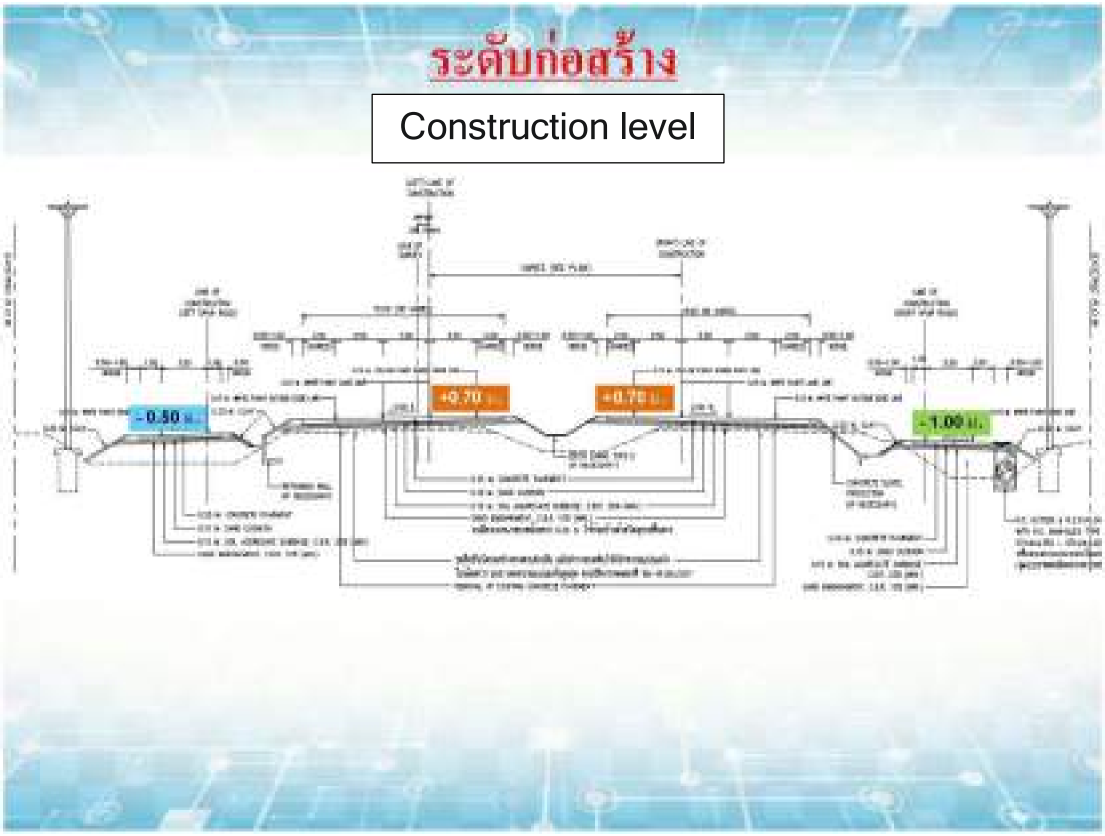


Figure 8-17 The construction plan and traffic pattern, including drainage, at the Po Koi intersection area



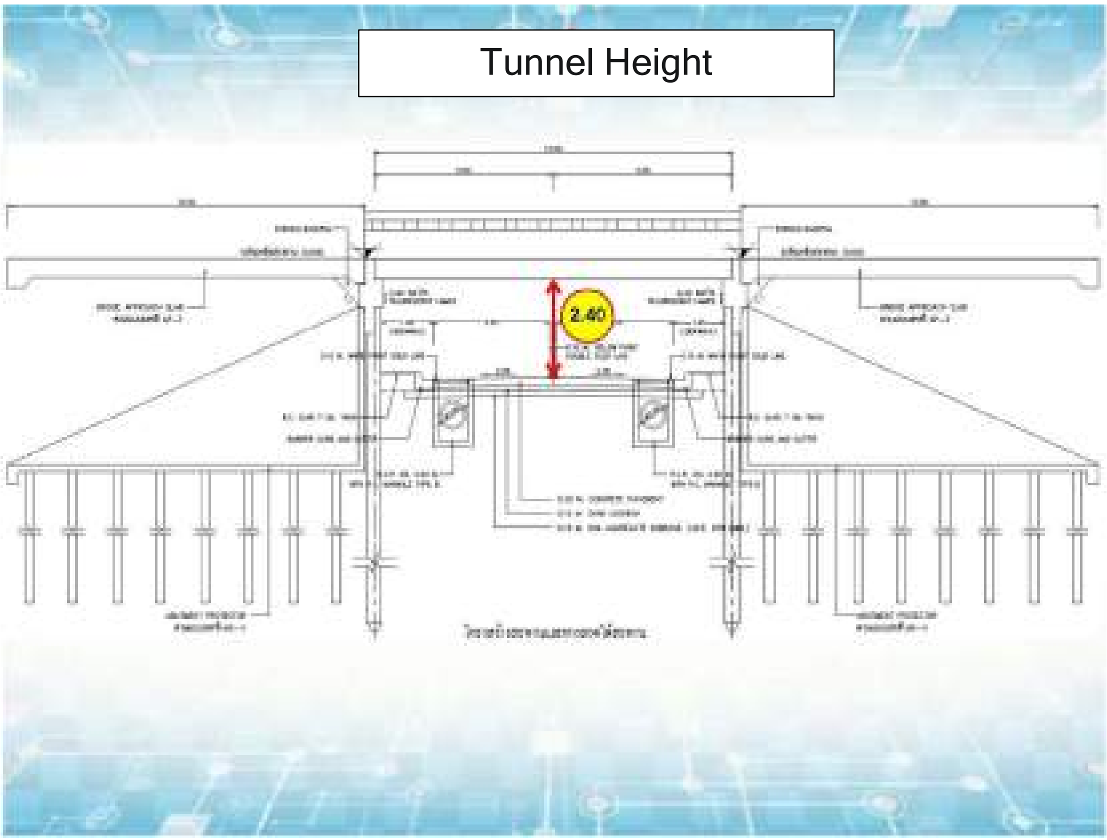
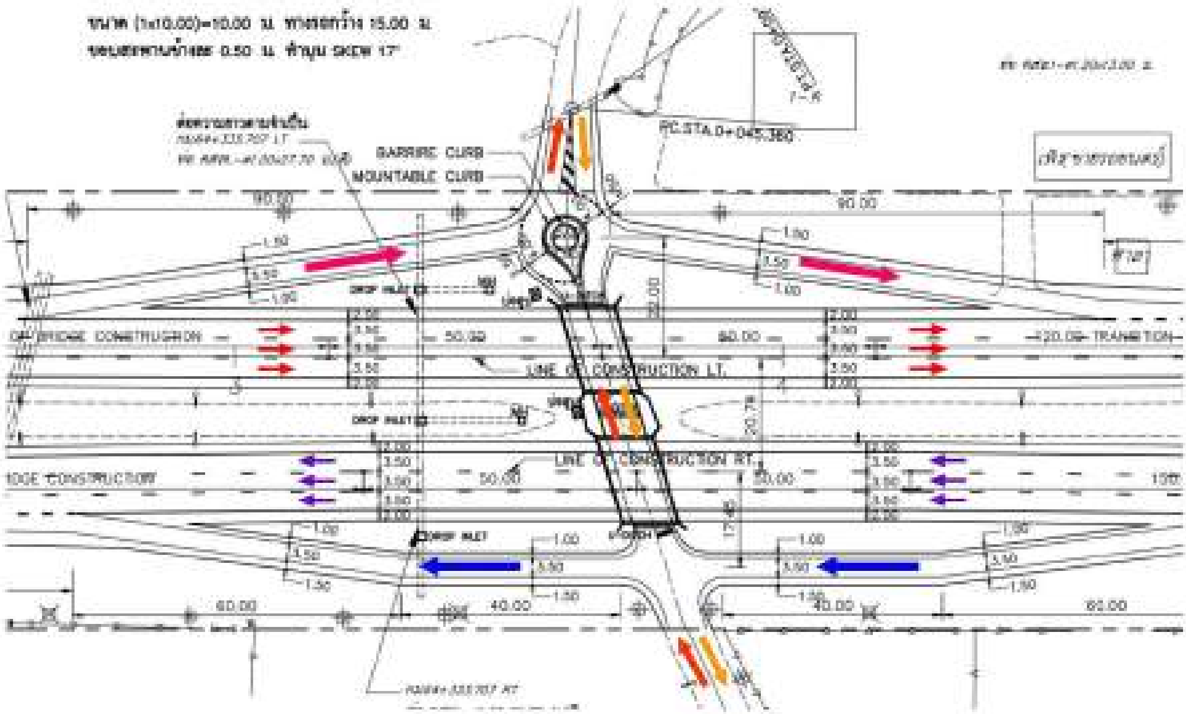




Figure 8-18 (Cont.) The construction plan and traffic patterns, including drainage, at the Po Koi intersection area

Traffic stream



Drainage flow

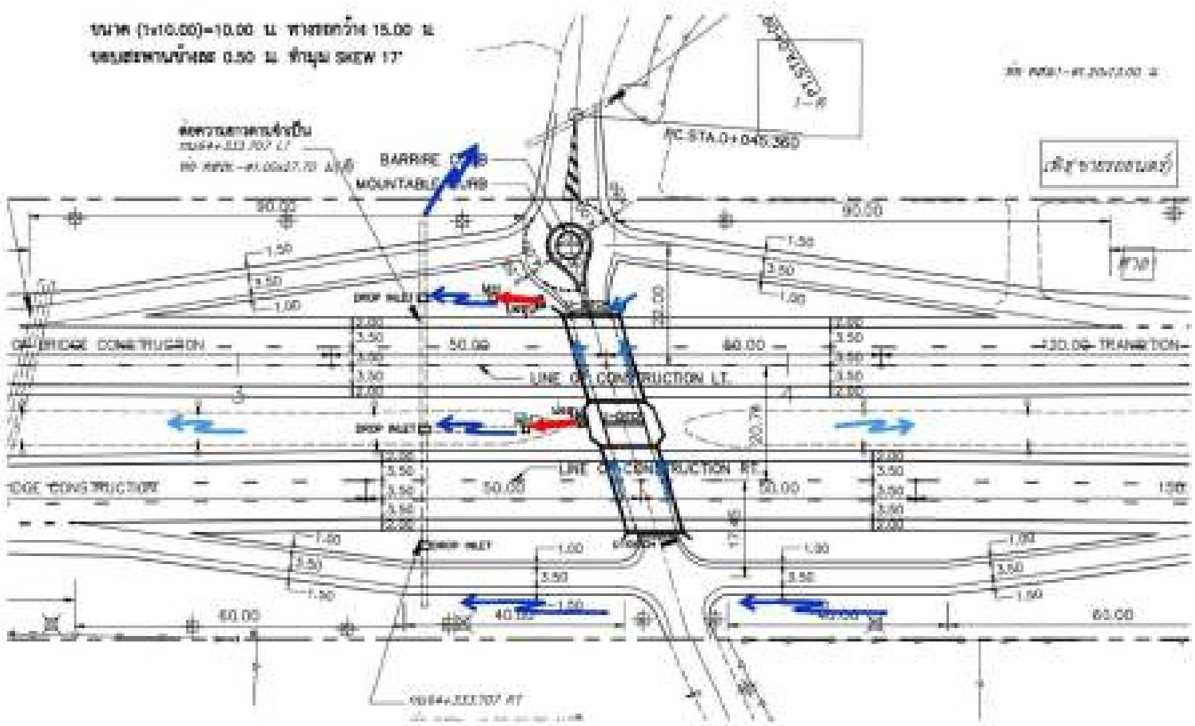
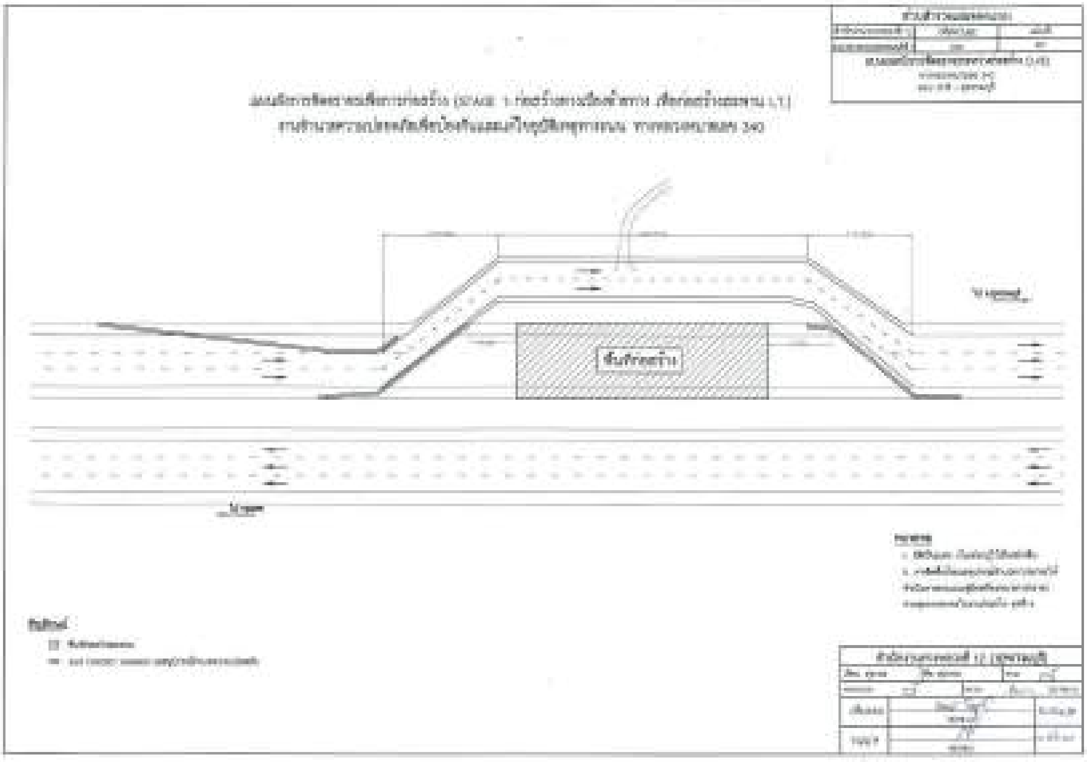


Figure 8-19 (Cont.) The construction plan and traffic patterns, including drainage, at the Po Koi intersection area

As shown in Figure 8-18, the designer specified the traffic management plan for each stage of construction in order to reduce its impact.



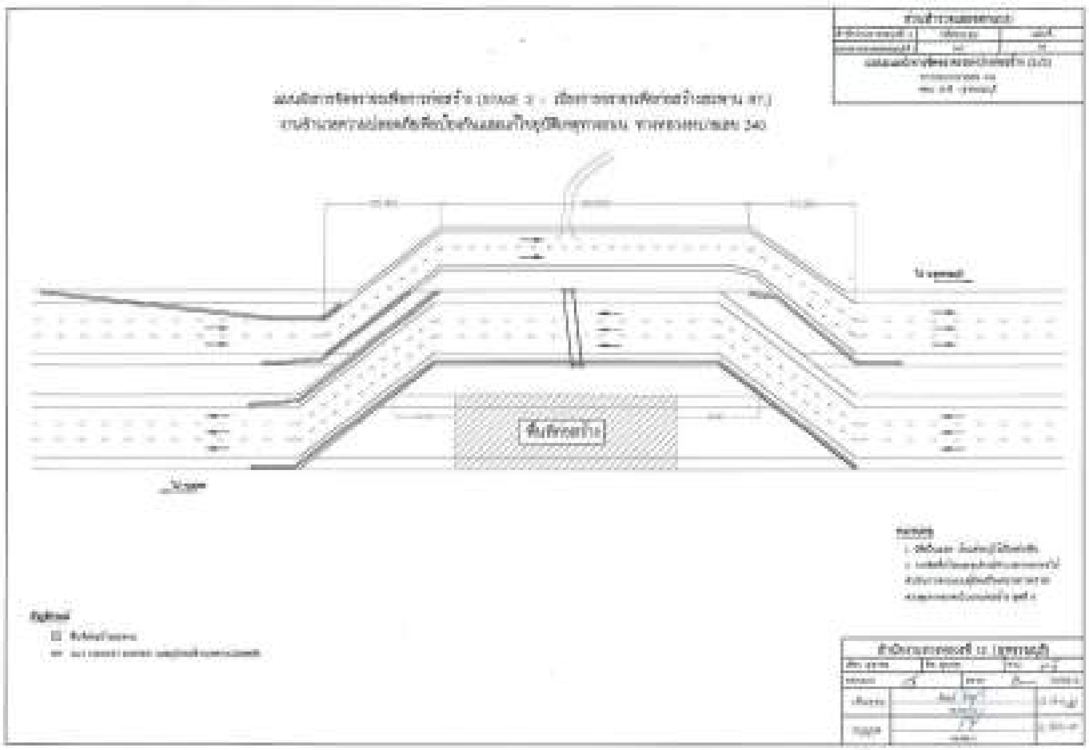


Figure 8-20 The road arrangement plan for construction at each stage

The construction budget is approximately 24.5 million baht, and the construction period is approximately seven months. The image of the Po Koi passage after construction was completed is shown in Figure 8-21.


Figure 8-21 The photos after the construction was completed according to the plan

In response to heavy rain, an underground flood warning sign system (flashing LED warning sign) was developed, and signs were installed in clearly visible positions above both the entrance and exit, as shown in Figure 8-22.

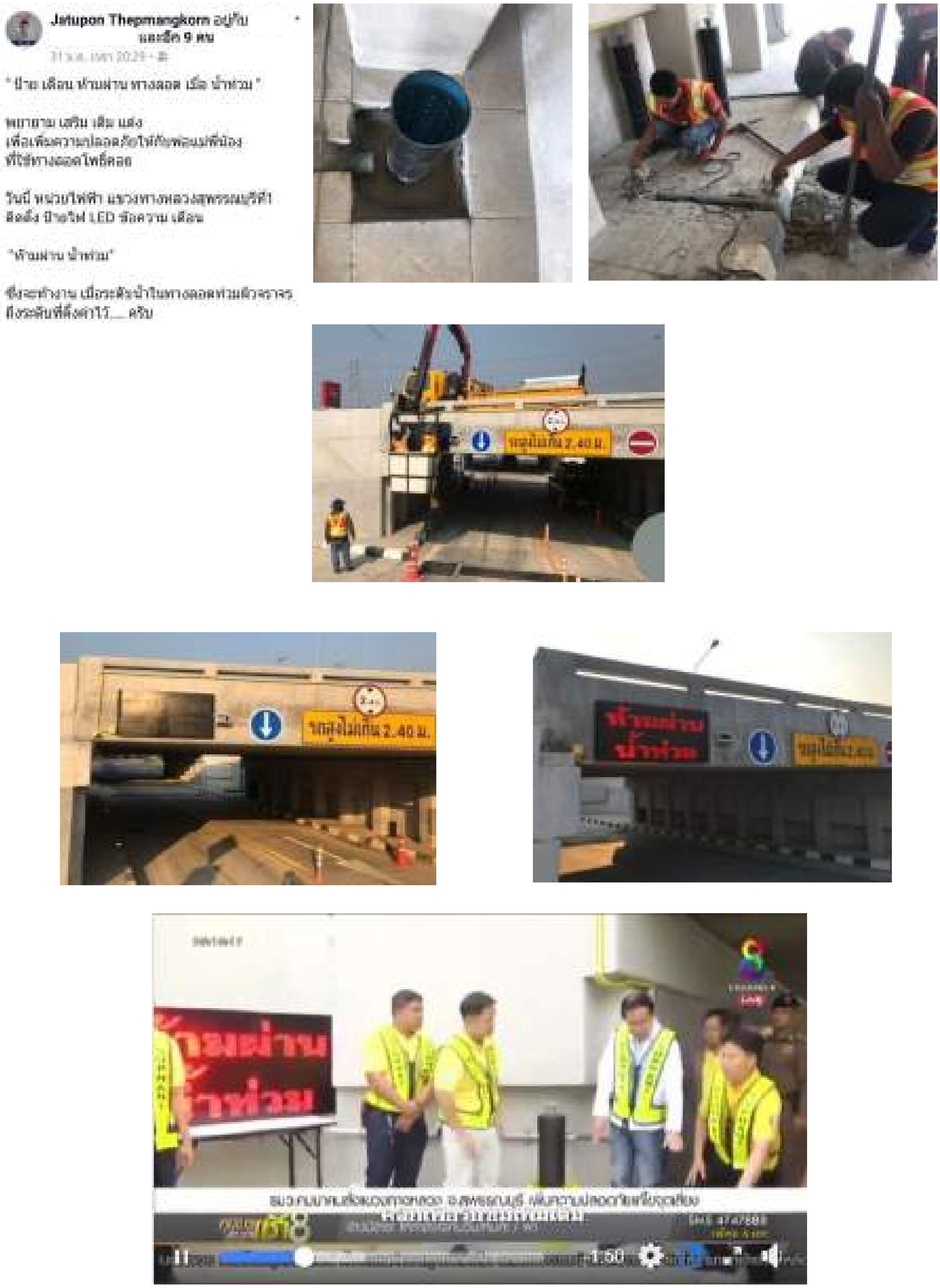



Figure 8-22 The installation of warning sign system in case of flooding underpass (LED warning sign flashing)

After the construction was completed, an underpass constructed at the Pho Kho intersection was opened in mid-September 2018, and the number of traffic accidents and traffic volume were monitored to evaluate the degree of achievement of the project.

From mid-September 2018 to the present (March 2020), no accidents occurred at the Pho Kho intersection, and the solution is considered successful.

Highway 340 is the main route for small cars (up to 2.40 meters of height) from Muang District, Suphan Buri Province to Bangkok and surrounding areas. In the past, vehicles making a U-turn at this intersection often collided with vehicles returning from Suphan Buri to Bangkok or to the Bangprama district in the southern part of the Suphan Buri Province. The construction of the underpass has eliminated the need for local cars to make U-turns on Highway 340, greatly reducing the risk of traffic accidents.

As shown in Table 8-4, the Suphan Buri 1 Highway District, Department of Highway has a CCTV installed to record traffic volume on the underpass. We compared the data from March 3 to 5, 2019 to the previous results collected on March 8 and 12, 2017.

Table 8-4 Comparison of traffic driving through the intersection before

and after the construction of the underpass

| Date | | Pho Koi - Khan Thot direction | | Khan Thot -Pho Koi direction | |
|---|---|---|---|---|---|
| | | Motorcycles | Car | Motorcycles | Car |
| Before construction | 8/03/2017 | 279 | 250 | 192 | 118 |
| | 12/03/2017 | 338 | 240 | 183 | 105 |
| After construction | 3/03/2019 | 606 | 576 | 556 | 522 |
| | 4/03/2019 | 721 | 706 | 634 | 429 |
| | 5/03/2019 | 648 | 574 | 567 | 663 |

The data indicate that the completion of the underpass construction has increased traffic across Highway 340 from Pho Koi to Khan Thot and from Khan Thot to Pho Koi. The construction of an underpass to mitigate the danger of the 340 Po Koi junction has achieved its goal of eliminating the risk of making U-turns on the highway and providing safer travel options.

### (4) AREA 4: Median strip (form 65+400 km to 65+600 km: PTT station)

At this point, as shown in Figure 8-23, many cars enter and exit gas stations on both sides of the U-turn and access a nearby ring road; as there are many intersections, frequent accidents occur.

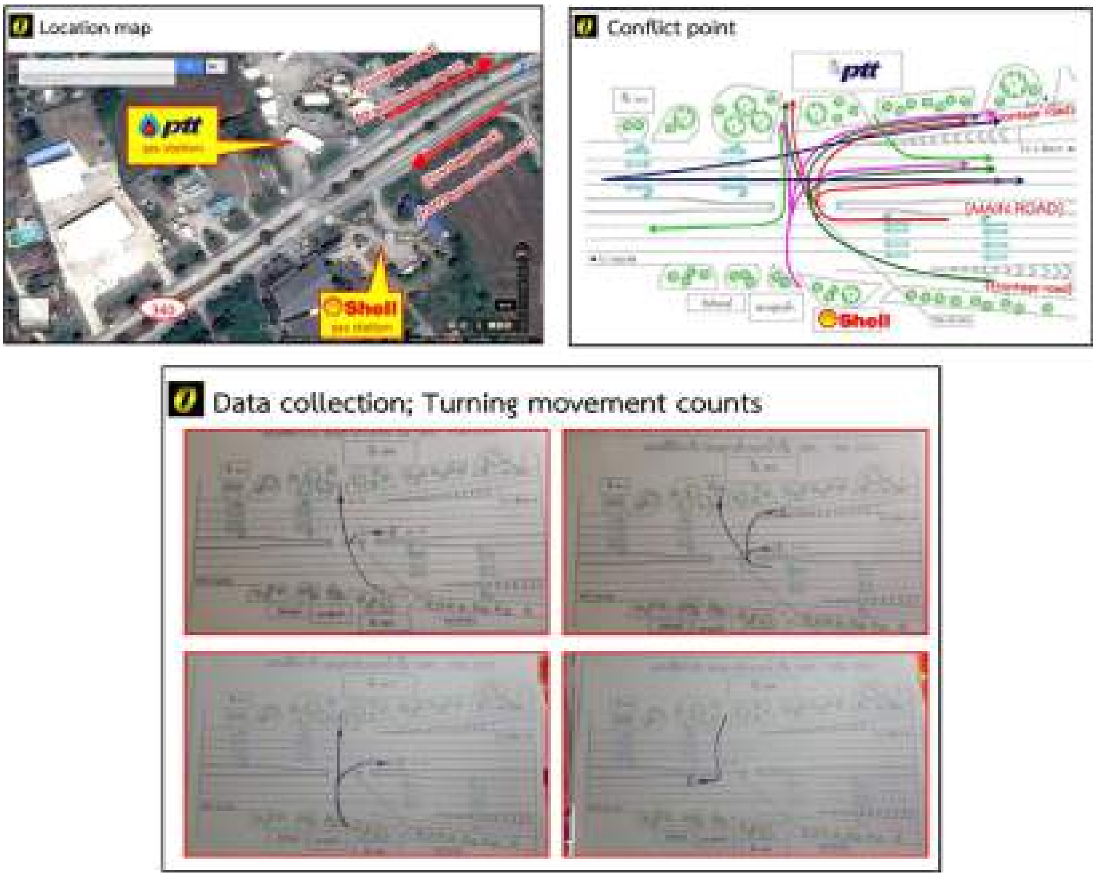



Figure 8-23 Physical characteristics of Median Opening

(from 65+400 km to 65+600 km) in front of PTT Station

As shown in Figure 8-24, the Suphan Buri 1 Highway District improved this situation by closing the original U-turn and allow the next U-turn at an appropriate distance.


Figure 8-24 Closing the original U-turn place and opened the next U-turn place at the road section from 65+400 km to 65+600 km in front of PTT gas station

**(5) AREA 5: Median Opening (from 68+950 km to 69+150 km: Tesco Lotus)**

**(6) AREA 6: Median Opening (from 69+830 km to 69+950 km: Suphan-Malaiman)**

**(7) AREA 7: Median Opening (from 70+970 km to 71+200 km: Exit to Old 340)**

All three areas are urban roads—special 10-lane main roads that are 10.50 meters wide on each side (three traffic lanes) and 5–15 meters wide in the middle, and parallel roads with 7.00 meters on each side (two traffic lanes) with pedestrian paths on both sides. Since the U-turn place, the entrance to the highway from a parallel road, and the exit from the highway to the parallel roads are located near those areas, traffic accidents used to occur between vehicles driving on a parallel road and those on a highway, as shown in Figure 8-25.


Figure 8-25 Median Opening

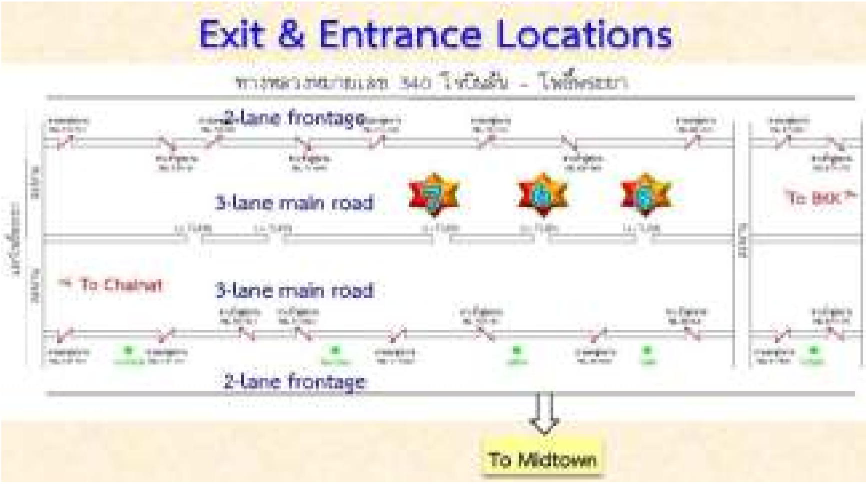



Figure 8-26 Physical characteristics and accident pattern of the area 5-7

As shown in the example in Figure 8-25, the Suphan Buri 1 Highway District office set up CCTV to collect traffic volume statistics and found that many drivers violated traffic regulations in many forms.


Figure 8-27 Recorded driving behavior violating traffic rules on the national highway route No.340

To prevent vehicles from driving in the designated lane and avoid inflow at the outflow section, we implemented an improvement measure by placing a concrete barrier along the lane at the exit of the highway. In order to analyze how effective this improvement was in preventing traffic regulation violations, we investigated and compared before and after the implementation to find solutions to further problems. Details are shown in Figure 8-28.

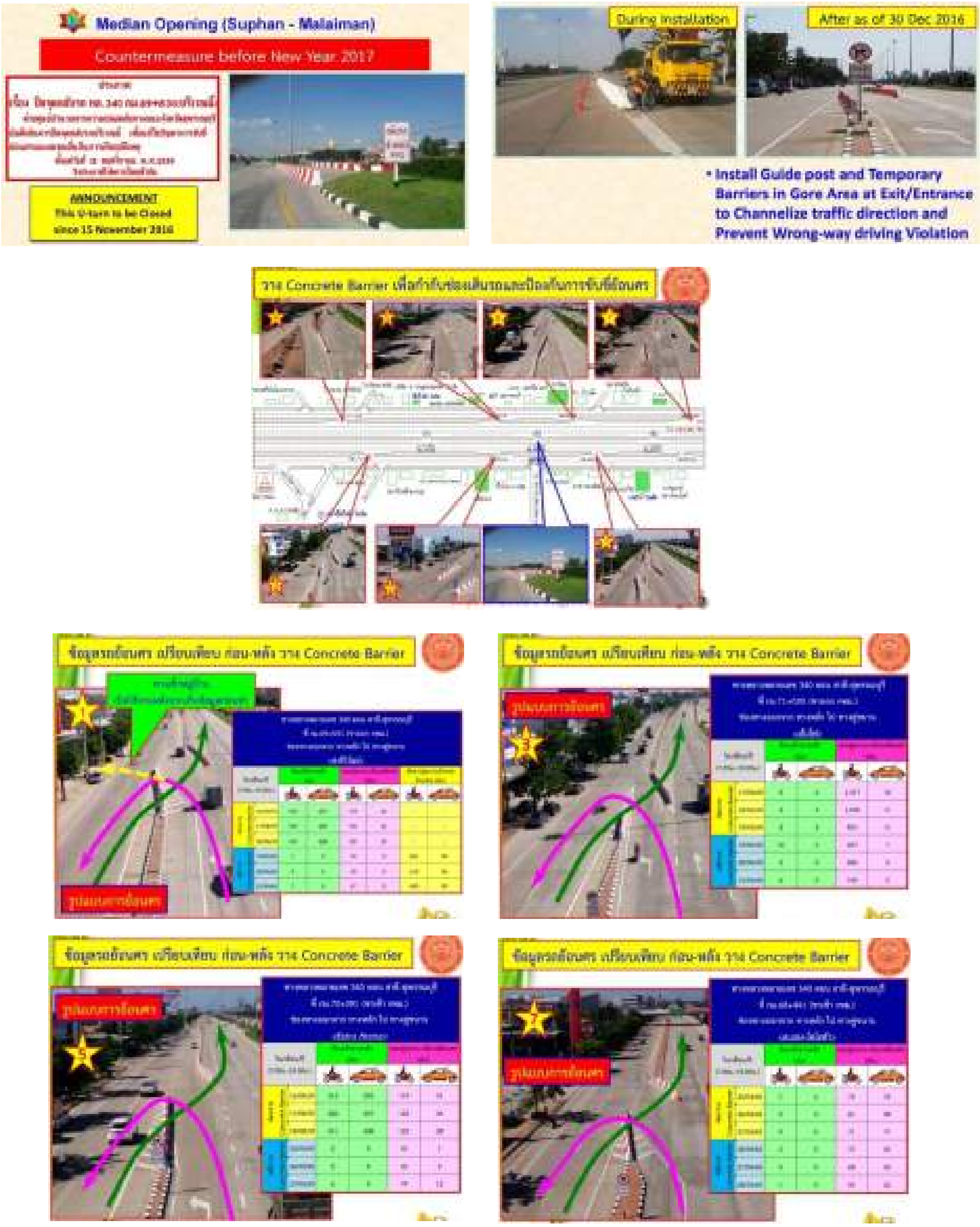



Figure 8-28 Concrete barrier to drive in the designated traffic lanes and comparison of a vehicle in violation of traffic regulations before and after implementation

The driving pattern shown in Figure 8-29 is a traffic rule violation found after placing a concrete barrier.


Figure 8-29 A violation of traffic rules after placing the concrete barrier

Comparing the number of vehicles that violated traffic regulations before and after the installation of the concrete barrier, it can be concluded that this measure was effective in forcing the vehicle to travel in the designated lane. However, some vehicles did not comply with traffic regulations after the installation, which requires increased policing and providing knowledge, understanding, or searching for alternative routes within the community connected to the highway. The seven areas introduced are the model areas where measures were implemented from 2016 to the end of 2018 on the section of Sali-Suphan Buri of highway 340 (from 48+841 km to 78+341 km, distance 29.5 km). In these areas, several risk factors have been reduced.

In addition to the measures in the above seven areas, the following two safety devices are examples of effective measures for driving in the designated lane:

**(1) Highway 357 (Suphan Buri Ring Road) at the Tha Chin Bridge (Wat Ratsadon)**

Figure 8-30 shows physical characteristics and driving styles violating traffic rules, including statistical data on the number of cars that violate traffic rules, comparing the situation before and after installing the concrete barrier to control driving in the specified traffic lane.

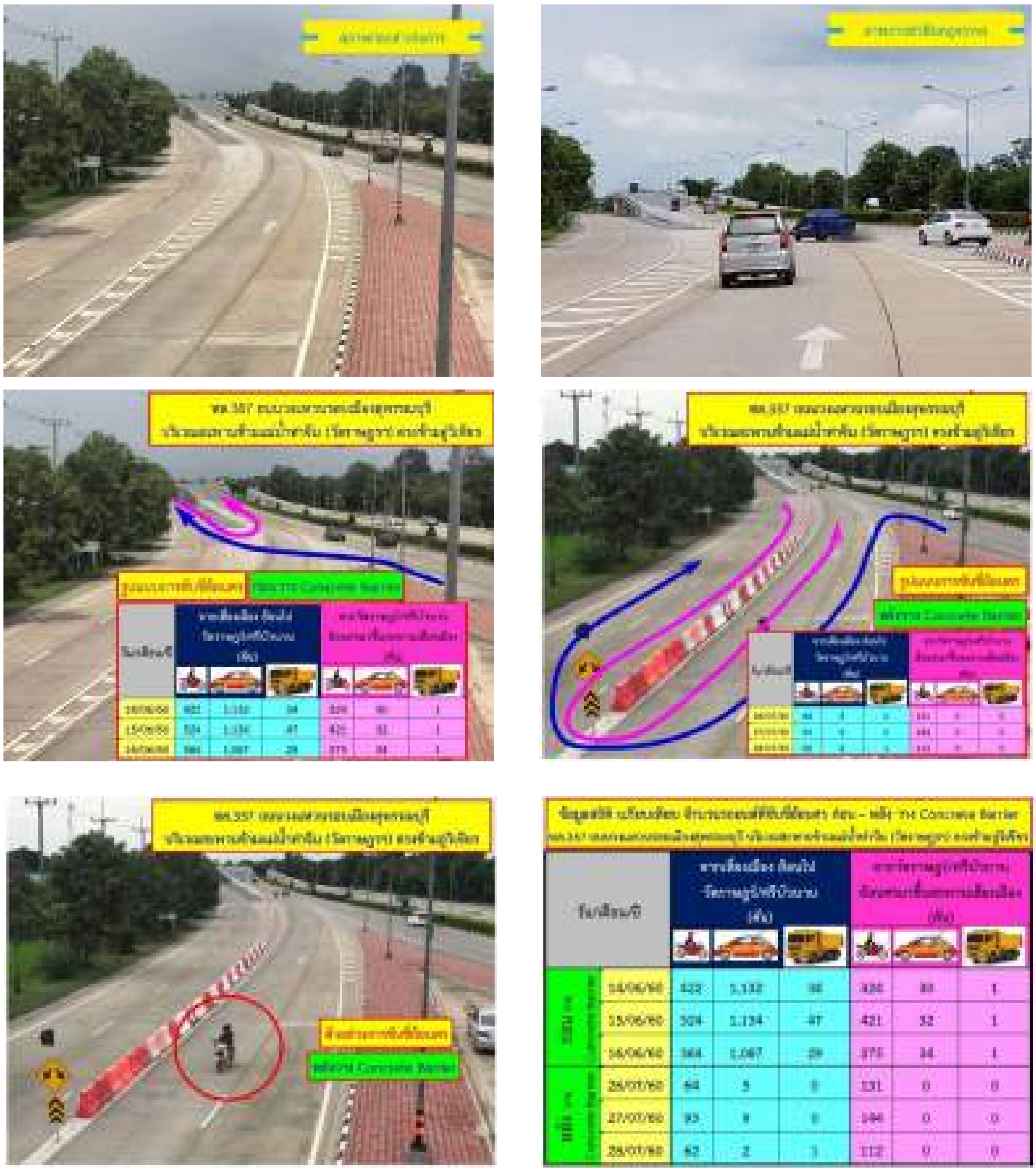


Figure 8-30 Physical features and driving in violation of traffic rules, including statistics on the number of cars in violation of traffic rules, comparing before/after concrete barrier and directing the driver in the designated traffic lane.

### (2) Highway 321 (Malai Man Road) at Suan Tang Market

Figure 8-31 and Figure 8-32 show physical characteristics and driving styles violating traffic rules, including statistical data on the number of cars that violate traffic rules by comparing befor and after the installation of the concrete barrier to control driving in the specified traffic lane.

Figure 8-31 Concrete barrier

Figure 8-32 Impact of concrete barrier

# 9. Key Points to Analyze Traffic Accidents and Develop Countermeasures

In order to reduce traffic accidents, this guideline explains the process from data collection to the development of countermeasures; however, traffic accident countermeasures rarely solve all problems in a single implementation. It is necessary to fully evaluate the effects after implementing the countermeasures, clarify any remaining or newly generated problems, and keep implementing them continuously.

It is therefore important to be aware of problems on a daily basis—as in the PDCA (Plan, Do, Check and Action) cycle—as key points to analyze traffic accidents and develop countermeasures. The process from data collection to evaluation of countermeasures reflects the PDCA cycle, as shown in Figure 9-1. This cycle has five steps: (1) understanding occurrence of traffic accidents, (2) identification of accident factors, (3) planning of measures, (4) implementation of measures, and (5) evaluation of measures. The details of each step are already described in each chapter. The Kamagaya Model described in Chapter 1 is a successful case in which residents, municipalities, and experts jointly implement traffic safety countermeasures based on this cycle.

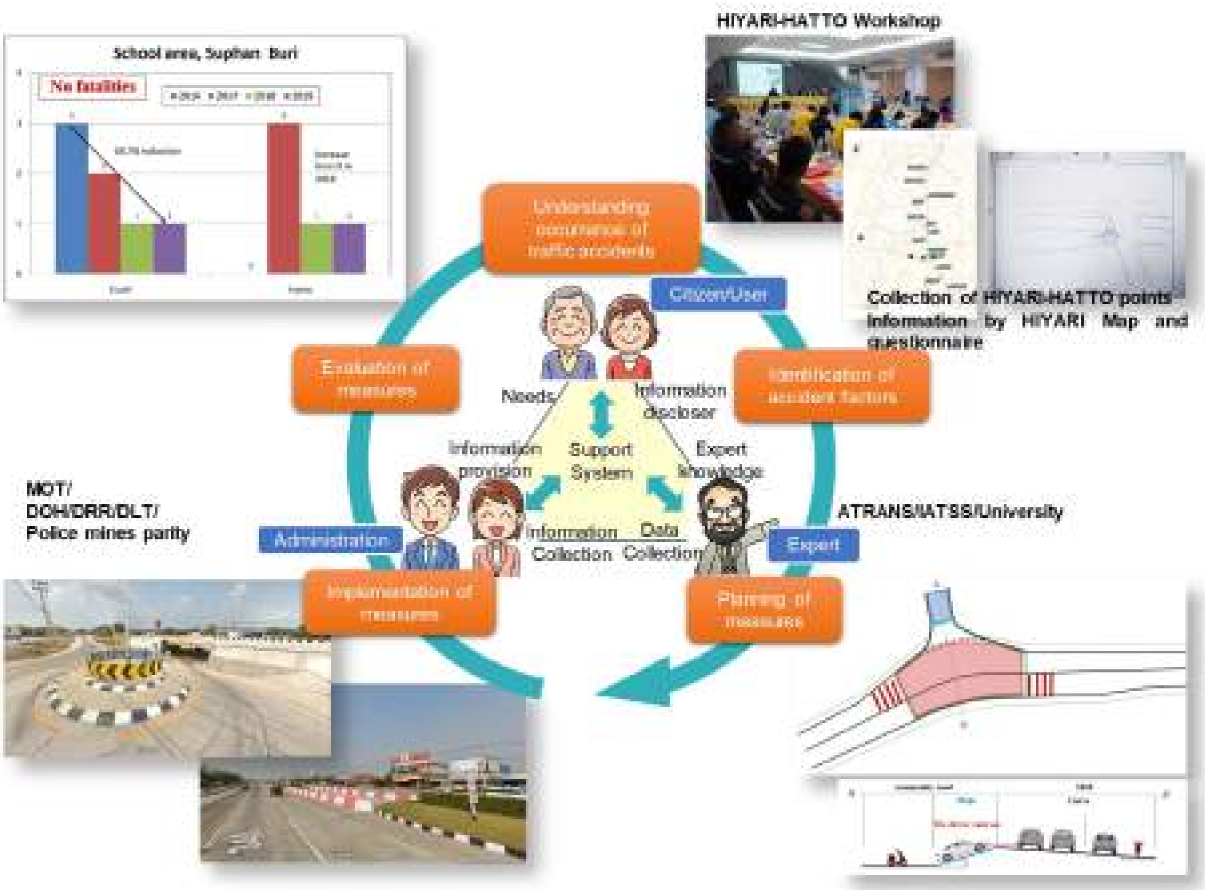



Figure 9-1 PDCA cycle for traffic safety

# Epilogue

This is the second time that I have worked on an IATSS research project on road safety in Thailand. For the first time, a workshop for designing a HIYARI map entitled “Support for traffic safety measures in Thailand” was held for three years from 2005. At that time, it aimed to promote traffic safety activities at the community level and worked in many urban communities such as Chiang Mai, Khon Kaen, Udon Thani, and Samat Prakan as well as high schools and junior high schools. At that time, Dr. Makoto Okamura, a victim of the terrorist attacks in Dhaka, was a student and worked enthusiastically with Dr. Tuenjai Fukuda and other students at Nihon University and Khon Kaen University. In three years, we have noticed an increased interest in road safety in these areas.

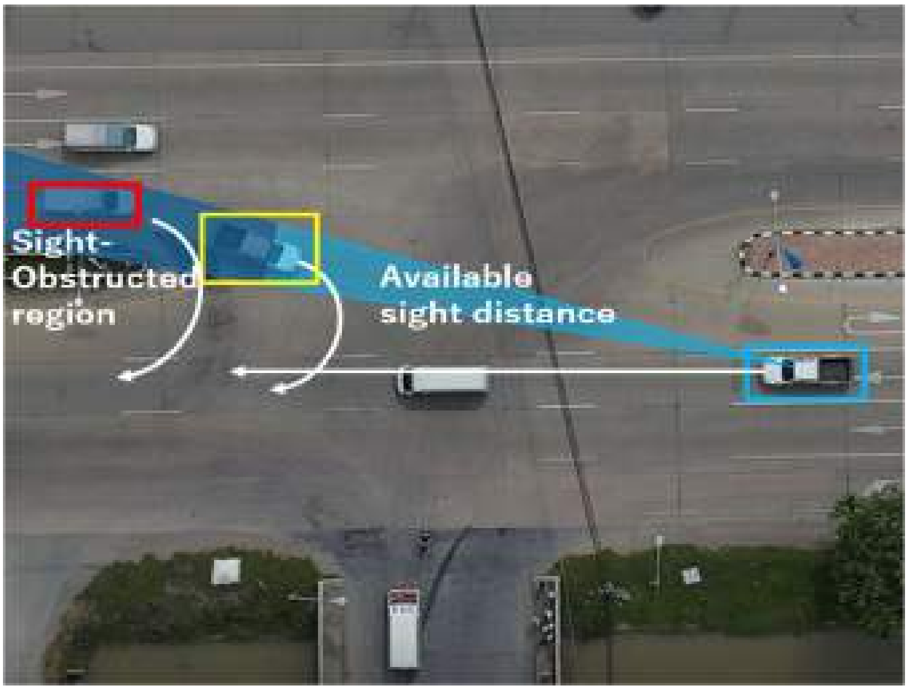
Now, about ten years later, our activity was conducted in cooperation with the community as well as the government and it led to more specific measures. Although our efforts are quite limited, we believe that we could help reduce traffic accidents in Thailand by applying the successful traffic safety information support system in Kamagaya City in Japan to Thailand. The analysis in this project primarily depends on the experiences of an Emeritus Professor Kunimichi Takada, Professor Hirokazu Akahane, Professor Satoru Kobayakawa, and others who have managed the Kamagaya Model as well as the experiences of Mr. Hisao Akiyama, Dr. Yasushi Nishida, Mr. Seiya Tazawa, and others in Japan and other Asian countries. These guidelines incorporate the wisdom and thoughts of many members. In addition, our activities were coordinated with traffic safety workshops by the Japanese Ministry of Land, Infrastructure, Transport, and Tourism and the Ministry of Transport of Thailand. In the future, we hope that JICA’s traffic safety project will make use of our achievements.

# Appendix

## A1. Measuring the risk of collision during turning movements using aerial videos

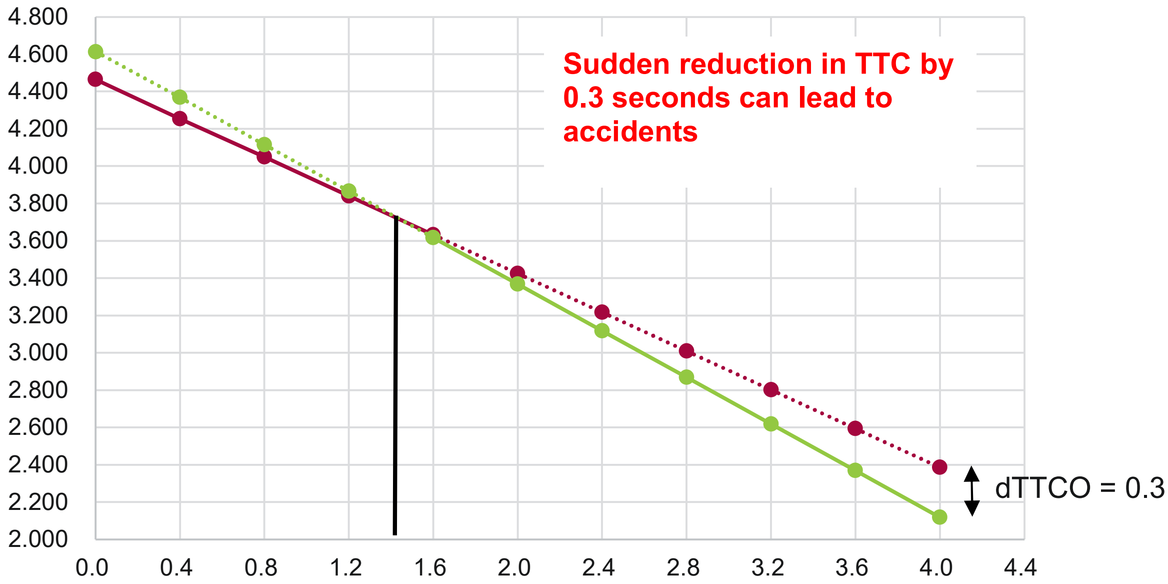
With the advent of drones and high-resolution video cameras, recording traffic activity has become quite accessible. Particularly, monitoring intersections using aerial videos captured by drones allows us to study the various aspects of traffic—especially in Thailand, where vehicles not following designated lanes and making right turns and U-turns on highways pose serious challenges.

A large proportion of crashes at non-signalized intersections on high-speed rural expressways lead to fatal and serious injuries. These crashes are generally right-angle crashes caused either due to (a) vehicles arriving from a minor road turning right by crossing one or more lanes of the expressway or (b) vehicles making a U-turn. Both these turning maneuvers result in conflict with the thoroughfare high-speed traffic on the expressway. Adding to the severity of these crashes are smaller vehicles, such as cars and motorbikes that are occluded by larger vehicles and hence fall in the blind spot of oncoming vehicles. The blind spots reduce the available sight distance leading to poor gap selection, which in turn causes HIYARI-HATTO experiences and accidents.



Cause of vehicle crashes at U-turn

TTC is much simpler as it measures the time required for two vehicles to collide if they continue at their present speed and on the same path. However, TTC can only be used to quantify the collision risk between two vehicles. This makes it unsuitable for the types of interactions where more than two vehicles are involved in a HIYARI-HATTO scenario. Hence, we propose a measure called dTTCO (difference in TTC after Overtaking) that extends the concept of TTC in the context of three vehicles when the vehicle in the blind spot overtakes the occluding one, which can lead to potential collision. We evaluate the effectiveness of dTTCO using the aerial videos of different rural expressway and minor road intersections in Suphan Buri. Our obtained value of dTTCO shows that accidents increase due to the sudden appearance vehicles in blind spots.




Relationship of TTC between vehicles

## A2. Report of the HIYARI Map Development Workshop in Suphan Buri

Workshop on community-based road safety at Suphan Buri Province
on August 19, 2017 at Tah-Radhad District Meeting Hall, Suphan Buri

Explanation about HIYARI-HATTO

Creation of HIYARI Map

Understanding HIYARI locations

Field survey

Group photo

Second workshop on community-based road safety at Suphan Buri Province
on January 20, 2018 at Suphan Buri


Answering questionnaires


Explanation about HIYARI-HATTO

Creation of HIYARI Map

Group photo

Third workshop on community-based road safety at Suphan Buri Province
on August 28, 2018 at Ban Don District Meeting Hall, Suphan Buri

Explanation about HIYARI-HATTO

Answering questionnaires

Understanding HIYARI locations

Field survey

Group photo

Fourth workshop on community-based road safety at Suphan Buri Province
on March 6, 2019 at Suphan Buri

Field survey

Fifth workshop on community-based road safety at Suphan Buri Province
on August 27, 2019 at Suphan Buri


Explanation about HIYARI-HATTO


Explanation about “HIYARI-HATTO”

Answering questionnaires

Creation of HIYARI Map

# A3. Workshop on community-based road safety at Suphan Buri Province

In cooperation with ATRANS, Suphan Buri Highway District 1, DOH, and Suphan Buri Provincial Police
August 19, 2017 at Tah-Radhad District Meeting Hall, Suphan Buri

## Background

Thailand was ranked as having the second highest road fatality in the world according to the WHO. The major causes of road fatalities are speeding, drunk driving, drowsiness, and reckless driving, respectively, and most accidents occurred in rural and local roads. Raising awareness in communities is vital to road safety activities; this project selects Suphan Buri as study area because of the readiness of the local authority and willingness of the local community to participate in workshop activities.

## Objectives

- To understand the relations between community, daily travel behavior, and black spot location in Suphan Buri;
- To encourage community participation in identifying HIYARI spots and black spots;
- To propose countermeasures for road safety not only by improving road design and traffic control instruments but also by reducing conflict in nondaily life;
- To propose appropriate schemes for road safety measures not only to public sectors but also local communities in Thailand by comparing experiences with Japan and Malaysia.

## Method

| **1.** | **Target participants** | **-Local authority, i.e., DOH, DRR, DLT, Police, DDMP, MOPH, NGOs = 10 persons**<br>**-Municipality and community from Tah-Rahad and Tonh-Kham districts = 30 persons** |
|---|---|---|
| **2.** | **Number of participants** | 40 persons |
| **3.** | **Workshop date, during and venue** | August 19, 2017 during 10 AM–5:30 PM at Tah-Radhad District Meeting Hall |
| **4.** | **Workshop activity** | 4.1 Face-to-face communication method<br>4.2 Self-introduction of participants<br>4.3 Pre-workshop questionnaire<br>4.4 Provision and presentation of knowledge and information on road safety with the exemplifying case of the “Kamagaya Model” by Japanese experts<br>4.5 Presentation on how to identify HIYARI (HIYARI-HATTO incidents) spots and black spots by Japanese expert<br>4.6 Training on HIYARI spots and black spots identification on the questionnaire provided<br>4.7 Training on how to use ATRANS Safety Map Application by ATRANS member<br>4.8 On-site survey on identified HIYARI spots and black spots (time permitting) |

Continued:

| **4.** | **Workshop activity** | **4.9 Group discussion on analysis of the identified HIYARI spots and black spots**<br>**4.10 Comments and recommendations from Japanese experts**<br>**4.11 Evaluation of the workshop** |
|---|---|---|
| **5** | **Equipment for Workshop** | 5.1 Overhead projector and screen<br>5.2 Wi-Fi Internet<br>5.3 Microphone and wireless microphone |
| **6** | **Distributed materials** | 6.1 PPT presentation of speakers<br>6.2 Cognitive maps of A0 size = 3 sheets and A3 size= 40 sheets<br>6.3 Manual of HIYARI spot identification<br>6.4 Manual of Safety Map Application<br>6.5 Program of workshop<br>6.6 Questionnaire |
| **7** | **Workshop meeting package & provision** | 7.1 2 Coffee breaks for Suphan Buri participants and WS organizing staff (40+20=60 persons)<br>7.2 Lunch boxes for Suphan Buri participants and WS organizing staffs (40+20=60 persons) |
| **8** | **Language** | The workshop will be conducted in Thai and an interpreter will be available for the Japanese experts |

## rticipants from the Project Team

| Project Team | ATRANS | IATSS | MEXT |
|---|---|---|---|
| **Prof. Atsushi Fukuda** | Dr Tuenjai Fukuda | Mr Toru Yoshihara | Three representatives |
| **Prof. Kunimichi Takada** | Mr Pongsakorn | | |
| **Prof. Satoru Kobayakawa** | Ms Narisara | | |
| **Dr Yasushi Nishida** | Ms Suwishada | | |
| **Four students, Nihon U.** | | | |
| **Thai staff: Ms Rattanaporn** | | | |
| **Interpreter: Thai-Japanese-Thai** | | | |

## Research work activity before and after workshop

1) Analyzing road accidents based on traffic accident data from DOH
2) Input HIYARI-HATTO information, which will be obtained at the WS by using ATRANS Safety apps.
3) Develop the daily activity of the community and identify courses of road accidents.
4) Develop recommendations for road safety activities based on results in (1)–(3).
5) Develop recommendations for the scheme.
6) Develop the report under the title “Safety Community in Suphan Buri.”

## Workshop Schedule and Program

| Time | Program |
|---|---|
| **9:30 – 10:00** | Registration |
| **10:00 – 10:05** | Opening Address by Atsushi Fukuda |
| **10:05 – 10:15** | Traffic Situation and Road Accident in Suphan Buri<br>(road safety activities and their impact during New Year and Songkran in Suphan Buri)<br>By Pol.Col. Somdech Kasemsukh, Superintendent of Investigation, Suphan Buri Provincial Police |
| **10:15 – 10:30** | Road Accidents and Black Spot Treatments in Suphan Buri<br>(road safety activities and their impact during New Year and Songkran in Suphan Buri)<br>By Mr Jatupon Thepmungkorn, Director of DOH Sub-District 1 |
| **10:30 – 10:50** | Coffee break |
| **10:50 – 11:20** | Community-Based Road Safety Activities: Introduction to the Kamagaya Model<br>By Prof. Satoru Kobayakawa, Nihon University |
| **11:20 – 11:30** | Road Safety Culture in Thailand and HIYARI Spots and Black Spots Identification in the Community<br>By Dr Tuenjai Fukuda, ATRANS and Nihon University |
| **11:30 – 12:20** | Step of HIYARI Map Development<br>-Firstly, participants identify HIYARI-HATTO places on the cognitive map by using stickers.<br>-Secondly, participants draw 2 or 3 HIYARI-HATTO cases.<br>-Thirdly, participants draw the origins, destinations, routes, modes, etc. of daily activities such as commuting, shopping, and others on the sheet provided. |
| **12:20 – 13:00** | Luncheon (lunchboxes provided to all participants) |
| **13:00 – 13:30** | Report of HIYARI-HATTO situations and daily activities from the community<br>(participants explain HIYARI-HATTO situations at potential black spot places and the relationship with their daily activities in front of other participants) |
| **13:30 – 14:30** | Utilizing technology for mapping HIYARI and black spot locations: ATRANS Safety Map Application<br>By Mr Sarayut Julkaew, ATRANS Project member |
| **14:30 - 16:00** | On-site observation and survey of the three identified HIYARI and black spot locations |
| **16:00 – 17:00** | Group discussion on the analysis of three identified HIYARI and black spot locations and presentation |
| **17:00 – 17:25** | Comments and recommendations by Japanese experts – Prof. Takada and Dr Nishida |
| **17:25 – 17:30** | Group photo and closing remarks |

## A4. Data used for accident analysis

แบบสอบถามเรื่อง "การระบุจุดเสี่ยงจากอุบัติเหตุจราจรทางถนน (ชิซาริโมเดล)"

แบบสอบถามนี้เป็นส่วนหนึ่งของโครงการวิจัยเรื่อง
"บทเรียนอุบัติเหตุทางถนนในประเทศไทยและการนำกิจกรรมความรู้ด้านความปลอดภัยทางถนนที่มีประสิทธิภาพของญี่ปุ่นมาประยุกต์ใช้"

ส่วนที่ 1 ข้อมูลส่วนตัว

1.1 ชื่อ-สกุล.................................................................................................

1.2 เพศ ☐ 1)ชาย ☐ 2)หญิง

1.3 อายุ.............ปี

1.4 อาชีพ

☐ 1) ไม่ได้ทำงาน ☐ 2) ข้าราชการ ☐ 3) พนักงานรัฐวิสาหกิจ

☐ 4) พนักงานบริษัท ☐ 5) อาชีพส่วนตัว เช่น ค้าขาย ☐ 6) นักเรียน/นักศึกษา

☐ 7) รับจ้างรายวัน ☐ 8) ขับรถสาธารณะ ☐ 9) ครู/อาจารย์

☐ 10) นักวิจัย ☐ 11) อื่น ๆ (ระบุ)..............................

1.5 ท่านมีใบอนุญาตขับขี่ประเภทใด (ตอบได้มากกว่า 1 ข้อ)

☐ 1) รถจักรยานยนต์ตลอดชีพ ☐ 2) รถยนต์ 1 ปี ☐ 3) รถยนต์ 5 ปี

☐ 4) รถยนต์ตลอดชีพ ☐ 5) อาชีพส่วนตัว เช่น ค้าขาย ☐ 6) อื่น ๆ (ระบุ).................

1.6 ครอบครัวท่านมีรถประเภทใด

☐ 1) ไม่มี ☐ 2) รถจักรยาน.........คัน ☐ 3) รถจักรยานยนต์.........คัน

☐ 4) รถยนต์เก๋ง.........คัน ☐ 5) รถกระบะ...........คัน ☐ 6) อื่น ๆ (ระบุ)........................คัน

1.7 ส่วนใหญ่ท่านเดินทางในแต่ละวันด้วยยานพาหนะประเภทใด

☐ 1) เดินเท้า ☐ 2) รถจักรยาน ☐ 3) รถจักรยานยนต์

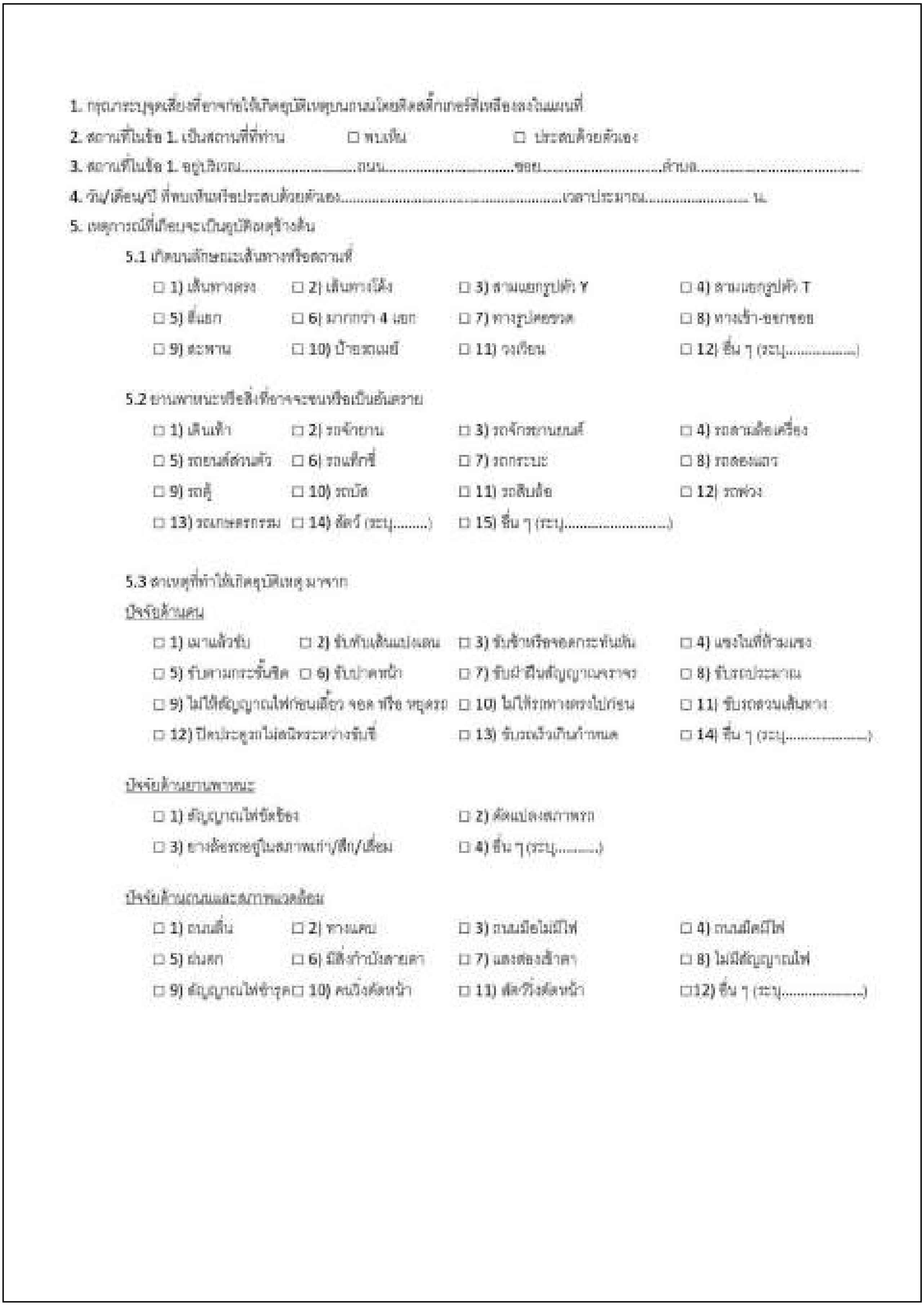
☐ 4) รถยนต์ส่วนตัว (เก๋ง) ☐ 5) รถยนต์ปิคอัพส่วนตัว ☐ 6) รถแท็กซี่

☐ 7) รถขนส่งสาธารณะ (สองแถว/สามล้อ/ตุ๊กตุ๊ก)

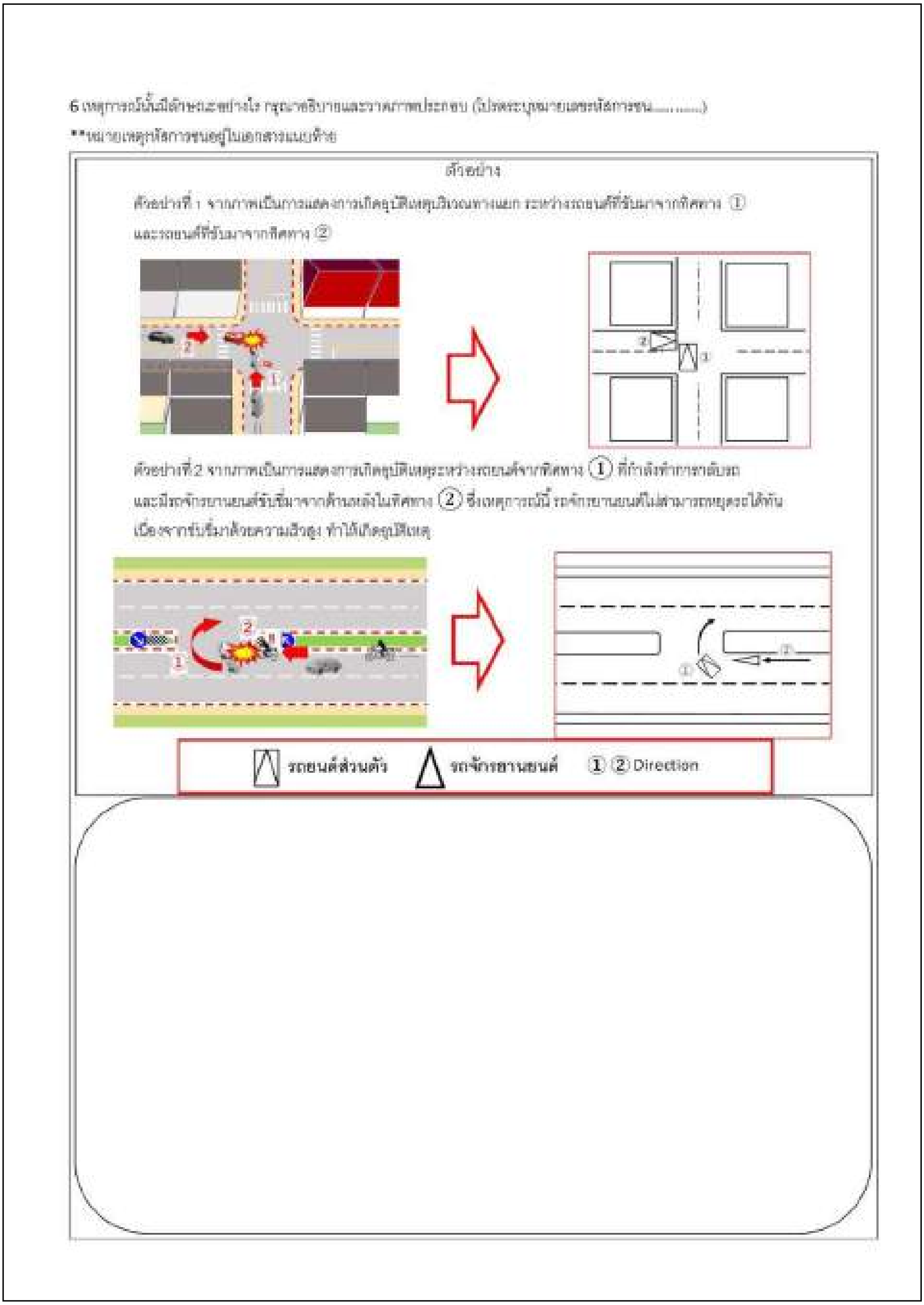
1.8 ส่วนใหญ่ท่านเดินทางอย่างไรไปทำงาน/ไปเรียน (ให้เลือกประเภทยานพาหนะด้านล่าง)



Questionnaire sheet



Questionnaire sheet



6 เหตุการณ์นั้นมีลักษณะอย่างไร กรุณาอธิบายและวาดภาพประกอบ (โปรดระบุหมายเลขรหัสการชน..........)

**หมายเหตุรหัสการชนอยู่ในเอกสารแนบท้าย

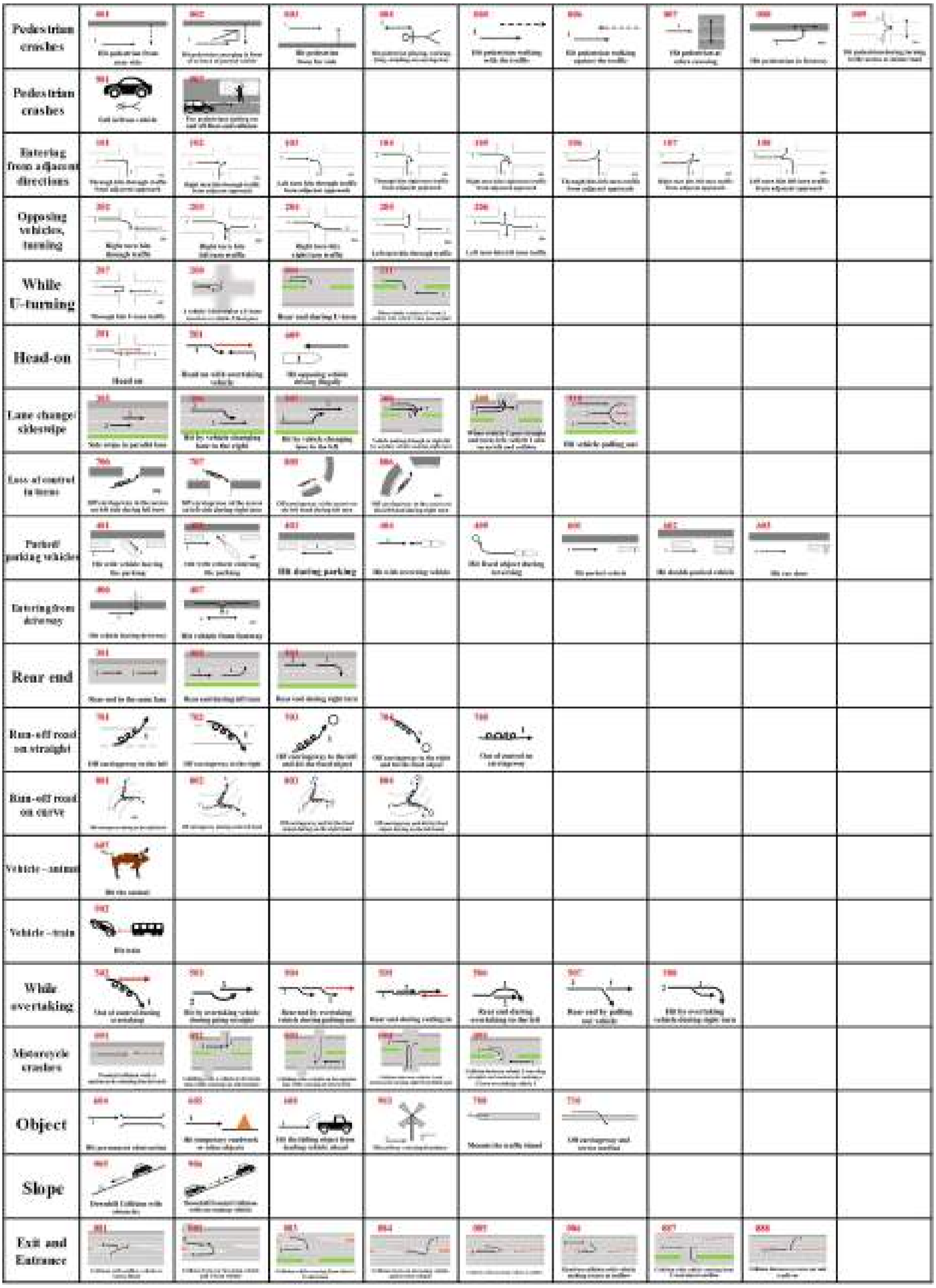
ตัวอย่าง

ตัวอย่างที่ 1 จากภาพเป็นการแสดงการเกิดอุบัติเหตุบริเวณทางแยก ระหว่างรถยนต์ที่ขับมาจากทิศทาง ① และรถยนต์ที่ขับมาจากทิศทาง ②

ตัวอย่างที่ 2 จากภาพเป็นการแสดงการเกิดอุบัติเหตุระหว่างรถยนต์จากทิศทาง ① ที่กำลังทำการกลับรถ และมีรถจักรยานยนต์ขับขี่มาจากด้านหลังในทิศทาง ② ซึ่งเหตุการณ์นี้ รถจักรยานยนต์ไม่สามารถหยุดรถได้ทัน เนื่องจากขับขี่มาด้วยความเร็วสูง ทำให้เกิดอุบัติเหตุ



Questionnaire sheet




Modified collision diagram

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Road Traffic Safety Guideline Suphan Buri

The Research Report for IATSS Social Contribution Project 1920, March 31, 2020

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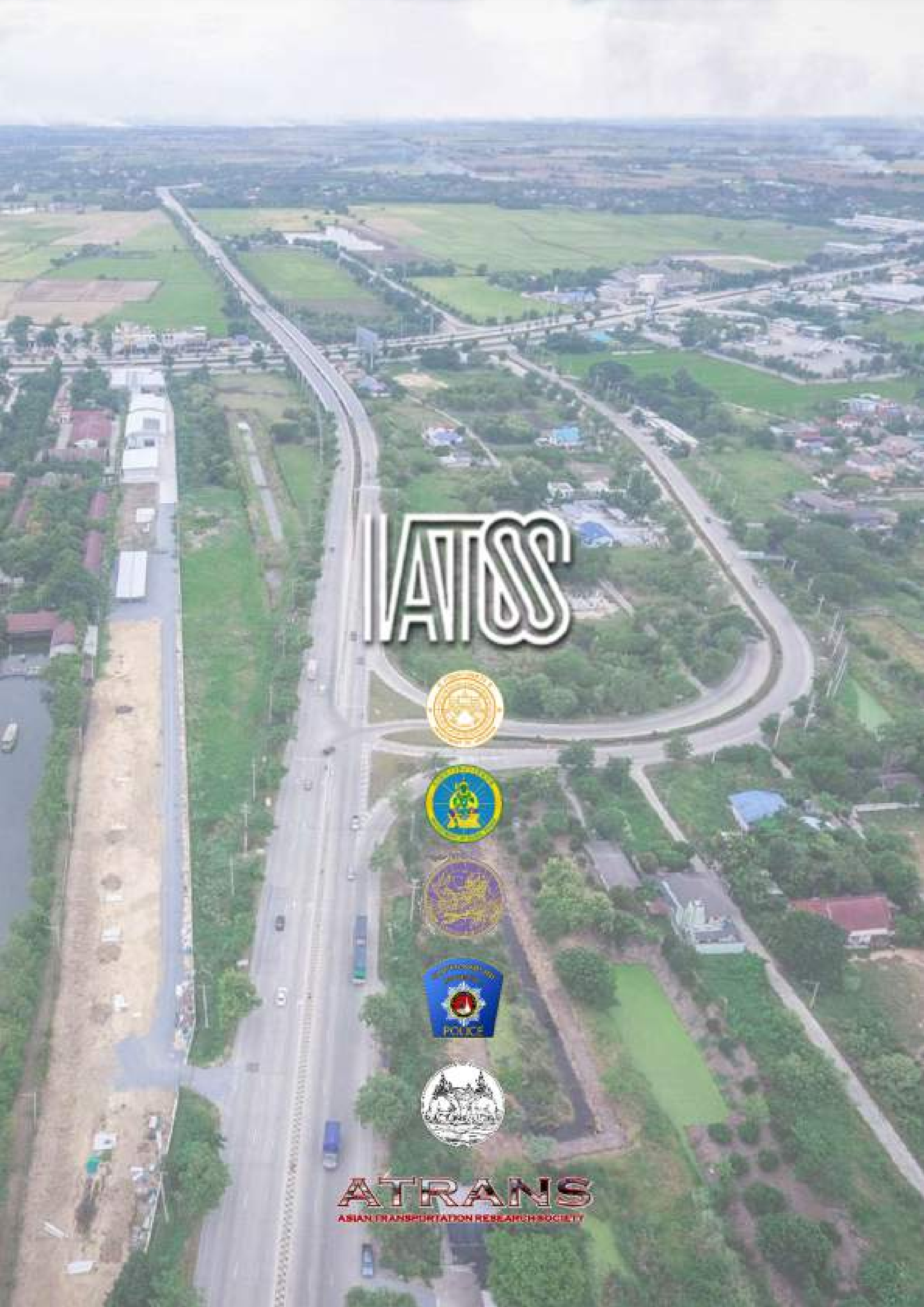
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