# CONFLICT TECHNIQUE APPLIED TO TRAFFIC SAFETY ON THE MODEL CORRIDOR OF HA NOI 

## Trinh Thuy ANH

Lecturer.
University of Transport and Communication.
Department of Transport - Economics
Address: Caugiay, Ha Noi, Vietnam
Tel: 844 7842346; Mobile: 84903439643
Email: [thuyanh@yahoo.com](mailto:thuyanh@yahoo.com)
Prof. Dr. Nguyen Xuan DAO
Vietnam Road and Bridge Association
Ministry of Transport.
Mobile: 0912042588
Email: [nxd310@yahoo.com](mailto:nxd310@yahoo.com)

Trinh Tu ANH

Lecturer.
University of Transport and Communication.
Department of Transport - Economics
Address: Caugiay, Ha Noi, Vietnam
Tel: 84-4-7842346; Mobile: 84912258919
Email: <tuanhxd @ yahoo.com>


#### Abstract

Traffic accidents in Vietnam is the hot problem today in terms of increasing alarming growth rate and severity level compared to other countries. More than ever, there is an urgent need of implementing a pilot program to examine a black spot in a dangerous road as a starting point of improving a whole network.

Conflict technique is the most suitable and useful method applied in traffic safety audit of a road network to reveal type and reason of a conflict and accident, especially in case of lacking historical data. This paper aims to apply conflict technique on the national highway No. 5 - the most dangerous corridor of Hanoi. The conflict technique works best in combination with interviews of road-users. In the paper, interviews of drivers and inhabitants were conducted to investigate road-user's behavior. Base on that, holistic solutions should be proposed that really give the desired changes in behavior.


Key word: Conflict technique, Road safety, Traffic accident, Black spot, Time to accident.

## 1. INTRODUCTION OF TRAFFIC SAFETY IN HANOI

Hanoi is the capital, cultural, political and economic center of the Socialist Republic of Vietnam. Recent years, rapidly increasing number of motorcycles in Hanoi has caused many negative consequences such as traffic congestion and accidents. Traffic accident is the hot problem today.

Transportation infrastructure and public system has not been developed to meet the big travel demand of Hanoi. People usually use motorcycle for their daily trip, recently years from 1995 up to now, number of motorcycle in Hanoi has been increased at the growth rate of $15-20 \%$ per year. Therefore, most accidents involve motorcycle drivers.

Traffic accidents on Hanoi is very high, refer figure 1 for road traffic accidents in Hanoi.


Figure 1. Road Traffic Accidents in Hanoi in Recent Years
Figure 2 shows the analysis of cause of serious traffic accidents. Speeding and careless driving are the most significant causes; the next is careless crossing or passing; changing direction is the least reason of accidents. All are going to dramatically reduced. However, other reason occupied a large proportion, and going to increase again.


Figure 2. Analysis of Serious Traffic Accidents by Causes
Data analysis from traffic police reveal the main cause of accidents due to bad travel behavior of road-users, under-condition of increasing number of vehicles, poor transport facilities and infrastructure, poor transport management of concern government agencies.


Figure 3. Analysis of Serious Traffic Accidents by Time of a Day

Figure 3 shows proportion of serious accidents in 2001 by time of a day. According to the data, highest proportion of traffic accidents at night time but not peak hours. The reason is on night time, few traffic volume on the road usually let drivers speeding up, then a lot of accidents happened this time. For peak hours, many traffic policemen assigned on the road, then people is more concentrated on following traffic law, accidents is less.

## 2. METHODOLOGY

### 2.1. Conflict technique

Conflict technique is a most modern and appropriate method applied to investigate and audit the safety in traffic. This method aims to find out the most traffic behavior of road-users. The technique has been refined through the years (from 1970 as invention by General Motors in the US) and its applicability is large - not only in motorized countries but even in developing countries worldwide, primarily in urban areas.

The technique enables us to study "hazards" in traffic in an uncomplicated way. We can judge whether the site is dangerous after only three to five days of conflict studies, and if so, propose suitable countermeasures. It is better than waiting three to five years for sufficient statistic data.

The technique was conducted by observation at the site and camera taking of traffic flow at black spot on certain duration of time. The objectives of the conflict technique are:

- to identify characteristic of accidents at the black spot including collision type, numbers of vehicle involved, vehicle type, severity, time, weather, causes of the accidents.
- to observe vehicle and pedestrian maneuvers at the black spots.
- To calculate time to accident to evaluate whether a collision is potential dangerous or not

Conflict survey form for description of position, time, weather, type of vehicle, type of reaction, distance to collision point, conflict level, type of conflict, direction of move, type of move, etc. were established by direct and continuous observation on certain time at specific area. Then types of conflict were marked in a conflict diagram and dangerous movements of road users were constructed in a dangerous movement diagram. Based on distance to collision point, time to accident was calculated to define whether a collision is a potential accident or not.

The conflict technique works best in combination with other method, in the paper interview survey with road-user were conducted.

### 2.2. Interview survey

The interview survey includes 2 components: driver interview survey and inhabitant survey. The objectives of the interview survey are to identify:

- characteristic of motorcycle driver in terms of sex, age, occupation, years of driving experiences, etc.
- characteristic of accidents involved location, time, collision type, etc.
- people's awareness of traffic safety


### 2.3. Selected area for study

## A. Selection of a model corridor of Hanoi

The National Highway No. 5 (NH5) was selected as the model corridor to investigate traffic safety condition those could represented for Hanoi. NH5 has its important function of connecting the two cities Hanoi and Haiphong, is considered as one of the most dangerous road of Hanoi in recent years. Huge traffic flow causes unsafe movement of vehicle in the road, there were 1782 traffic accidents in NH5 for 5 years (1998-2002).
The length of the selected road for the survey is in Hanoi area, from Km 0 to Km 12.
B. Selection of black spot on a model corridor

Reviewing of statistic data in combination with interviews of inhabitants who were living around NH5 shows three black spots Saidong intersection, Vuxuanthieu intersection and SuiBattrang intersection are the most dangerous points and need to focused study. However, due to scope limitation, result of conflict technique application at Saidong four-leg intersection was presented in the paper only.

## 3. REVIEW EXISTING SITUATION OF THE SELECTED MODEL CORRIDOR OF HANOI

### 3.1. Description of existing road condition

The selected segment on NH5 has its complicated characteristics due to rail way along. The width of the road is 28 meters with six lanes of both direction from Km 0 to $\mathrm{Km}(6+700)$ and is narrowed down to 21 meters with four lanes for both directions from $\mathrm{Km}(6+700)$ to Km 12 . Noted that marking is very blear on NH5.

- Most of intersections in NH5 are non-signalized intersections.
- So many entrances to NH5. Most of them are narrow, without road marking and road sign.
- Road sign system on NH5 is very poor with a limited numbers. Before any intersection on NH5, there is only two road signs: pedestrian sign ( 200 m ) and intersection sign ( 100 m ). However, these signs are all located on the right side, some sign is behind the tree. Therefore it is difficult for truck and car drivers who running at a high speed on the left lane.


### 3.2. Description of existing traffic maneuvers of drivers

Huge travel demand and big residential zones and industrial parts located along NH5 create over-crowded traffic flow on the road. Motorized vehicles including cars, trucks, interprovincial buses, and motorcycles running at a high speed on NH5, especially at the intersections. Pedestrian usually crossing the road freely but not on zebra crossing. There are so many entrances to NH5, some are narrow and sloped those cause dangerous movement to vehicles. Motorcycle drivers and bicyclist sometimes taking opposite way for their convenient driving also cause the unsafe in traffic.

### 3.3. Description of existing traffic situation at black spot

Saidong street and Saidong Industrial road crossing NH5 creates this intersection. Numbers of industrial parks and residential areas located around the intersection cause mix raffic with increasing volume of motorcycles, cars, inter-provincial buses, light and heavy trucks,
bicycles, pedestrian crossing NH5. Moreover, a huge vehicle volume between Hanoi and Haiphong make difficult to control traffic at the intersection.

The intersection is non-signalized and no control. Marking on NH5 is very blear, especially no marking on Saidong street and Saidong Industrial road. Saidong street is very narrow ( 7 m width) and very sloped that cause difficult and dangerous for vehicle movement from Saidong street to NH5, especially heavy and long trucks. Beside, there is a school at Saidong street then a lots of pupils driving a bicycle or walking through the intersection at $6.30-7.30 \mathrm{am}$; $11.30-12.30$ am and $4.30-5.30 \mathrm{pm}$. Market meeting at the corner of the intersection on morning time cause many conflicts and accidents.

There is no speed limit lines in front of the intersection both on NH5 and Saidong street and Saidong Industrial road to make reduction of travel speed of vehicles before coming to the intersection. Therefore vehicle going through intersection with a very high speed. No different priority setting for road users on the NH5 and Saidong street and Saidong Industrial road, therefore vehicles from all of directions move freely depend on their skill and ability of driving (see figure 4). Numbers of vehicles stopped on the main road to wait for the train passing is other problem (see figure 5).


Figure 4. Dangerous Movement of a Heavy Truck at Saidong Intersection


Figure 5. Dangerous Waiting of Vehicle on NH5 for the Rail at Saidong

## 4. CONFLICT TECHNIQUE APPLIED TO STUDY A SELECTED BLACK SPOT

### 4.1. Conduct conflict technique

Conflict technique were conducted by camera recording or direct observation of the traffic flow at a certain point. This method requires no complicated equipment and make advantage of simple application in developing countries. The survey were conducted during 3 days observation, from 6 am to 10 pm . Eight observers were divided into 2 shifts ( $6 \mathrm{am} \div 2 \mathrm{pm}$; and $2 \mathrm{pm} \div 10 \mathrm{pm}$ ). Two cameras were located at corners of Saidong intersection.

Conflict technique form was constructed to identify position, time, weather, type of vehicle, trend movement of vehicle, type of conflict, serious level of conflict (see reference A). Then all of this information were marked in conflict diagram and dangerous movement diagram. Based on distant to potential conflict and velocity of vehicle, time to accident were calculated to determine whether conflict is dangerous or not.

### 4.2. Conflict analysis

Total 14 collisions were observed at Saidong intersection. Analysis of collisions as follows:

- Motorcycle were involved in all collisions (100\%) while car and bicycle involved for around $35 \%$ and $28 \%$ of total collisions. Truck and bus were found rarely on traffic conflicts. Motorcycle - motorcycle collisions were $36 \%$ of the total and motorcyclebicycle collisions were $14 \%$ of the total.
- Most of the observed collisions had taking a brake action (one or both of road users) to avoid accidents ( 13 case among the total, occupied $93 \%$ ). One or both of road users in $36 \%$ of collisions ( 5 cases) observed changing direction to minimize the severity of collision while many conflicts ( $43 \%$ of total) had taking no action (even one or both of drivers involved).
- Review on type of traffic collisions: around $29 \%$ of total collisions were crossed - face collisions or perpendicular collisions. Only one case for crossed-same direction collision, same direction hit and opposite-direction hit. No loosing control at Saidong intersection.
- Many collisions observed on the west-east direction ( $44 \%$ of the total) while number of collisions observed on the east-west direction were lesser ( $26 \%$ of the total). There was $19 \%$ and $11 \%$ of total collisions observed in south-north and north-south direction, respectively.
- Many drivers of collision observed were taking turn left (56\%) and the rest were try to go strait (44\%).

Figure 6 and figure 7 show collision diagram and dangerous movement diagram for Saidong intersection. Figure 8 shows traffic volume at the intersection.


Figure 6. Conflict Diagram for Saidong Intersection


Figure 7. Dangerous Movement Diagram for Saidong Intersection


Figure 8. Traffic Volume at Saidong Intersection

### 4.3. Time to accident

Serious conflicts are in the same way as traffic accidents, the result of a breakdown in the interaction between the road-user, environment and vehicle. The necessary evasive action is usually braking, but may also be swerving or acceleration, or a combination of these. The border between serious and slight conflicts was showed in figure 9 .


Figure 9. Serious and Slight Conflict based on Time to Accident
$\mathrm{TA}=$ Time to accident
The time that is remaining from when the evasive action is taken until the collision would have occurred if the road-users had continued with unchanged speeds and directions. The TA-value can be calculated based on estimates of distances D and speed V those are estimated by the conflict observer.

$$
\mathrm{TA}=\mathrm{D} / \mathrm{V}
$$

$\mathrm{D}=$ Distance to potential point of collision.
$\mathrm{V}=$ Speed when the evasive action is taken.


Figure 10. Traffic Safety Analyses based on Conflicts

Among 14 observed collisions, 8 collisions (occupied $57 \%$ of the total) were serious conflict with TA calculated in the following table.

Table 1. Time to Accident Calculated for 14 Observed Collisions

| Collision | Distance to potential point of collision (m) | Speed when the evasive action is taken $(\mathrm{km} / \mathrm{h})$ | Time to accident (seconds) | Type of collision |
| :---: | :---: | :---: | :---: | :---: |
| No. 1 | 6 | 20 | 1.1 | Slight conflict |
| No. 2 | 10 | 50 | 0.7 | Serious conflict |
| No. 3 | 8 | 35 | 0.8 | Serious conflict |
| No. 4 | 20 | 40 | 1.8 | Slight conflict |
| No. 5 | 5 | 20 | 0.9 | Serious conflict |
| No. 6 | 20 | 50 | 1.4 | Serious conflict |
| No. 7 | 10 | 25 | 1.4 | Slight conflict |
| No. 8 | 15 | 40 | 1.4 | Serious conflict |
| No. 9 | 8 | 25 | 1.2 | Slight conflict |
| No. 10 | 10 | 45 | 0.8 | Serious conflict |
| No. 11 | 15 | 30 | 1.8 | Slight conflict |
| No. 12 | 7 | 40 | 0.6 | Serious conflict |
| No. 13 | 8 | 30 | 1.0 | Serious conflict |
| No. 14 | 5 | 15 | 1.2 | Slight conflict |

It is shows that this black spot is very dangerous and need to be improved immediately. Therefore, it is supposed that if no data available, applying conflict technique could reveal a black spot in a simple way.

## 5. INTERVIEW SURVEY OF ROAD-USERS

Questionnaire of traffic safety were distributed mostly for people living in Gialam district and going on NH5 daily who know well about traffic condition and traffic safety in NH5.

Table 2 shows some figures from driver's interview survey.
Most of drivers said they respect to traffic law and regulation, such as driving on the right way, passing the lane legally, right, left or round turning legally, following speed limit, following traffic signal and road marking. Inhabitant respect to traffic law lesser than drivers. However, traffic flow observation on NH5 revealed that people do not pay much attention as they said. Unfortunately, many of drivers ( $44 \%$ ) sometimes over speeding in NH5 mostly because of the felling of good road while time limitation is insignificant reason. People did not recognize that their consciousness of traffic safety is very poor and should be improved.

Many of respondents observed $1-5$ accidents per month. However, inhabitants know more clearly about traffic accidents in NH5 than the drivers. Especially, many of inhabitant (16\%) even said more than 20 accidents per month. Accidents in NH5 are quite seriously because it is mostly involved by cars and motorcycles. According to the result of the interview survey, $36 \%$ of the total observed accidents were death cases, $62 \%$ were heavy injury cases, $43 \%$ were light injury cases, and all were physical damaged. Main causes of accidents were revealed as careless driving ( $70 \%$ ), over speeding ( $50 \%$ ), illegal crossing the road of drivers or pedestrians ( $30 \%$ ). Therefore, people's awareness of traffic law and traffic safety needs to be improved immediately.

Table 2. Interview survey of driver in NH5


People's opinion to improve traffic safety in NH5

| Education/campaign | Enforcement | Road design improvement |
| :---: | :---: | :---: |
| 71\% yes ${ }^{\text {a }}$ | $66 \%$ yes $53 \%$ no | $53 \%$ yes ${ }^{\text {a }}$ |

Source: Result from the interview survey
Traffic enforcement on NH5 is very poor, most of people do not have punishment due to traffic law violation even many violations happened always. Unfortunately, only few could consider it was poor enforcement (14\%) and ineffective traffic policemen (13\%) while many of interviewees thought enforcement was good or fair ( $38 \%$ or $43 \%$ ) and traffic policemen were effective or all right ( $38 \%$ or $43 \%$ ). Inhabitant's assessment was more divergent than drivers. Traffic policemen on NH5 mostly catch truck drivers who carry overweight. Traffic law violation was not considered appropriately. For improving people's traffic behavior, their awareness as well as traffic law enforcement should be focused as the two main aims.

The NH5, a national highway connecting the two big cities in the north of Vietnam: Hanoi Haiphong and has its important function on development process of the north area as well. However, facilities were under international standard. Surprising that most of people did not recognize about that, many from them evaluate traffic safety in NH5 very optimistic. For example, many considered NH5 as traffic safety road or all right (around 55\%), most of them assessed good or all right traffic control (more than $80 \%$ ), most of them though good view for
driving on NH5, many said good traffic condition (50\%) and good traffic signal and lighting on NH5 (81\%).

From interview survey, four main alternatives are selected such as traffic safety education and campaign ( $70 \%$ ); speed limit, especially at high density population areas ( $53 \%$ ); improving road coossing condition for pedestrians and non-motorized drivers (48\%); and traffic law enforcement (38\%).

## 6. COUNTERMEASURES TO IMPROVE THE SAFETY AT THE BLACK SPOT

Conflict technique application at a black spot shows $57 \%$ of collisions are serious conflicts. For future, when Saidong industrial park would be developed more, numerous heavy trucks passing through the intersection may make difficult and impossible for traffic control there. Different-grade intersection would be proposed as the best way for Saidong in the future. At this time, some countermeasures are proposed in order to improve traffic safety at the intersection as follows:

- The left lane is for cars, trucks, and buses only. The right lane (near non-motorcycle lane) is for motorcycles only; while the median lane is proposed for both of car and motorcycle used. Motorcycle-probation sign should be put on the left lane. Marking should be improved on NH5 with a break luminous line is used for separation of lanes. Before the intersection 150 m the luminous break line become luminous continuous line (from stop line).
- Gate way should be added on NH5 (100m far from the stop line) for better information to drivers.
- The rigid median should be constructed as luminous barrier median ( 50 m high) in order to avoid bicycle or pedestrian climbing on the rigid median.
- Speed limit lines should be put on of NH5, Saidong street and Saidong Industrial road NH5 to reduce speed of vehicles before passing the intersection. Speed limit lines on NH5 include 3 speed limit line groups, 7 lines for each group, far from the zebra crossing 30 m , 80 m , and 150 m , respectively. Speed limit lines on Saidong street and Saidong Industrial road far from the stop line 30 m .
- Speed limit sign is going to put on all direction coming to the intersection.
- Road marking should be put on Saidong street and Saidong Industrial road such as flexible median, stop line, road sign, zebra crossing.
- Noted that road sign should be located more on the rigid median for easier looking of car or truck drivers.

Figure 11 show alternatives in road design for improving traffic safety in the selected intersection.

## 7. COUNTERMEASURES TO IMPROVE THE SAFETY ON SELECTED MODEL CORRIDOR: NH5

Result of data analysis, especially causes of accidents reveals that people's awareness should be focused as the first countermeasure to improve traffic safety on NH5. Interesting that is same with the result of answer from interviewees.

The second priority is given to road engineering improvement. The conflict technique shows problems in terms of safety with road design for the model corridor, especially at the selected
intersection. Other intersections are on the same situation then the conflict technique should be applied for road safety audit for a whole NH5.

Enforcement that could be well done after implementing traffic education and road re-design program, should be focused as a major countermeasure to force the safety in NH5. Re-built of black spot, better management and heavy punishment would be in cooperated.


Figure 11. Proposal for Saidong Intersection

## 8. CONCLUSION AND RECOMMENDATION

The conflict technique is used foremost in urban areas for studying sites with traffic signals, round-about, speed humps, etcetera. Moreover, the technique enable us to examine the whole town, not only a few isolated intersections. In the paper, this measuring method help to demonstrate conflicts which resemble accidents by calculating the time to accident. Successful introduce of conflict technique on the most dangerous corridor of Hanoi marks significant change on taking theory into the real life and technology transfer on field of traffic safety from the developed countries into the developing countries. The paper is expected to have a contribution into methodology and experience on traffic safety in Vietnam.

## REFERENCES

Trinh Thuy Anh (2004) Methodology to study road traffic safety, Vietnam Road and Bridge Journal, 01-02 /2004

Trinh Thuy Anh (2003) Road accident as a major killer of the world, Vietnam Road and Bridge Journal, 12/2003.

Trinh Thuy Anh (2003) Road traffic safety of Vietnam: Problems and countermeasures, Vietnam Road and Bridge Journal, 11/2003.

Trinh Thuy Anh (2003) Research on Road Traffic Safety in Vietnam, University of Transport and Communication, 2002-2003.

Trinh Thuy Anh (2002) Research on Traffic Safety Survey in model corridors of Hanoi, sponsored by JBIC.

Trinh Thuy Anh (2002) Integrated probability model applied for identification of black spots, Vietnam Road and Bridge Journal, 06/2002.

Trinh Thuy Anh (2002) Research on Study and Policy Proposal for Traffic Safety in Hanoi, University of Transport and Communication, 2001-2002.

Prof. Dr. Christer Hyden (2000) The Swedish Traffic Conflict Technique, Lund University.
Traffic Safety Management - Short course program in Sweden, 2000.

## APPENDICES

Table A: CONFLICT SURVEY FORM
Date ... month ... year ... Intersection: Saidong

Weather: sunny / rain / shady / fresh
Surveyor:

| N | Time |  | Type of vehicle |  |  | Type of reaction |  |  | $\begin{gathered} \text { Confl } \\ \text { ict } \\ \text { level } \end{gathered}$ | Confl ict <br> type | Direct move |  |  | Type of move |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| o | H | M | $\begin{gathered} \hline \text { Veh } \\ 1 \end{gathered}$ | $\begin{gathered} \hline \text { Veh } \\ 2 \end{gathered}$ | Veh | $\begin{array}{\|c} \hline \text { Veh } \\ 1 \end{array}$ | $\begin{array}{\|c} \hline \text { Veh } \\ 2 \end{array}$ | $\begin{aligned} & \text { Veh } \\ & 3 \end{aligned}$ |  |  | $\begin{gathered} \hline \text { Veh } \\ 1 \end{gathered}$ | $\begin{gathered} \hline \text { Veh } \\ 2 \end{gathered}$ | $\begin{aligned} & \text { Veh } \\ & 3 \end{aligned}$ | Veh | Veh | $\begin{gathered} \hline \mathrm{Veh} \\ 3 \end{gathered}$ |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |

Intersection describe


## Symbol used in accident diagram

| Sign | Symbol | Interpretation | Sign | Symbol | Interpretation |
| :---: | :---: | :---: | :---: | :---: | :---: |
| TYPE OF VEHICLE |  |  | TYPE OF CONFLICT |  |  |
| V1 | (M) | Motorbike | A1 |  | Bottom-hit |
| V2 | (PC) | Car | A2 |  | Face to face |
| V3 | (B) | Bus | A3 |  | Perpendicular |
| V4 | (T) | Truck | A4 |  | Crossed-face |
| V5 | (D) | Bicycle | A5 | - | Cross-same direction |
| V6 | (DB) | Walker | A6 |  | Same direction |
| V7 | (K) | Other | A7 | $\bigcirc$ | Opposite-direction |
| TYPE OF MOVEMENT |  |  | A8 | $\mathrm{OB}_{2}$ | Losing control |
| M1 | 7 | Turn left | A9 |  | $\square$ Physical crash |
| M2 |  | Go strait |  |  |  |
| M3 |  | Turn right |  |  |  |
| CONFLICT LEVEL |  |  | TYPE OF REACTION |  |  |
| S1 | $\bigcirc$ | Undisturbed passage | B1 |  | Brake |
| S2 | + | Potential conflict | B2 |  | Change direction |
| S3 | O- | Slight conflict | B3 |  | No reation |
| S4 | $\square$ | Serious conflict |  |  |  |

Table B: TRAFFIC SAFETY QUESTIONAIRE FOR DRIVERS ON NH5
Date:
Supervisor:
Surveyor:
Tel:
Age:

11. What is your average driving speed on NH5? (SA)

1. $<20 \mathrm{~km} / \mathrm{h} \quad$ 2. $20-40 \mathrm{~km} / \mathrm{h} \quad$ 3. $40-60 \mathrm{~km} / \mathrm{h} \quad$ 4. $60-80 \mathrm{~km} / \mathrm{h} 5 . \quad>80 \mathrm{~km} / \mathrm{h}$
2. Have you ever over speeding on NH5? (limited speed for non-motorized vehicle: $<20$
$\mathrm{km} / \mathrm{h}$, for motorized vehicle: $<60 \mathrm{~km} / \mathrm{h}$ ) (SA) 1. Yes 2. No
If "Yes" the reason is: a. I am in a hurry b. That is my habit
c. Felling of good road d. No punishment for those cases
3. Have you often use helmet when driving on the NH5? (SA)
4. Never 2. Sometimes 3. Always

If "Yes" the reason for (1) and (2) is: a. Not convenient to me
b. I do not need, it is not un-safe without helmet
14. Which lane normally do you use when you are using motorized lane? (SA)

1. Median side (high speed lane)
2. Right side lane ( near the non - motorize lane)

If your answer is (1): Why do you always use median side lane?
a. This is regulated by traffic rules.
b. Right side lane is very dangerous because many vehicles entering to NH5
15. Have you ever involved traffic accidents on NH5? (SA)

1. Yes: How many times for 3 recent years. $\qquad$ 2. No

If "Yes": a. how is it? i. serious injury ii. minor injury iii. damage only b. what is collision type? i. car, truck ii. motorcycle iii. bicycle iv. pedestrian
16. How often do you observe traffic accident on NH5?
16.1. average...... times/day average.....times/week average......times/month
16.2. How severity is it?
i. With fatalities ii. serious injury iii. minor injury iv. damage only 16.3. What is collision type?
i. MC with car, truck
ii. MC with MC
iii. MC with bicycle
iv. MC with pedestrian
v. MC with median/barrier
vi. Auto with bicycle
vii. Auto with pedestrian
viii. Auto Vs Auto
ix. Auto with median/barrier
16.4. What is reason?
i. Over speeding
ii. Reckless and dangerous driving
iii. Drunk driving
iv. Illegal crossing the street v. Improper road design
vi. Weather
vii. Other(specify please)
16.5. Which place has you often you observe the accident? (brief description).
17. Within recent 5 years, How many times had you ever got penalty by traffic/traffic controller on NH5 ? (SA)

1. More than 5
2. 3-5 times
3. 1-2 times
4. None

If you had involved, please answer the following:
17.1. Reason (MA): i. No license ii No insurance
iv. Wrong way driving v. Illegal parking
17.2. Model of penalty: i. With penalty bill/ticket
17.3. Average penalty rate that you paid:
18. What is your assessment of safeness of NH5? (SA)
iii. Over speeding
vi. Over sized transport
ii. None

1. Safe traffic on NH5: very safe safe
2. Traffic law enforcement:
very good good
3. Traffic control \& regulation very good
4. Effectiveness of traffic police:
5. Global view for road users: very good good
6. Road lane for non-motor. vehicle: very good good fair good fair bad very bad good fair bad very bad bad very bad bad very bad

|  |
| :---: |
| 19. Give your most effective opinion to make NH5 safer (MA max 3) <br> 1. Reduce max speed, especially at populated area. <br> 2. Control, regular inspect and severe punishment for illegal behavior of road users. <br> 3. Need much more education/campaign for inhabitants, particularly for school <br> 4. Need more traffic police and traffic control operation. <br> 5. More additional traffic informatory and warning sign. <br> 6. Facilities for night time driving such as lighting, delineating (visual guidance) <br> 7. Need more safe facilities such as signal, marking and lighting, especially at intersection <br> 8. Improve road crossing facilities for pedestrian and NMV riders. <br> 9. Others: |

