Objective Framework Design for National Road Safety Strategic Plan

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Abstract—It is important to formulate road safety strategic plan for improving road safety. The road safety strategic plans of several other countries in the world are studied in this paper. The differences between China's road safety plan and other countries’ are obtained. We can design the objective framework of China's road safety strategic plan from the perspective of technology, and put forward specific suggestions for formulating China's road safety strategic plan.

1. INTRODUCTION
According to statistics, since the first traffic accident occurred, the total number of people killed in traffic accidents in the world has exceeded the number of people killed in the wars in the same period. At present, nearly 1.3 million people die in road traffic accidents every year in the world, and another 20-50 million people are injured or disabled due to the collision caused by road traffic accidents. The World Health Organization predicts that traffic accidents will become the fifth "killer" of mankind by 2030 if effective action is not taken immediately. In every 100 people in the world, 3.6 people will eventually die due to traffic accidents. Facing this situation, the United Nations proposed 2011-2020 as the decade of global road safety actions. They call on all countries to speed up the construction of road safety, and formulate action plans to reverse the global situation and achieve the goal of halving the annual death toll of road traffic accidents in the world.

Some developed countries started to study earlier in road traffic safety. The successful experiences of the United States, Britain, Australia and other countries show that road safety can be effectively managed when a responsible organization formulate medium and long-term strategic plan according to the local road safety situation. In 2011, China issued the first special plan for road traffic safety, in which the planning objectives, key tasks, major projects and organizational measures were specified. But this plan is born out of the five-year plan of safety production, it is not strictly a strategic plan of road traffic safety. Facing the new situation of road traffic safety, we analyze the strategies of major countries and fully understand the strategic planning of developed countries, which will help us to design objective framework of China’s road safety strategic plan.

2. ANALYSIS ON ROAD TRAFFIC SAFETY STRATEGY OF REPRESENTATIVE COUNTRIES
U.S.A[1]
National Highway Traffic Safety Administration Strategic Plan 2016-2020 was worked out by the National Highway Traffic Safety Administration (NHTSA). NHTSA is adopting five strategic goals that illustrate their commitment to improving roadway safety, and boldly pursue their vision of eliminating fatalities. These goals are supported by measurable strategies to reach their safety objectives.
Safety is and will always be NHTSA’s mission and primary goal. They will pursue proactive safety and the use of advanced safety and the use of advanced safety technology as new tools to prevent crashes from occurring. With driver choice or error accounting for 94 percent of all crashes, however, they must seek new ways to improve driver and other road-user behaviors. They are committed to exploring new partnerships and tools to augment their proven safety programs to meet the challenges they face. Lately, they will continue to focus on improving their internal processes by improving data collection and critical information technology infrastructure to help them work smarter and more effectively with their resources. By employing strategies to attract and retain the brightest minds in transportation safety to enhance NHTSA’s dedicated staff, they can lead the Nation down the road towards eliminating roadway fatalities. NHTSA’s strategic goal is safety, proactive vehicle safety, automated vehicles, human choices, organizational excellence.

1) Strategic goal 1: Safety

It includes three objectives, they are as follows: reducing fatalities and injuries, increasing survivability from crashes, reducing economic costs. Two strategies included in the objective 1 are reducing impaired driving, increasing occupant protection use. Three strategies included in the objective 2 are improving vehicle crashworthiness, enforcing compliance with vehicle safety standards, saving lives through improved emergency response. Three strategies included in the objective 3 are improving fuel economy, reducing odometer fraud, reducing vehicle theft.

2) Strategic goal 2: Proactive vehicle safety

It includes four objectives, they are as follows: promoting the proactive safety principle, retooling recalls, informing and empowering consumers, coordinating global road safety. Four strategies included in the objective 1 are enhancing and facilitating proactive safety, enhancing analysis and examination of EWR data, maximizing safety recall participation rates, enhancing automotive cybersecurity. Two strategies included in objective 2 are office of defects investigations enhancements, conducting campaigns to improve recall completion rates. Three strategies included in objective 3 are improving the new car assessment program, enhancing public understanding of NHTSA’s programs, updating NHTSA’s website. Two strategies included in objective 4 are promoting best traffic safety practices globally, improving motor vehicle safety through global harmonization.

3) Strategic goal 3: Automated vehicles

It includes four objectives, they are as follows: providing national leadership for the safe deployment of automated vehicles, providing federal leadership for the deployment of vehicle-to-vehicle communications, enabling a robust and layered framework for vehicle cybersecurity, democratizing safety technologies. Four strategies included in the objective 1 are improving, expanding and overseeing vehicle performance guidance, facilitating a national framework of laws and policies to govern automated vehicles, exploring NHTSA’s current authorities pertaining to oversight of automated vehicles, exploring modern regulatory tools for federal leadership and oversight of automated vehicles. Objective 2 has no specific strategy. One strategy included in objective 3 is to provide leadership in automotive cybersecurity. Two strategies included in objective 4 are promoting the deployment of automatic emergency braking in all vehicles, developing driver alcohol detection system for safety.

4) Strategic goal 4: Human choices

It includes four objectives, they are as follows: promoting innovative solutions for behavioral safety, leverage law enforcement partnerships, providing oversight and guidance to state highway safety offices, providing assistance and oversight to state departments of motor vehicles. Ten strategies included in objective 1 are facilitating a coalition for behavioral safety, drowsy driving initiative, reducing distracted driving, addressing diverse and vulnerable populations, reducing pedestrian and bicyclist fatalities, enhancing older road-user safety, enhancing youth traffic safety efforts, enhancing motorcycle safety, improving pupil transportation safety, establishing a national heatstroke prevention plan. Two strategies included in objective 2 are seeking active nationwide participation in High-Visibility Enforcement (HVE) activities, expanding use of DWI courts. One strategy included in
objective 3 is improving transparency during the grant management process. One strategy included in objective 4 is working closely with stakeholders to develop technical guidance.

5) **Strategic goal 5: Organizational excellence**

It includes four objectives, they are as follows: properly identifying human capital needs, improving NHTSA’s ability to deliver, ensuring NHTSA has state-of-the-art information systems, improving financial performance. Objective 1 has one strategy, and it is developing and implementing human resources policies that enable the agency to recruit and retain appropriate personnel. Two strategies included in objective 2 are improving the quality, timeliness and relevance of safety data collected, increasing the power of data analysis and improving data sharing. Two strategies included in objective 3 are modernizing IT systems quality, developing and modernizing existing and new systems to improve execution of NHTSA’s mission in the collection and analysis of data. Objective 4 has no specific strategy.

**Britain**

There have been substantial reductions in road user casualties since the Government first produced a road safety strategy in 1987. However in 2009 there were still 2,222 fatalities on Great Britain’s roads. The overall social and economic cost of road collisions is estimated at around £16 billion in 2009. These costs do not include the economic impacts from the congestion that collisions cause. There is an established link between road safety and areas of disadvantage, in particular for pedestrian casualties. Child pedestrian casualties are five times higher in the 10% of most deprived areas in Great Britain compared to the 10% of least deprived areas. There are significant differences between the casualty rates for different modes of transport as well as between areas. Motorcycling accounts for only 1% of road traffic but motorcyclists make up 21% of fatalities.

There has previously been an emphasis on the three Es – engineering, enforcement and education. This has provided a useful framework for improving safety, but did not generally look at specific groups, issues and risks. More recently there has been interest in both the systems approach to road safety and the public health approach. They have used a combination of these approaches, with most focus upon the public health approach. Ultimately they all share a common goal with Wales, Scotland and England for road safety – to reduce death and serious injury on their roads.

1) **Strategic framework 1: Improving road safety together**

Seven themes are included in this framework, they are as follows: empowering local citizens and local service providers, the role for local citizens and communities, the role for local public services, the role for industry and business, the role for the voluntary sector, the role for central government, main areas of responsibility in road safety, vehicle technology.

2) **Strategic framework 2: Education**

Six themes are included in this framework, they are as follows: developing skills and attitudes; starting well; learning to drive and ride; advice to road users; educational interventions for offenders; advice, choices and training for older drivers.

3) **Strategic framework 3: Targeted enforcement and sanctions**

Six themes are included in this framework, they are as follows: drink and drug driving, careless driving, fixed penalty levels, forfeiture of vehicles, HGV and foreign vehicle compliance.

**Australia**

Australia’s first National Road Safety Strategy was established by federal, state and territory transport Ministers in 1992. It provided a framework for national collaboration on road safety improvement that has evolved over the last two decades. Their last national strategy, for the period 2001 to 2010, aimed to achieve a 40 per cent reduction in the per capita rate of road deaths. Under the 2001–2010 strategy, Australia was one of the first countries to formally adopt the Safe System approach to road safety improvement. The Safe System approach takes a holistic view of the road transport system and the interactions of its various elements. It aspires to create a road transport system in which human mistakes do not result in death or serious injury.

**National Road Safety Strategy 2011–2020** aims to elevate Australia’s road safety ambitions through the coming decade and beyond. It is firmly based on Safe System principles and is framed by the
A guiding vision that no person should be killed or seriously injured on Australia’s roads. As a step towards this long-term vision, the strategy presents a 10-year plan to reduce the annual numbers of both deaths and serious injuries on Australian roads by at least 30 per cent. These targets will be challenging; they compare, for example, with a 23 per cent reduction in road deaths achieved over the last decade.

This strategy is based on four cornerstone areas of intervention, Table 1 describes the strategic aim of improvements for each cornerstone.

**Table 1 Strategic intent in each of the cornerstone areas**

| Cornerstone Area | Strategic Aim |
|------------------|---------------|
| Safe roads       | Roads and roadsides designed and maintained to reduce the risk of crashes occurring and to lessen the severity of injury if a crash does occur. Safe roads prevent unintended use through design and encourage safe behaviour by users. |
| Safe Speeds      | Speed limits complementing the road environment to manage crash impact forces to within human tolerance; and all road users complying with the speed limits. |
| Safe Vehicles    | Vehicles which not only lessen the likelihood of a crash and protect occupants, but also simplify the driving task and protect vulnerable users. Increasingly this will involve vehicles that communicate with roads and other vehicles, while automating protective systems when crash risk is elevated. |
| Safe People      | Encourage safe, consistent and compliant behaviour through well-informed and educated road users. Licensing, education, road rules, enforcement and sanctions are all part of the Safe System. |

On each of the four cornerstone areas, the specific aims and actions to be pursued through this strategy are presented under the following headings:

- **Directions** — what the strategy aims to achieve by 2020.
- **First Steps** — actions for the first three years.
- **Future Steps** — what else will be considered?
- **How will progress be assessed?**

What will be considered on the future steps of safe roads is implementing innovative infrastructure safety treatments, working with local governments to develop and deliver infrastructure improvement strategies, implementing infrastructure measures to physically separate bicyclists and motor vehicles on higher-speed roads with significant bicycle-usage, introducing motorcycle black spot/black length programs in all jurisdictions, improving land use planning to reflect Safe System principles. The future steps in each cornerstone area are as follows:

1) **Safe speeds**

What will be considered on the future steps is investigating the case for promoting or mandating speedometer displays, promoting or mandating speed governing and ISA in a broader range of vehicles, developing telematics as a regulatory tool for heavy vehicle speeding, improving the effectiveness of registration sanctions, improving the effectiveness of registration sanctions.

2) **Safe vehicles**
What will be considered on the future steps is mandating the vehicle safety features for new vehicles, investigating the scope for regulatory action, working with ANCAP to encourage the latest high-benefit vehicle safety innovations, introducing automatic crash notification, developing telematics as heavy vehicle regulatory tools, working with industry to secure good community understanding of vehicle safety ratings systems, implementing international standards to improve light commercial vehicle safety, review the current ADRs, working with the vehicle industry and emergency services.

3) Safe people

What will be considered on the future steps is addressing the substantial increase in crash risk at the beginning of the unrestricted licence period, continuing to explore the case for a national post-licence driver education program, promoting alternative mobility options for older drivers, developing road safety resources for parents of pre-school children, developing educational and regulatory interventions, investigating the use of new technologies.

This strategy describes the steps needed in years to put safety at the very heart of their road transport system.

Germany[4]

Excellent road traffic safety plans are a challenge for the whole society. The safe and efficient mobility should be acceptable.

The critical goal of excellent road traffic safety plans is to reduce the number that the people are killed and seriously or critically injured in road accidents. The main principle is that every road fatality is too much. On the basis of an EU plan, Road Safety Programme 2011 aims to reduce the number of fatalities in Germany by 40 percent by 2020. The primary objective of the plan is to reduce human suffering.

The goal of the Federal Government’s transport policy is to promote safe and reliable mobility for the whole people, while concurrently making this mobility environment-friendly and reducing its impact of climate change. Correspondingly, this Road Safety Programme is focused on:

- Road traffic safety will be stably enhanced.
- The environment-acceptable and environment-sustainable mobility will be promoted.
- People in wheelchairs and on crutches should be helped to move through the public areas safely.
- Popularizing a culture of caring and responsible behavior in road traffic.
- The technological innovations by German industry in the automotive and road safety branches will be supported and the framework for improving the competitiveness of the German automotive branch will be created.

It is a manifestation of a firm political stance that will to enhance road traffic safety and further improve the all road transport system for the profit of all road users. Therefore, adequate measures will be taken in the action fields as follows: human factors, infrastructure and auto-motive engineering. These measures will continuously improve road traffic safety on a sustained basis.

1) The “human factors” action field

The road user behavior is focus on in the “human factors” action field. These steps are on account of both on the age groups of the road users and on the way in which they use the road:

a) Children and young people

- The use of child restraints in motor vehicles is encouraged, and publicity activities were launched.
  - It should be encouraged that children and young people should wear cycle helmets voluntarily.
  - The Child Accident Atlas are regularly worked out.
  - The programmes for children should be continued and improved.

b) Rookie drivers / younger drivers

- Pre-test driver training should be improved.
- The specific communications will be taken for target group.

c) Old people

- Voluntary health check-ups are encouraged.
The range of schemes for providing transport-related medical advice to older road users will be widened.

\[ \text{d) Cyclists} \]
- The voluntary wearing of cycle helmets will be encouraged.
- The visibility of cyclists will be improved.
- The consideration shown by and to cyclists will be improved.
- Cycling campaigns will be encouraged.

\[ \text{e) Motorcyclists} \]
- The specific measures will be taken to target group.
- The visibility of motorcyclists, specially by means of retroreflective materials should be improved.

\[ \text{f) Alcohol, medicines and drugs in road traffic} \]
- The new findings on drug-driving will be implemented.
- The system of medico-psychological assessment of a person’s suitability to drive and measures to restore their suitability to drive should be improved.
- Appropriate designation and classification of medicines will be put to use.

\[ \text{g) Fatigue and distraction in road traffic} \]

\[ \text{h) Critically injured casualties} \]
- The most frequent injury patterns that result in critically injured casualties should be identified.
- First aid – making the population more willing to intervene.

\[ \text{i) Compliance with the rules of the road} \]
- Compliances with the rules of the road should be encouraged.
- The penalty points system will be reformed.

2) The “infrastructure” action field

In the “infrastructure” action field, the Federal Ministry of Transport, Building and Urban Development takes this condition into account in different means within the framework of its limits of authority:

\[ \text{a) Rural roads} \]
- The extra overtaking lanes to prevent overtaking accidents will be provided.
- The accidents involving a crash with a roadside hindrance will be prevented.
- Motorcycle-friendly safety systems will be applied.
- The road safety at junctions will be enhanced.
- The speed monitoring at accident blackspots will be deployed.
- Assessment measures to prevent accidents involving wildlife will be used.

\[ \text{b) Motorways} \]
- Preventing run-off accidents by deploying rumble strips.
- Providing additional lanes on gradients.
- Installing more active traffic management systems.
- Making more use of temporary hard shoulder running.
- Enhancing safety at roadworks sites.
- Wrong-way warning signs.
- Rest areas and parking management.

\[ \text{c) New technologies} \]
- Transposing the ITS Directive into national law.
- New possibilities for assisting drivers in dangerous situations outside built-up areas through cooperative systems.
- General availability of safety-related information.
- Establishing an automated emergency call system (eCall).

\[ \text{d) Cycling} \]
• Cycle infrastructure.

3) The “automotive engineering” action field

In the field of “automotive engineering”, there has been great progress for road traffic safety in the past through improvements to passive safety device in and on vehicles. The function of active vehicle safety has become more and more important in the last few years and, especially takes credit for developments in elec-trical engineering and information technology, is now on the threshold of new chances for preventing accidents by means of “intelligent” vehicle systems:

a) Active safety: passenger cars and light commercial vehicles
   • The market penetration of driver assistance systems will be increased.
   • The intrinsic range in driver assistance systems for old people will be exploited.
   • The driver assistance systems in the safety assessment of new vehicles (Euro NCAP) to a greater extent will be included.
   • The winter tyres will be forced to use.

b) Passive safety: passenger cars and light commercial vehicles
   • The test requirements controlling pedestrian protection to sports utility vehicles (SUVs) and vehicles with a short front end (vans) will be applied.
   • The occupant restraint systems in vehicles should be improved.
   • Emergency response guides will be drafted.

c) Electric and hybrid vehicles
   • Audible sense of electric vehicles will be studied.
   • Roadworthiness testing of electric and hybrid vehicles will be developed.

d) Motorbikes, pedal cycles and other two-wheeled vehicles
   • The anti-lock braking systems will be fitted for all motorbikes with as standard.
   • The safety of electrically assisted pedal cycles (pedelecs) will be considered.
   • The “minimum engineering standard” for pedal cycles will be codified.

e) HGVs
   • Protection on HGVs.

This plan has developed or will develop 40 measures in the “human factors”, “infrastructure” and “automotive engineering” action fields, which will continuously enhance road traffic safety on a lasting basis. Particularly, vulnerable road users are to be better protected and the number of accidents on rural roads is to be further reduced.

3. ANALYSIS OF CHINA’S ROAD SAFETY PLAN[8]

The 13th Five Year Plan For Road Traffic Safety was issued by the Work Safety Committee of the State Council, which mainly covers seven aspects: system and mechanism, traffic participants, vehicles, roads, management and law enforcement, organizational measurements, scientific and technological support. Each aspect of the task also contains a number of specific tasks.

Improving the road traffic safety responsibility system

It mainly includes further strengthening the responsibilities of local Party Committees, governments and departments, strengthening the main responsibility of enterprise safety, promoting the common governance of all social parties of road traffic safety, and forming a multi-level and multi-directional social governance of local Party Committees and governments, relevant functional departments, relevant enterprises and relevant industries / fields.

Improving the traffic safety quality of traffic participants

It mainly includes the improvement of traffic safety publicity and education system, continuous and in-depth development of traffic safety publicity and education, improvement of drivers’ traffic safety awareness and driving skills, establishment of traffic safety credit system for road traffic participants, and promotion of comprehensive improvement of traffic safety quality of traffic participants.
Improving vehicle safety

It mainly includes strengthening the intrinsic safety management of motor vehicles, strengthening the dynamic safety supervision of motor vehicles, strengthening the safety supervision of electric bicycles, and strengthening the source management of low-speed electric vehicles.

Improving road safety

It mainly includes strengthening the implementation of road safety standards and specifications, comprehensively implementing road safety evaluation, continuously and deeply implementing highway safety life protection project, improving the construction and configuration level of urban road safety facilities, and comprehensively improving the intrinsic safety of roads.

Improving the law enforcement ability of road traffic safety management

It mainly includes improving road traffic safety laws and regulations, improving traffic safety supervision efficiency, strengthening road traffic safety law enforcement and improving road traffic safety law enforcement ability.

Improving the ability of road traffic emergency management and rescue

It mainly includes improving the command linkage mechanism of road traffic emergency disposal, increasing investment in road traffic emergency management, strengthening the construction of road traffic accident handling capacity and increasing the construction of road traffic accident rescue capacity.

Improving the support capacity of road traffic safety science and technology

It mainly includes strengthening the basic theory and technology research of road traffic safety, strengthening the transformation and resource sharing of road traffic safety research results, strengthening the application of road traffic safety big data, and strengthening the in-depth investigation and data collection application of road traffic accidents.

Focusing on the main tasks of road traffic safety during the 13th Five Year Plan period, six major projects are proposed in the plan: road traffic safety culture construction, key vehicle safety improvement, key road facilities safety improvement, road traffic safety active prevention and control system construction, expressway traffic emergency management capacity improvement, road traffic safety technology application and data sharing. The key and difficult problems of road traffic safety are strived to make a breakthrough by the six projects.

4. OBJECTIVE FRAMEWORK DESIGN OF CHINA’S ROAD TRAFFIC SAFETY STRATEGIC PLAN

According to the local conditions, the road traffic safety strategic plan is established by the United States, Britain, Australia, Germany and other countries, and each of them has different emphasis. From the analysis of the strategic content of each country, the strategic plan pays more attention to the technologies, the necessity of the technology and the specific content of the technical research. China’s road traffic safety plan is born out of the Five-year Safety Production Plan, its objectives, tasks and major projects are closely linked with the safety production plan. It is refined and extended in the field of road traffic safety production and road traffic public safety. Referring to the key points of road traffic safety in other countries’ plan, this paper puts forward technical suggestions, which will be studied in the strategic plan of China’s road traffic safety. The plan includes five parts: safe people, safe vehicles, safe roads, safe speeds and education.

In “safe people” area, technologies and measures to make road users safe are considered. “Safe vehicles” include technologies and measures to make drivers and passengers safe, as well as new energy vehicles and heavy trucks. “Safe roads” focus on rural road safety, highway safety, and systematic measures to make road users safe. “Safe speeds” include speed limit and sanctions against speeding. “Education” includes road safety education for minors, ordinary drivers, professional drivers, cyclists, two wheeled electric / motorcycle drivers and other road users. The specific plan of China’s road traffic safety strategy is shown in Table 2.
### Table 2 The Specific Plan of China’s Road Traffic Safety Strategy

| Field                        | Objective Framework               | Field                        | Objective Framework               |
|------------------------------|-----------------------------------|------------------------------|-----------------------------------|
| Safe people                  | Children and young people         | Safe vehicles                | Driver assistance systems         |
|                              | Rookie drivers / younger drivers  |                              | Driver assistance systems for senior citizens |
|                              | c) Old people                     |                              | Vehicle occupant restraint system  |
|                              | Cyclists                          |                              | Audible perceptibility of electric vehicles |
|                              | Motorcyclists                     |                              | Influence of electric bicycle on road safety |
|                              | Alcohol, medicines and drugs in road traffic |                              | Alcohol interlock and safety belt lock |
|                              | Fatigue and distraction in road traffic |                              | /                                  |
|                              | Compliance with the rules of the road |                              | /                                  |
| Safe roads                   | Rural roads safety                | Education                    | Children and young people         |
|                              | Motorways safety                  |                              | Ordinary drivers education and re-education |
|                              | Modern traffic safety system      |                              | Professional driver licence testing and re-education |
|                              | Availability of safety-related information |                              | Cyclists                           |
| Safe speed                   | Motorcycle speed limits           |                              | Two wheeled electric/motorcyclists |
|                              | Sanctions against speeding        |                              | Road users                         |

### 5. Conclusion

The strategic plan of road traffic safety in other countries is generally the plan of technological development, while the China’s plan focuses more on the management. Therefore, due to different countries and mechanism, foreign plan can not be completely used as a reference for China's strategy, but understanding the advanced technical research carried out by foreign counterparts will help us to determine what should we do.
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