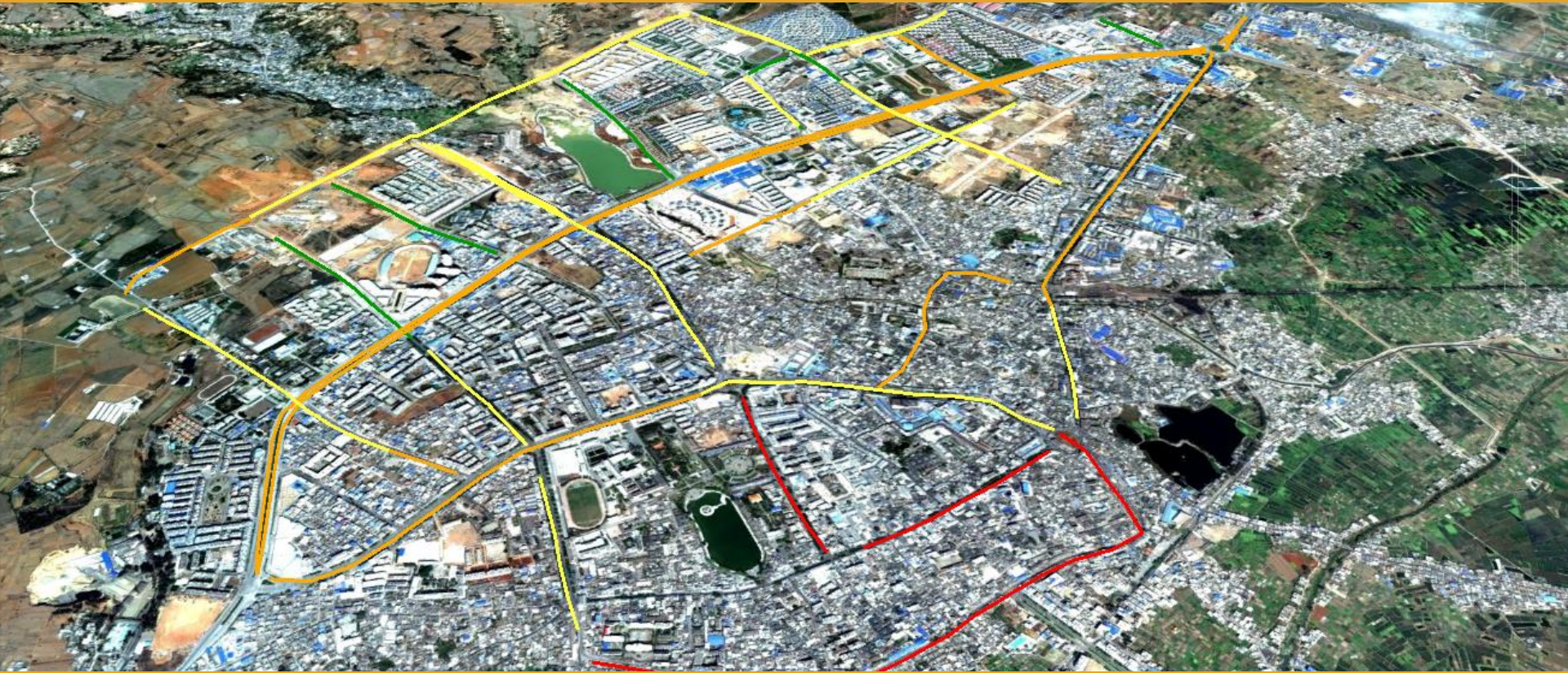


Road Safety Improvement in China



Research Institute of Highway MOT
Zhang Tiejun
2016.8

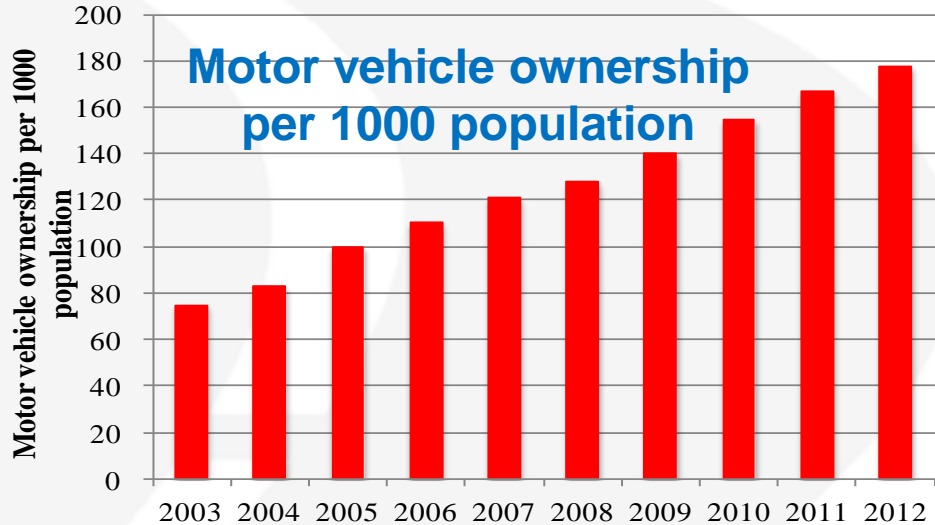
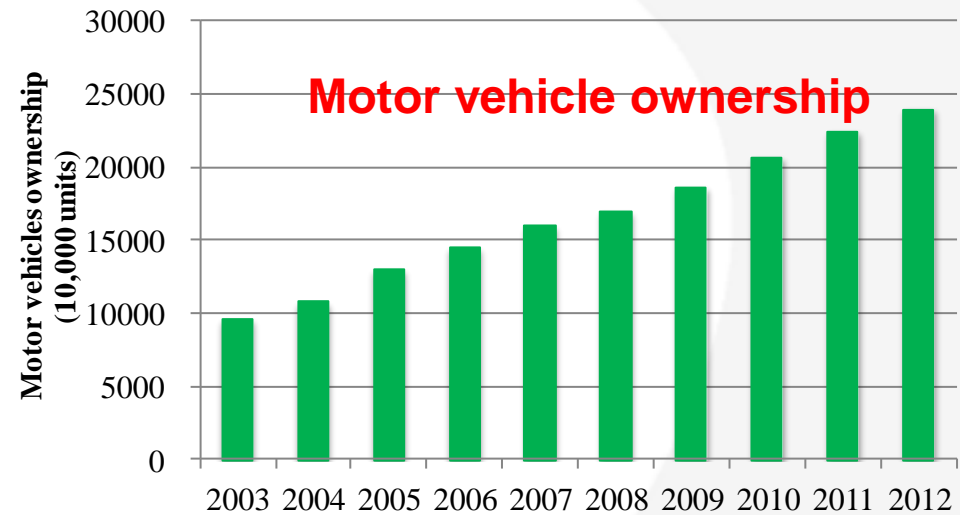


ChinaRAP
CHINA ROAD ASSESSMENT PROGRAM

Contents

- **Traffic Safety Situation**
- **Improving Countermeasures**
- **ChinaRAP Research and Applications**

Rapid increase of motor vehicles

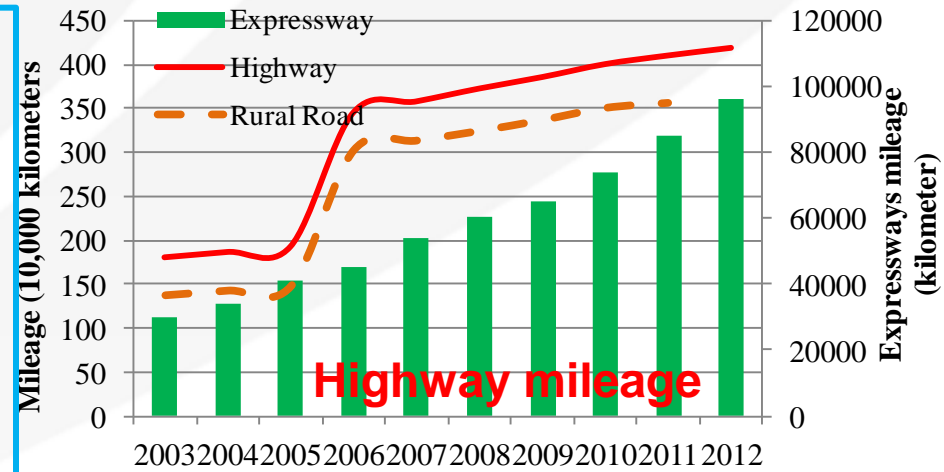


By the end of 2015, the motor vehicle ownership reached 279 million

Rapid growth of road mileage and vehicle kilometer travelled

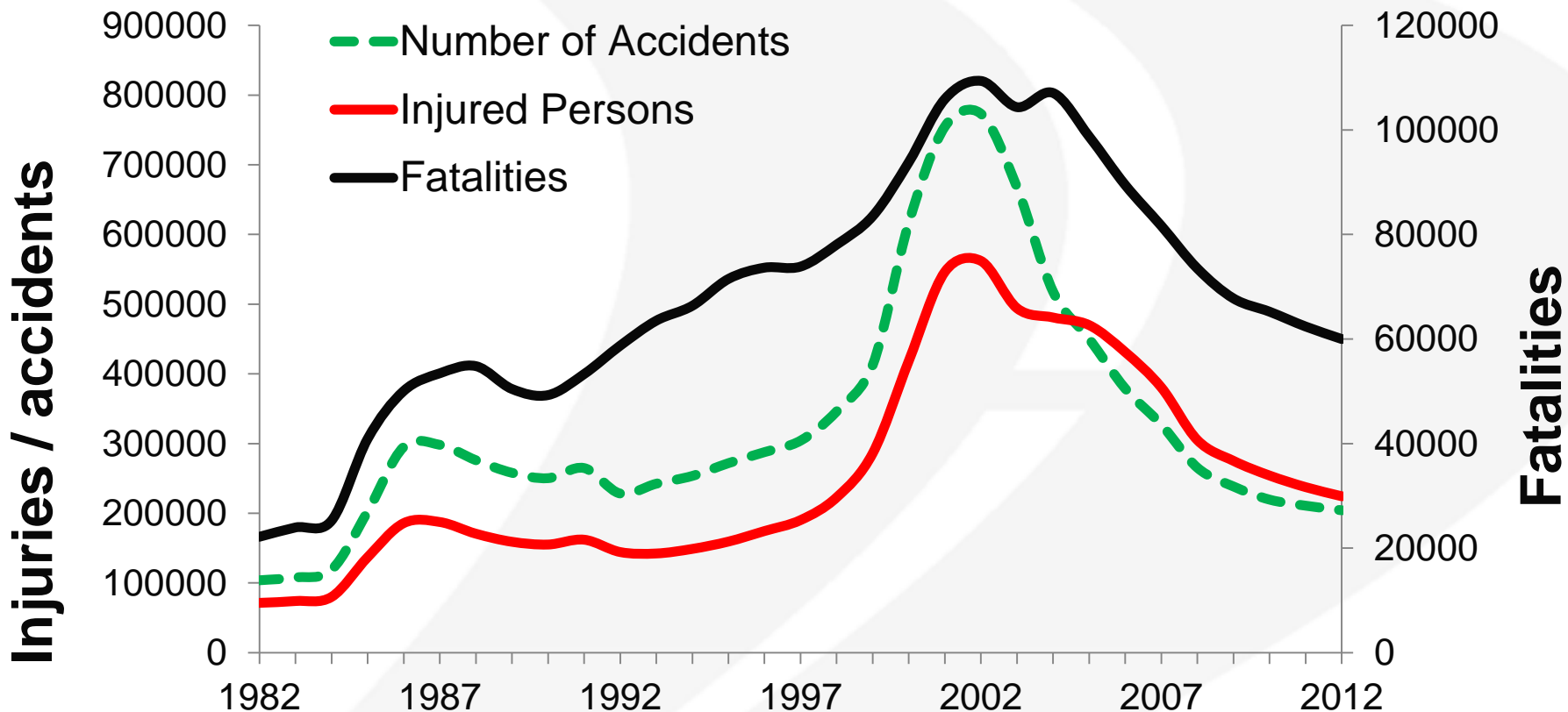
By the end of 2015, the highway mileage reached 4.5773 million kilometers, in which the expressway mileage reached 123.5 thousand kilometers.

The annual average daily vehicle kilometer travelled of the national highway network in 2012 increased 101.88% than that of 2004, and increased 236.64% for the expressway network.



Note: since 2006, highway mileage includes rural roads.

Traffic accident status



New drivers cause more accidents (about 30%)

Electronic bike accidents increase from 1.1% to 6.0%

More accidents happened in low level rural roads

Contents

- **Traffic Safety Situation**
- **Improving Countermeasures**
- **ChinaRAP Research and Applications**

Traffic System Improvement



Laws and polices

Sep. 2, 2003

The 20th executive conference of the State Council listened to the report by the Ministry of Public Safety on further improving the road traffic safety.

Sep. 5, 2003

The State Council held the teleconference to make arrangements for road traffic safety, and pointed out the goal of curbing high frequency of road accidents and reducing road accidents year on year in the tenure of the government (2003-2007).

Oct. 22, 2003

The National Inter-ministerial Joint Conference on Road Traffic Safety was established with the approval of the State Council.

Oct. 28, 2003

The *Road Traffic Safety Law* was approved at the 5th meeting of the standing committee of the 10th NPC.

May. 1, 2004

The *Road Traffic Safety Law* began to be put into practice.

Apr. 28, 2008

The 4th Plenary Session of the National Inter-ministerial Joint Conference on Road Traffic Safety put forward to the new goal.

New goal: In the tenure of the government (2008-2012), total number of accidents especially severe crashes and casualties can achieve further decrease. The better road traffic safety status will make the greater contribution to promote the economic and social development, and the social harmony and stability.

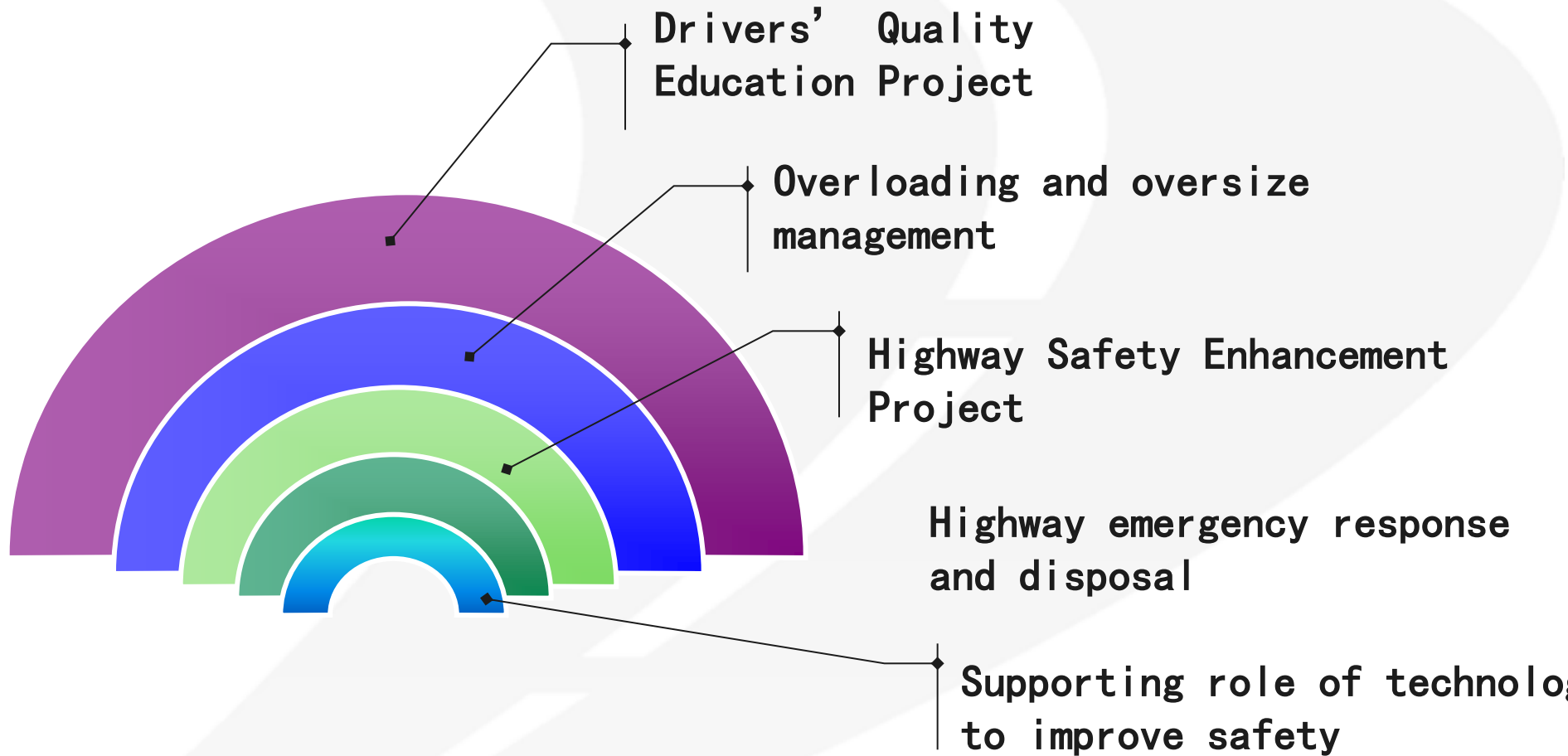
Jul. 22, 2012

The *Opinions of the State Council on Strengthening the Road Traffic Safety Work* was released.

Nov. 28, 2014

Improve Highway Safety to Cherish the Life Project.

Main initiatives of transport departments



Drivers' Quality Education Project

交通部发布驾驶员素质教育大纲 3月1日施行

为全社会普及道路交通安全常识,养成文明行车,减少交通事故,交通部2月24日发布了驾驶员素质教育大纲,将于3月1日施行。根据大纲编写的驾驶员素质教育教材《安全驾驶从这里开始》一同发行。

2004年

据驾驶员素质教育教材交通安全常识总章的统计,59.8%造成的死亡人数总数,67.4%的死亡人数总数,90.0%的死亡人数总数。

大纲和教材

总体目标

培养驾驶员“安全第一,珍爱生命”的交通安全意识。

四个新理念

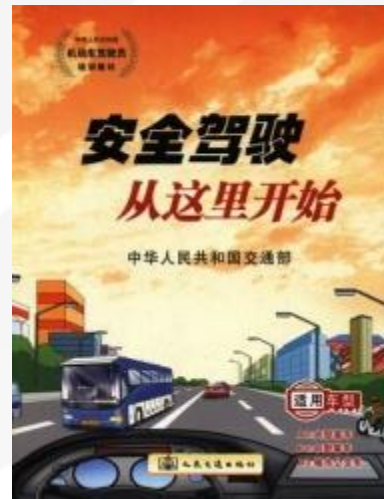
- 一是以“安全第一,珍爱生命”为理念,注重培养驾驶员的交通安全意识,规范驾驶员文明行车。
- 二是以“普及安全知识,提高驾驶员素质”为目标,注重培训内容的前瞻性、实用性和实效。
- 三是以“科技引领”为动力,推行“分时制”培训和智能模拟教学,提高学员的学习效率,节约资源,提高教学效率。
- 四是以“高规格和情景教学”为手段,建立和探索新模式,提高培训质量。

大纲的发布是驾驶员素质教育体系建设的重要里程碑,也是我国驾驶员素质教育体系建设的重要里程碑。驾驶员素质教育大纲的发布,将有力推动我国驾驶员素质教育体系建设,提高驾驶员的交通安全意识,规范驾驶员文明行车,减少交通事故,保障人民群众的生命财产安全。

公安部交管局 2004年3月1日



The accident rate due to the drivers with less than 3 years driving experience decreased by 5.5% annually from 2003 to 2009.



Overload and oversize management

The proportion of truck overloading on national trunk highways has dropped dramatically.

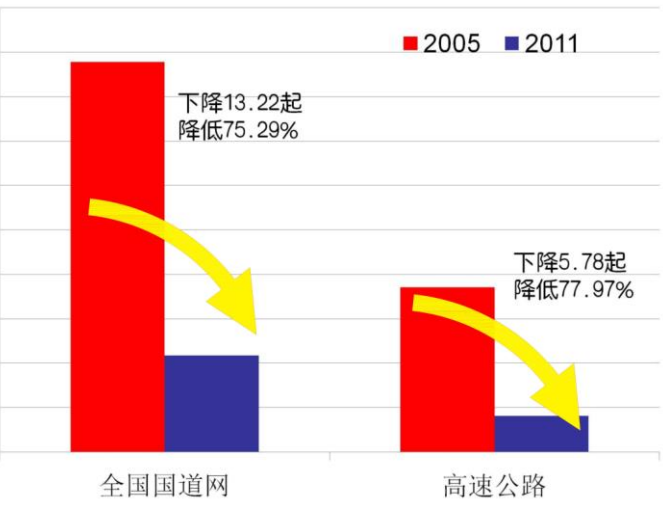
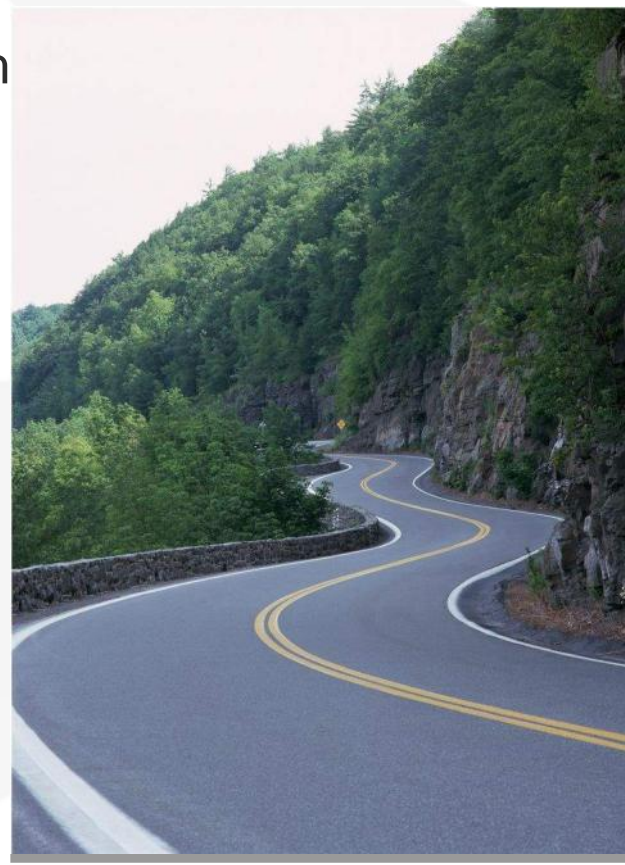


- Publicity and education
- Enforcement
- Vehicle production and modification
- Tonnage calibration and licenses issued
- Transport market order reorganization
- Highway charge policy

Highway Safety Enhancement Project (From 2004)

Focused on:

- High risk roads on the national and provincial high
- Total investment: 30 billion CNY(5 billion USD) to improve the safety facilities(barriers, improve sight distance)
- Total enhanced mileage: 350,000km;



**accident number
reduce 77.13%、
Death reduce
81.49%**

Contents

- **Traffic Safety Situation**
- **Countermeasures**
- **ChinaRAP Research and Applications**

ChinaRAP Objectives

Objectives

1. Develop road infrastructure risk assessment models that draw on RIOH, iRAP and relative knowledge for application in China.
2. Put risk assessment at the heart of strategic decisions on road improvements, crash protection and standards of road design and management.

Final goal: China free of high risk roads



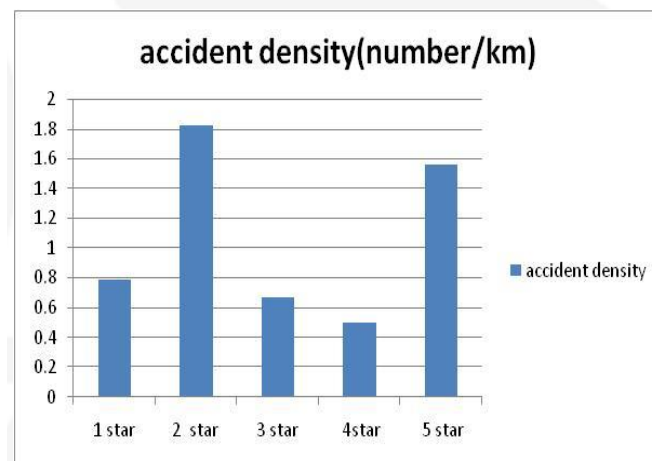
Research and Development – Model

Model include international framework and Chinese traffic safety characteristics

$$p(Y = y_i) = \frac{\Gamma(\frac{1}{0.68} + y_i)}{\Gamma(\frac{1}{0.68}) y_i!} \left(\frac{1}{1+0.68\lambda_i}\right)^{\frac{1}{0.68}} \left(1 - \frac{1}{1+0.68\lambda_i}\right)^{y_i}$$

$$\lambda_i = \text{expo} \times e^{(-4.65+0.06h+0.18zhlc+0.06crk+0.07hc)}$$

其中 h 为路段平曲线用长度加权的弯曲度, expo 为暴露度, hc 为路段交通量中货车比例, crk 为样本单位公里接入口个数, $zhlc$ 对路段两侧路侧危险级别的平均值。



Example of crash modification factor review¹

Countermeasure name ²	iRAP CMF ¹	Typical range (Crash Reduction Factors Clearinghouse) ²			RIOH ³			
		CMF ²	St dev ²	No. studies ²	CMF ²	Study design ²	No. road segments ²	St dev ²
Delineation ²	0.83 ²	0.67 ²	0.22 ²	13 ²	0.71 ²	Prediction model ²	1067 ²	0.25 ²
Street lighting ³	0.87 ⁴	0.63 ²	0.25 ²	34 ²	0.725 ²	Prediction model ²	1067 ²	0.16 ²

¹ See iRAP Model Risk Factors report²

² CMF Clearinghouse query: delineation; treatments without rumble strips and/or resurfacing; fatal, serious or minor injury crashes (<http://www.cmfclearinghouse.org/>)²

³ CMF Clearinghouse query: highway lighting; not intersection related²

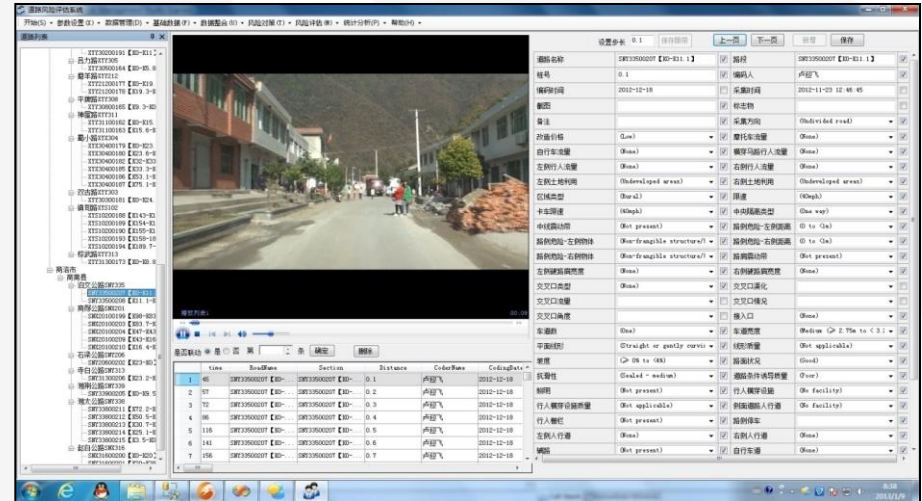
⁴ Note: iRAP figure used in intersection risk only²

Research and Development – Software

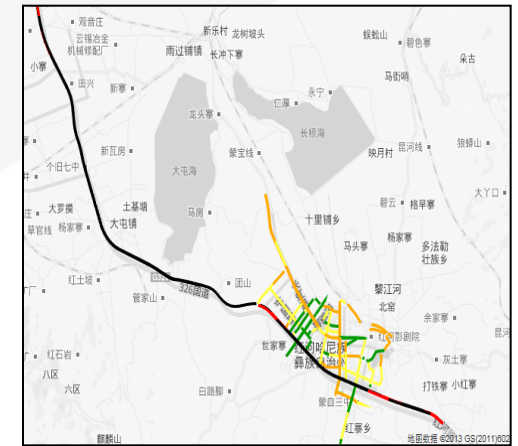
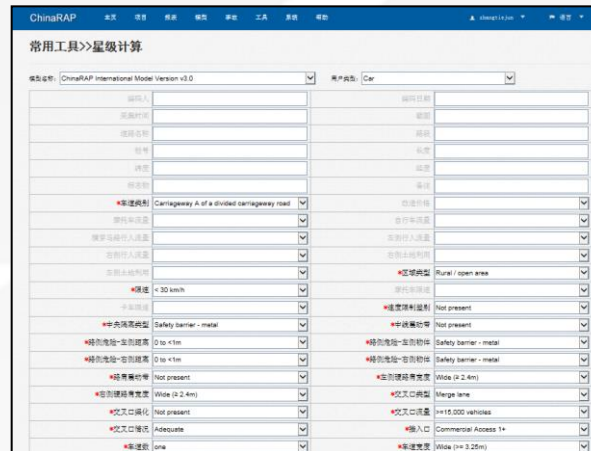
Survey software



Coding software



Analysis software



Research and Development – Equipment



FIRST (Fast Interactive Road Safety Test)

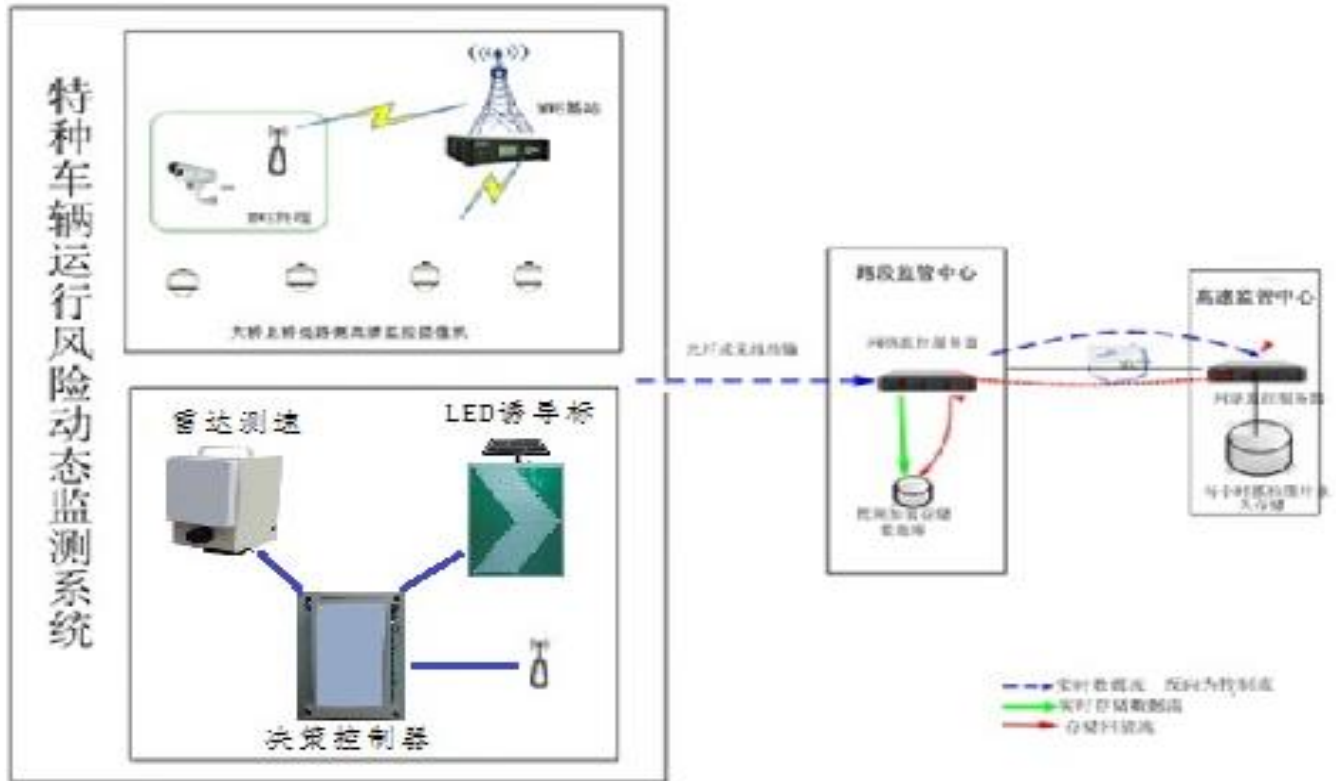


Manuals:

- ① Survey
- ② Supporting data collection
- ③ Coding
- ④ Quality checking
- ⑤ Analysis
- ⑥ Data management



Research and Development – Equipment



Vehicle dynamic risk monitoring and feedback system

ChinaRAP Research and Application Project

When is ChinaRAP used?

Policy

- Setting targets, such as “roads of national importance must be at least 4-stars”

Network planning

- Large-scale risk assessments of existing road networks
- Guide investment and track risk over time

Feasibility/concept

- Assessing safety benefits of road projects (new roads and road upgrades)
- Developing targeted safety projects

Detailed design

- Assessing risk for design iterations and standard cross sections, guidance on countermeasure options and economic assessments

Evaluation

- Post-construction evaluations
- Before and after studies
- Performance tracking

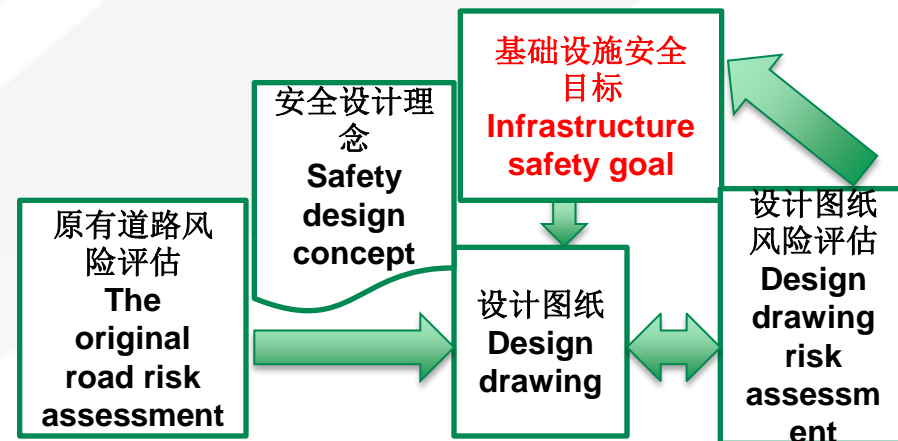
ChinaRAP Research and Application Project

Application Projects:

1 Collect data for model, software and equipment development and testing

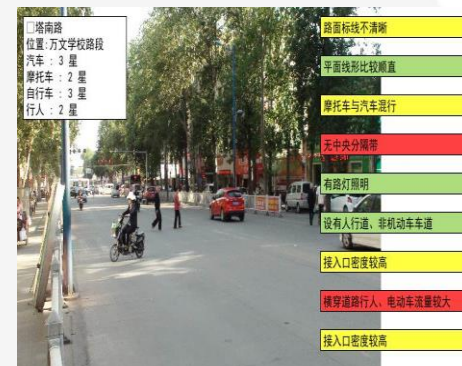
2 Actual work to improve safety

- ① General whole risk assessment to improve the safety management
- ② Interactive design to improve design



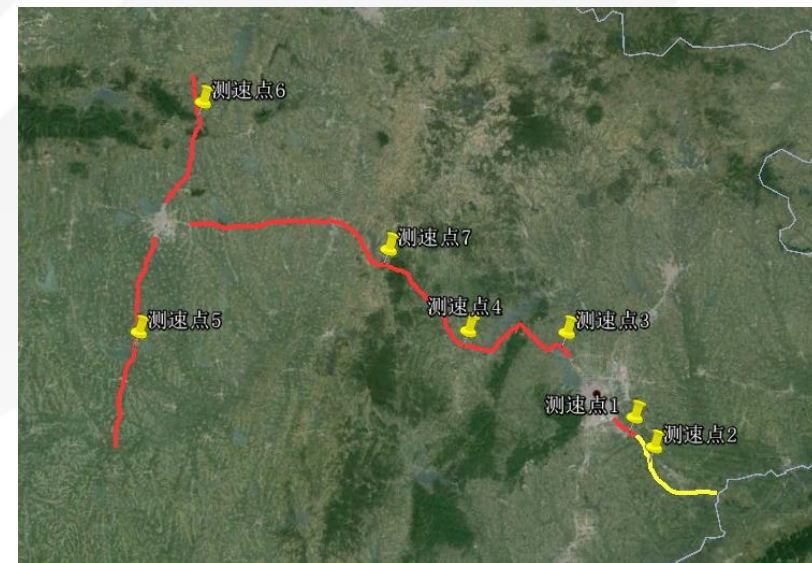
ADB and WB Application Projects

- ADB: Shaanxi mountain road network assessment
- ADB: Anhui road network by ADB loan
- ADB: Yun nan Puer road network assessment
- WB: Mengzi, Honghe urban road network
- WB: Jiaozuo road network assessment
- WB: Shanghai road network assessment
- WB: Tianjin road network assessment
-



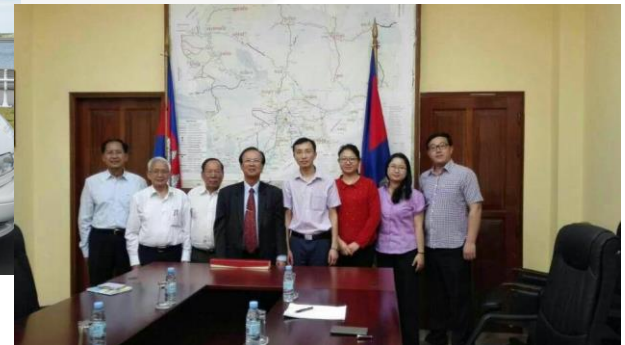
Chinese Government Projects

- Road networks of 2 counties at Guizhou Province
- Expressway network at Yunnan Province
- Expressway network at Chongqing City
- An Hui Chu Zhou S101, S311 road assessment
- 13 provinces of Cherish life project
-



International Projects

- Yemen national road safety survey and coding project
- Road safety assessment program, Yemen: Data analysis and reporting
- Australia ARRB Coding
- URBAN Kiwirap Star Rating Trial
- CHINA-CAMBODIA FRIENDSHIP ROAD SAFETY PROJECT
-



ChinaRAP Project Snapshot 1: Shaanxi Mountain Road Safety Demonstration Project

In Shaanxi, China, the ChinaRAP team achieved:

- double the percentage the roads that would be rated three stars or better
- estimated BCR : 6.1



Summary economic analysis for all roads (20 years)

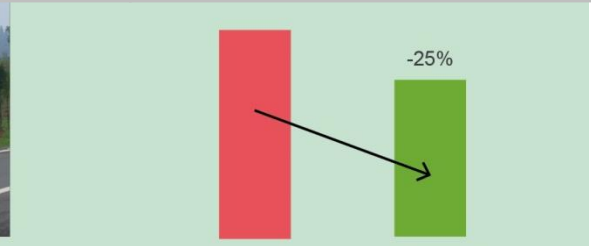
Scenario	Present value cost (m)	Present value benefit (m)	Benefit cost ratio
All Roads- Final designs	CNY 295.4	CNY 1 966	6.7



Existing roads: a higher-than-average number of vehicle occupant deaths and serious injuries.



New designs: safety barriers, paved shoulders, improved delineations, enhanced skid resistance and traffic calming.



Road improvements will result in **fewer deaths and serious injuries**, even though traffic speeds are expected to increase

ChinaRAP Project Snapshot 2: Tianjin Urban Transport Project

In Tianjin China, the ChinaRAP team assessed examining risk of death and serious injury on

- roads around existing metro stations which are slated for upgrade,
- a network of roads for NMT upgrades in the Heping and Nankai Districts.



The analysis indicates that

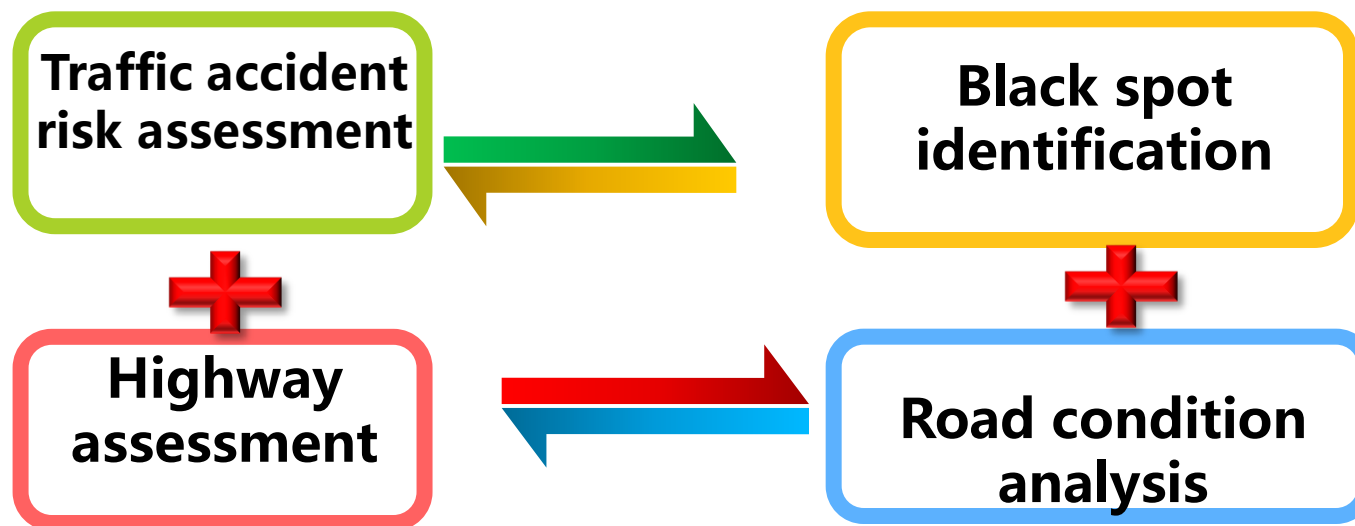
- an investment of a little over CNY 610 million in targeted safety improvements could reduce numbers of deaths and serious injuries by about 50%,
- generating a benefit cost ratio of 3:1.



ChinaRAP Project Snapshot 3: Improve Highway Safety to Cherish the Life Project (HSEP 2)

- **HSEP 2 focuses on:**
 - **scope of project: improving infrastructures on expressway, national and provincial trunk roads, and rural roads**
 - **total investment(estimated): 120 billion CNY**
 - **type of roads: existing roads, new built roads, and reconstructed roads.**
 - **principles and countermeasures**
 - principle 1: Existing roads - Eliminating the current hazardous road sections
 - principle 2: New-built roads - no more new hazardous roads should be added during the designs and constructions stage
 - countermeasures: Decision making process changes: single-index based method to ChinaRAP.

Risk assessment was defined as a method to define hazardous segments.



交通事故风险 / 公路风险	I	II	III	IV	V
I	D	D	D	C	C
II	D	D	D	C	C
III	D	D	D	C	C
IV	B	B	B	A	A
V	B	B	B	A	A



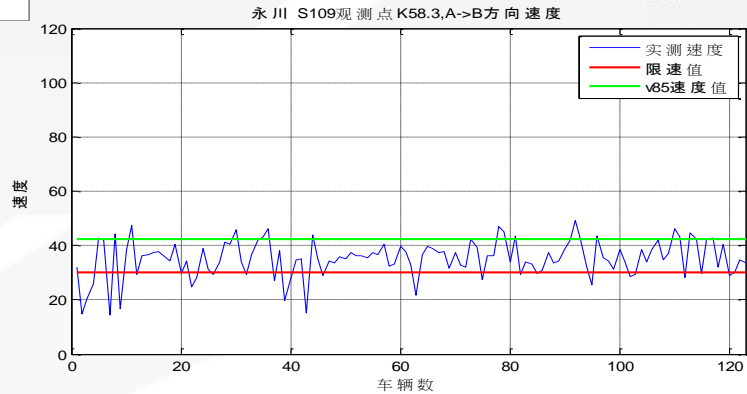
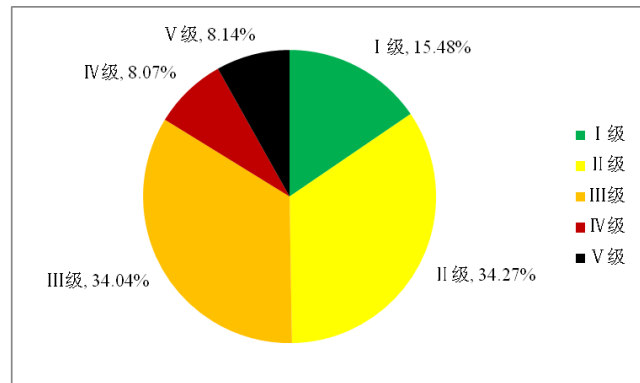
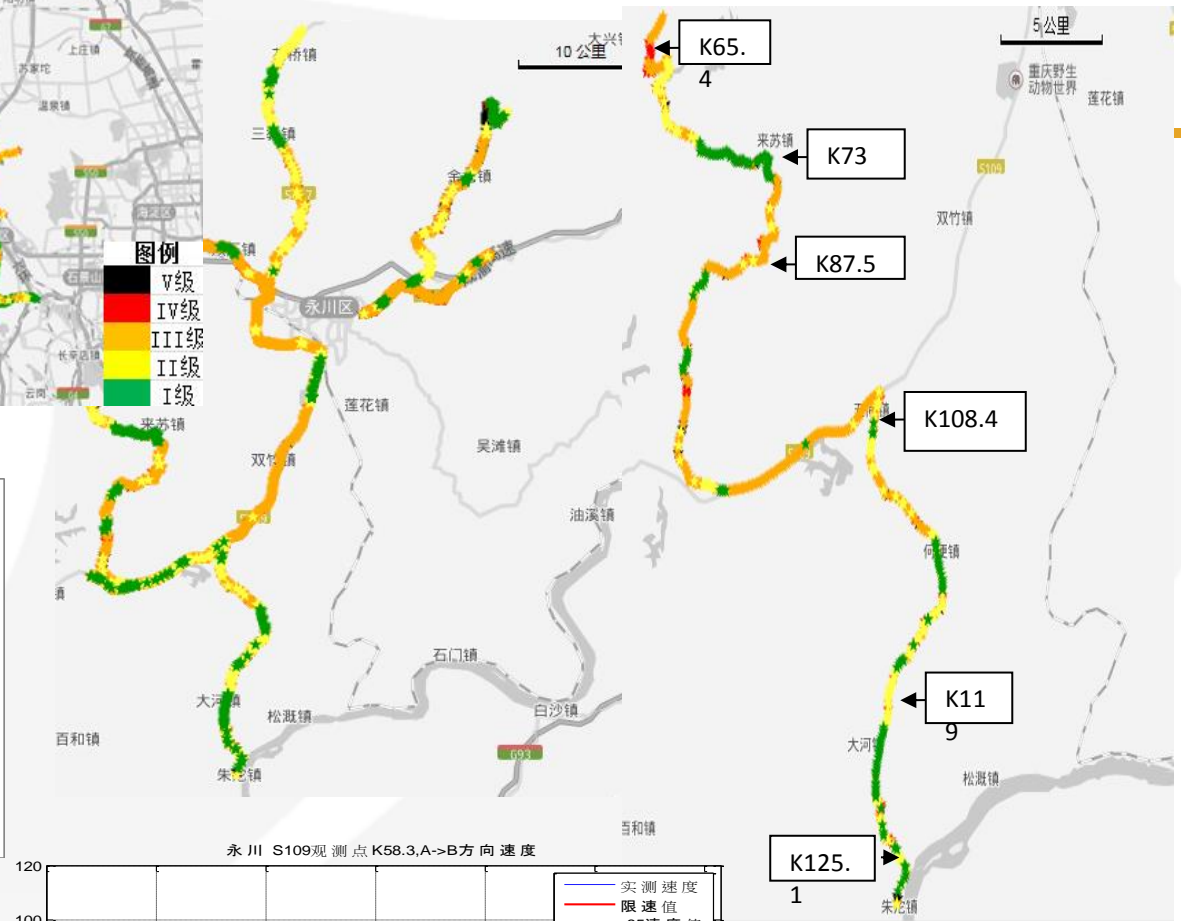
- More than 100,000km National and provincial roads in Beijing Shandong Guangdong Jilin Hubei Henan Chongqing Fujian Zhejiang Guizhou Yunan XinJiang were assessed.
- More than 100 staff take part in the survey
- More than 300 take part in the coding and quality checking



Microsoft Excel spreadsheet showing a project cost breakdown table. The table has columns for '名称' (Name), '数量' (Quantity), '单位' (Unit), '单价' (Unit Price), '合价' (Total Price), '材料' (Material), '人工' (Labor), and '机械' (Equipment).

名称	数量	单位	单价	合价	材料	人工	机械
总计	104	100.00%	34	100.00%	104000	100.00%	
1. 土石方工程	1	0.00%	0	0.00%	0	0.00%	0
2. 路面工程	1	0.00%	0	0.00%	0	0.00%	0
3. 桥梁工程	1	0.00%	0	0.00%	0	0.00%	0
4. 涵洞工程	1	0.00%	0	0.00%	0	0.00%	0
5. 隧道工程	1	0.00%	0	0.00%	0	0.00%	0
6. 交通工程	1	0.00%	0	0.00%	0	0.00%	0
7. 绿化工程	1	0.00%	0	0.00%	0	0.00%	0
8. 照明工程	1	0.00%	0	0.00%	0	0.00%	0
9. 排水工程	1	0.00%	0	0.00%	0	0.00%	0
10. 其他工程	1	0.00%	0	0.00%	0	0.00%	0







DISTANCE: 2262.9 km

□ Road Number G**

Mileage: K2262+900

Risk Type: A



DISTANCE: 29.7 km

□ Road Number S**

Mileage : K29+700

Risk Type: A

Results table: Typical road attributes and plan countermeasures and estimated cost.

样表：三四级公路安全生命防护工程排查数据上报表.xls [兼容模式] - Microsoft Excel

按公路实际编号填写，不限于四位。

1、同一个县、同一条路的排查数据应按桩号次序排列在一起。
2、不能出现上一路段终点桩号大于下一路段起点桩号的情况。
3、路段分段不能过长。不能将整条路作为同一个路段。

三、四级公路安全生命防护工程排查数据上报表

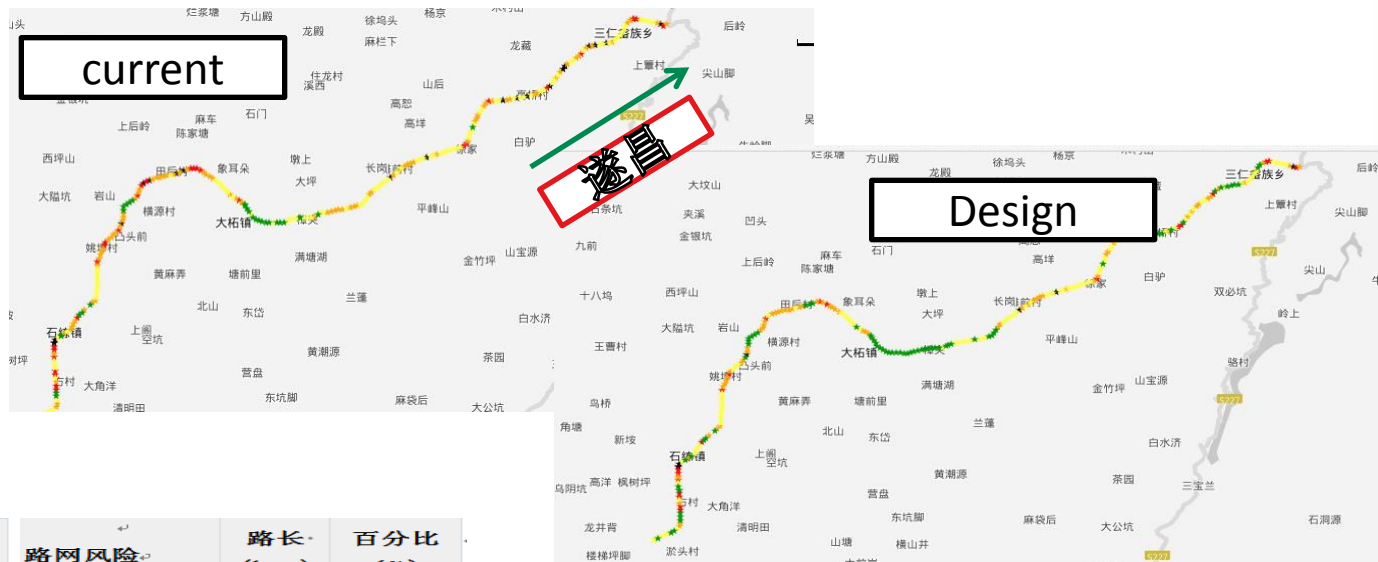
1、必须填“0”或者“1”，不能空着或者填文字。
2、A.1、A.3、B.1、B.2、B.3、B.4类中这五项指标至少有1项为“1”，可以有多个指标同时为“1”。

不符合事故判别指标，这里填“0”。
无事故资料，这里空着。

序号	省	市	县	公路编号	技术等级 3、三级 4、四级	方向 1、桩号大到小 2、桩号小到 3、不分方向	桩号起点	桩号终点	排查时间 (年/月)	路段分类 (A.1、A.2、A.3、B.1、B.2、B.3、B.4、C)	综合指标信息										
											符合事故判别指标	单个急弯	连续急弯	连续下坡	陡坡	视距不良	符合公路环境判别指标	符合交通量判别指标	符合通行校车或班车判别指标	运行车速或路段限速或设计速度	
											0、否 1、是	0、否 1、是	0、否 1、是	0、否 1、是	0、否 1、是	0、否 1、是	0、否 1、是	0、否 1、是	0、否 1、是	0、否 1、是	(km/h)
1	贵州省	黔东南	榕江县	Y020	4	2	K0+000	K0+100	2015/4	A.1	0	1	0	0	0	1	0	0	0	1	20
2	贵州省	黔东南	榕江县	Y020	4	2	K0+400	K0+500	2015/4	A.1	1	1	0	0	0	1	0	0	0	1	20
3	贵州省	黔东南	榕江县	Y020	4	2	K1+615	K2+135	2015/4	A.1	0	0	1	0	0	1	0	0	1	1	20
4	贵州省	黔东南	榕江县	Y020	4	2	K2+250	K2+600	2015/4	A.1	1	0	1	0	0	1	0	0	1	1	20
5	贵州省	黔东南	榕江县	Y020	4	2	K3+500	K4+300	2015/4	A.1	0	1	0	0	0	1	0	1	0	1	20
6	贵州省	黔东南	榕江县	Y020	4	2	K4+800	K5+500	2015/4	A.1	1	1	0	0	0	1	0	1	0	1	20
7	贵州省	黔东南	榕江县	Y020	4	2	K5+850	K6+300	2015/4	A.1	0	0	0	0	1	0	0	1	1	1	20
8	贵州省	黔东南	榕江县	Y020	4	2	k7+200	k7+500	2015/4	A.1	1	0	0	0	1	0	0	1	1	1	20
9	贵州省	黔东南	榕江县	Y020	4	2	k7+500	k7+900	2015/4	A.1	0	1	0	0	0	1	1	0	0	1	20
10	贵州省	黔东南	榕江县	Y020	4	2	k8+050	k8+400	2015/4	A.1	1	1	0	0	0	1	1	0	0	1	20
11	贵州省	黔东南	榕江县	Y020	4	2	k8+700	k9+200	2015/4	A.1	0	1	0	1	0	1	1	0	1	1	20
12	贵州省	黔东南	榕江县	Y020	4	2	k9+200	k9+400	2015/4	A.1	1	0	0	1	0	0	1	0	1	1	20
13	贵州省	黔东南	榕江县	Y020	4	2	k9+400	k9+800	2015/4	A.1	0	1	0	1	0	1	1	0	0	1	20
14	贵州省	黔东南	榕江县	Y020	4	2	k9+800	k11+300	2015/4	A.1	1	0	1	1	0	1	1	0	0	1	20

design

Interactive design

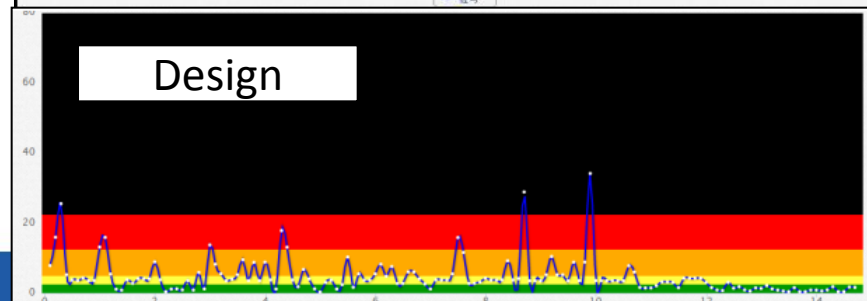
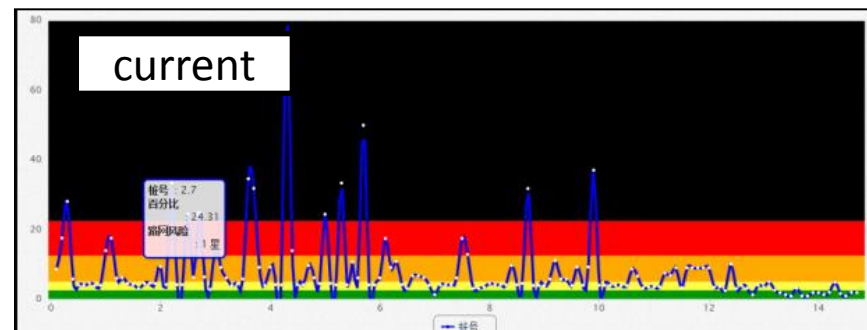


路网风险	路长 (kms)	百分比 (%)
5-星	2.70	10.34
4-星	10.20	39.08
3-星	8.50	32.57
2-星	2.80	10.73
1-星	1.90	7.28

路网风险	路长 (kms)	百分比 (%)
5-星	7.10	27.20
4-星	9.50	36.40
3-星	6.90	26.44
2-星	2.00	7.66
1-星	0.60	2.30

current: high risk roadside、lack of sign、high speed、bad sight distance....

design: barrier、delineation、traffic calming、intersection improvement





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- 专家呼吁建立中国路网交通风险评估系统降低或消除高风险路段
- ChinaRAP团队赴菲律宾参加GRIP/iRAP五年工作总结会议
- 交通运输部公路科学院派员参加iRAP技术会议和国际运输联合会(ITF/OEC)
- 交通工程部张铁军博士被选定为iRAP全球技术委员会成员
- 项目组对陕西省安康市汉滨区、旬阳县以及商洛市商南县公路网进行风险评估
- ChinaRAP 团队完成云南蒙自、建水路网风险评估工作

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Thanks!

项目成果

+ MORE

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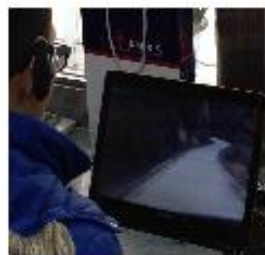
图片新闻



ChinaRAP



项目组对陕西省安



ChinaRAP



陕西省安康市汉滨

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