Risk study on daily traffic mode of the dwellers living along the western highways in China ---- a case study of Ping-Zhong section of G109-national highway

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Abstract

most of the dwellers living along the western highways in China adopt two kinds of traffic modes in their daily life: walking and cycling, and the risk of these traffic modes is higher than that of other traffic modes, so traffic accident of these modes on the highway happens frequently. This paper analyzed all the traffic accidents that happened on Pingluo-Zhongning section of G109-national highway in Ningxia Hui autonomous region from year 2001 to 2005, it considered that the accident percentage of walking and cycling is high obviously, and the degree of casualty is very serious, besides the paper analyzed the accident characteristics of these two kinds of traffic modes respectively from the aspects of time distribution, age distribution, sex distribution and accident type etc., in the end it put forward some preventing and treating advices basing on the accident characteristics and the accident causes aiming for better safe traffic environment for the dwellers.

Key words: western area, along the highways, traffic mode, walking, bicycle, accident characteristic, advice

1. Introduction

Ningxia Hui autonomous region, locates in west of China, there are more than ten thousand kilometres of highway in it; the highway length has exceeded 13,500km. The economy development of Ningxia is laggard correspondingly, so most of the dwellers living along the highways adopt two kinds of traffic modes in their daily life: walking and cycling, compared with other traffic modes, the dwellers above-mentioned are at a disadvantage, therefore the highway accidents happened frequently these years, and they had brought tremendous harm and loss to local dwellers, also badly imperiled local dwellers' life and belongings safety.

In other west regions of China, the daily traffic modes of the dwellers that live along the highways and the highway accident have the similar characteristics, so this paper took G109 Ningxia section as an example to discuss the risk of daily traffic mode of the dwellers lived along the western highways in China.

2. General situation of traffic accidents on G109

The full length of G109 in Ningxia is 338km, and it is a main artery running from north to south in Ningxia, and also an important channel for the dwellers' daily work. G109 Ningxia section is a secondary road in plain and rolling terrain, the width of roadbed is 12m, and the accident proportion is high on it. The original data of this paper came from traffic police detachments (Pingluo, Helan, Yongning, Qingtongxia, and Zhongning) that took charge of a certain section of G109 and also from traffic police station of the autonomous region, and they provided accident data from 2001.1 to 2005.12 on 233km section of G109 which were taken charge by them.

The traffic accident and casualty on G109 from 2001 to 2005 was showed in table1, from table1, the total accident number on Ping-Zhong section of G109 descended year by year, but the absolute accident number was still very high, 2001~2005 there was 3484 accidents of different kinds happened on this section, and the unit kilometer accident was 2.99/yr., it was much higher than that of 2005 in China: 0.14/km; 2001~2005 224 people died from highway accident on this section, and the death number didn't descend ever since, the unit kilometer death number was 0.19/yr, also was much higher than that of 2005 in China: 0.04/km; 2001~2005 2054 people injured from highway accident on this section, and the unit kilometer injured number was 1.76/yr, also was much higher than that of 2005 in China: 0.09/km; through above analysis it was known that Ping-Zhong section of G109 was a section on which accident happened frequently, so it was a high dangerous section.

Table1 accident statistic of Ping-Zhong section from 2001~2005

	2001	2002	2003	2004	2005	Total number
Accident number	874	858	835	566	354	3484
Death number	38	22	47	79	38	224
Injured number	581	429	423	389	232	2054

3. Risk analysis on daily trip modes of the dwellers living along the G109

As this study couldn't get statistical data of local dwellers' traffic mode, it adopted field survey to confirm the proportion of traffic mode. Through field survey, we found that the dwellers living along G109 mostly adopted two kinds of traffic modes in their daily life: walking and cycling, and these two kinds of trip mode accounted 30%~40% respectively in the whole trips, other trip modes include motorcycle, farming vehicle, horse vehicle, car and short-distance passenger vehicle, but these trip modes took very small proportion, so this paper mainly analyzed walking and cycling trip modes.

The security of walking and cycling were not very good, and the accident proportion was very high for them, the following text would analyze the risk of these two kinds of trip modes from aspects of accident frequency, casualty proportion, time distribution, age distribution, accident reason, and accident character etc.

3.1 Walking

Walking was the most universal tripping mode when the distance was short, and almost all the people from child to oldster were contained in this mode. People living in towns and villages along two sides of highway inevitably would contact with the highway nearly out of their doorway in the daily movement, so pedestrian accident happened at times on G109-national highway, and their characteristics were as follows:

(1) Proportion of this kind of accident in the whole accidents: table2 was statistic of pedestrian accident on Ping-Zhong section of G109 from 2001 to 2005, there were 401 pedestrian accidents in the five years, the accident proportion was 11.5%, and 299 people injured, this number accounted for 14.6% in the whole injured number in the five years, and 44 people died, the corresponding proportion was 19.6%, it was obvious that the pedestrian accidents number and its casualty proportion were very high, and its casualty proportion was higher than the accident proportion, so walking mode was at a disadvantage.

Table2 Statistic of pedestrian accident on Ping-Zhong section of G109 from 2001 to 2005

	2001	2002	2003	2004	2005	total
Accident number	123	69	108	64	37	401
Accident proportion(%)	14.1	8.0	12.9	11.3	10.5	11.5
Injured number	114	53	60	50	22	299
Injured proportion(%)	19.6	12.4	14.2	12.9	9.5	14.6
Death number	5	3	16	11	9	44
Death proportion(%)	13.2	13.6	34.0	13.9	23.7	19.6

(2) Time and month distribution: after analyzing the accident data in the five years, we found the peak period of pedestrian accidents centralize in 18:00~22:00 in one day, and the accidents happening in this period accounted for 35.2% in the total, accident proportion in the night was very low, and the accident proportion in the morning and afternoon (8:00~18:00) was smooth relatively; According to month distribution, accidents happened most in October.

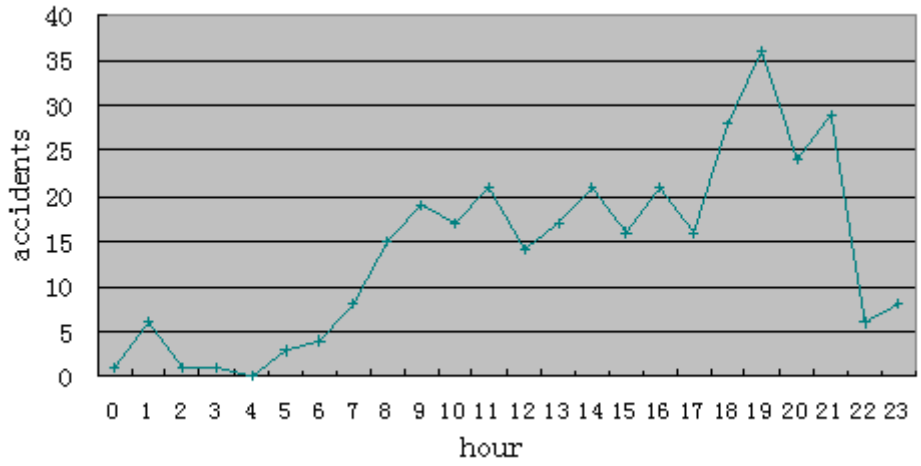

Fig.1 time distribution of pedestrian accident

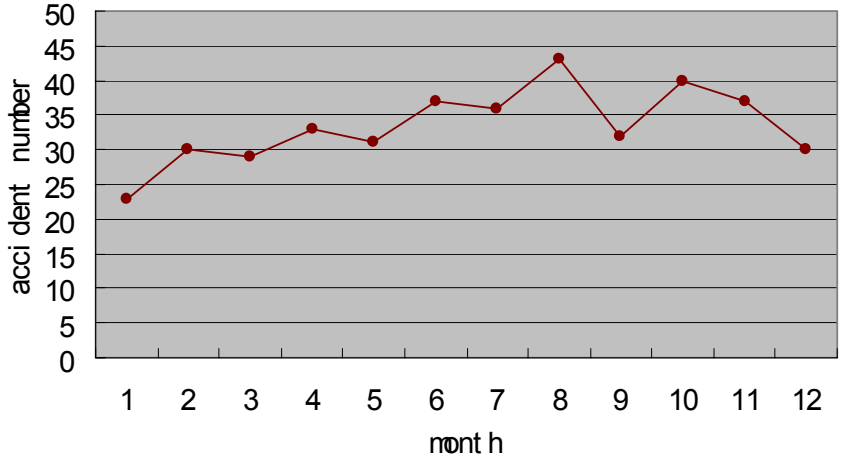

Fig.2 month distribution of pedestrian accident

(3) Sex distribution (table3): there were 124 woman-victims in the entire pedestrian accidents in the five years, and the number accounted for 36.6% in the total, the corresponding numbers of man-victims were 215 and 63.4%.

Table3 victims' sex comparison in pedestrian accidents

	2001	2002	2003	2004	2005	total
man-victims	63	34	50	38	30	215
woman-victims	36	21	30	20	17	124
Total number	99	55	80	58	47	339

(4) Age distribution(fig.3): pedestrian accidents of younger and child were very noticeable, thereinto the accident proportion of low-grade pupil(6~10 years old) was highest, and it took 20.7% of the total; furthermore, pedestrian accidents of old people(older than 60) couldn't be ignored, the accident number of old pedestrian accounted for 9.5% in the total, and the eldest victim was 86 years old in the pedestrian accidents. because of physical reason and the degradation of ears and eyes, senile pedestrians responded stolidly and were very drumble, so they could not take necessary measures in time when encountering dangerous situation, and the result was very serious: death or injured.

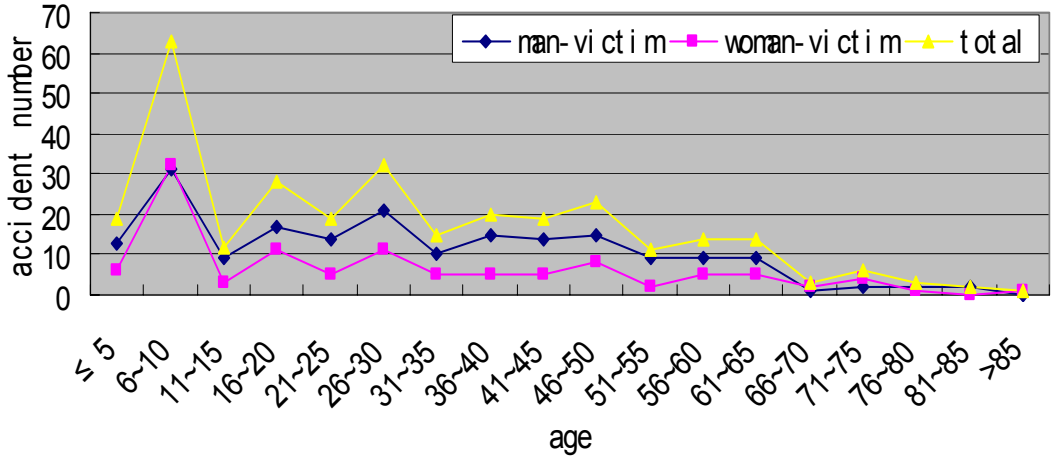

Fig.3 age distribution of pedestrian accident

(5) Spot distribution: the proportion of pedestrian accident was higher in vital sections, the accidents happening in junctions and curves accounted for 22.9% in the total number in five years.

Table4 pedestrian accident in junctions and curves

	2001	2002	2003	2004	2005	total
Total number	123	69	108	64	37	401
junction and curve accidents	20	15	27	21	9	92
proportion	16.3%	21.7%	25.0%	32.8%	24.3%	22.9%

(6) accident types: the accidents in which pedestrian came into collision with car took the tiptop proportion: 39.7%, the next highest are with motorcycle, heavy truck, light truck and farming vehicles, their proportions were 17.4%, 11.0%, 10.5%and 8.3% respectively, then were with other types of automobile and bicycle, the proportion was 13.1% in total (fig.4).

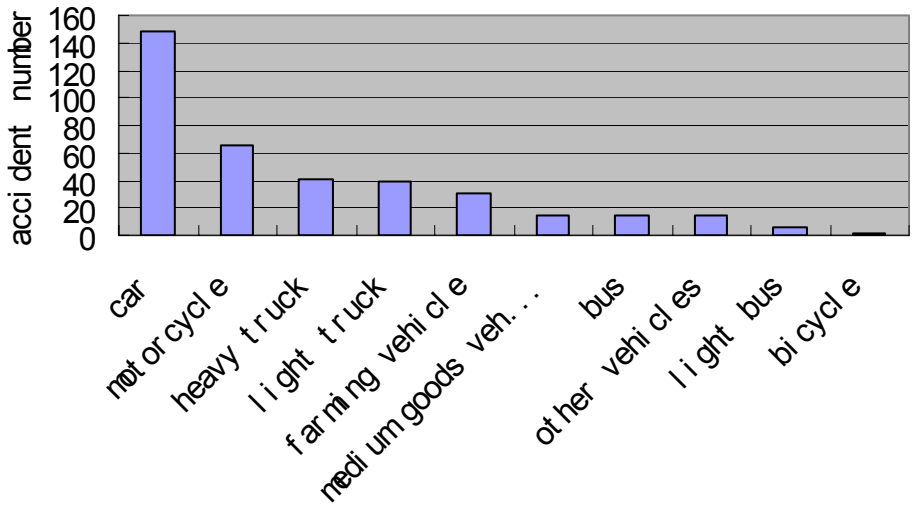

Fig.4 contrast of vehicle type in collision with pedestrian

(7) Accident reasons(fig.5): pedestrian accidents were mainly caused by the factors of people, vehicle drivers' factors accounted for 79% approximately, and the factors included overspeeding, not giving way according to the traffic rules and improper handling; the factors of nonmotorized vehicle drivers and pedestrian accounted for 8% and 13%, and the factor was mainly traversing roads illicitly.

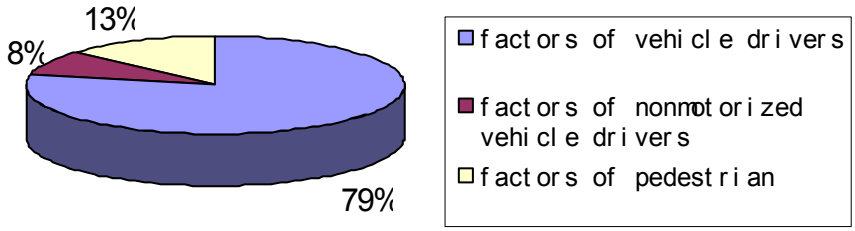

Fig.5 proportion of people's factor in pedestrian accidents

3.2 Cycling

Bicycle was a kind of "door-to-door" individual vehicle, its predominance was more obvious especially when the distance was not too long: convenient and economical. Country dwellers adopted bicycle as vehicle instead of walk in daily work, however the comfort and stability were weaker than other vehicles and there was no safeguard on it, so bicycle fell into "weak" comparing with other vehicles. Bicycle accident happened frequently on Ping-Zhong section of G109, it had characteristics as follows:

(1) Proportion of this kind of accident in the whole accidents: table5 was statistic of bicycle accident on Ping-Zhong section of G109 from 2001 to 2005, there were 445 bicycle accidents in the five years, the accident proportion was 12.8%, and 325 people injured, this number accounted for 15.8% in the whole injured number in the five years, and 36 people died, the corresponding proportion was 16.1%, it was obvious that the bicycle accidents number and its casualty proportion were very high, and its casualty proportion was higher than the accident proportion, so cycling mode was also at a disadvantage like waling.

Table5 Statistic of bicycle accident on Ping-Zhong section of G109 from 2001 to 2005

	2001	2002	2003	2004	2005	total
Accident number	128	100	96	70	51	445
Accident proportion(%)	14.6	11.7	11.5	12.4	14.4	12.8
Injured number	119	77	60	50	19	325
Injured proportion(%)	20.5	17.9	14.2	12.9	8.2	15.8
Death number	7	3	6	8	12	36
Death proportion(%)	18.4	13.6	12.8	10.1	31.6	16.1

(2) Time and month distribution: there were two wave crests of bicycle accidents distribution in one day, one was 16:00~21:00 and the other was 10:00-14:00, the accident proportions in these periods were 38.7% and 29.4% respectively, and accident proportion in the night was very low; According to month distribution, bicycle accidents happened most in August to October when it was just the time of harvesting in countryside, and the accidents in this period accounted for 36.0% in the total number.

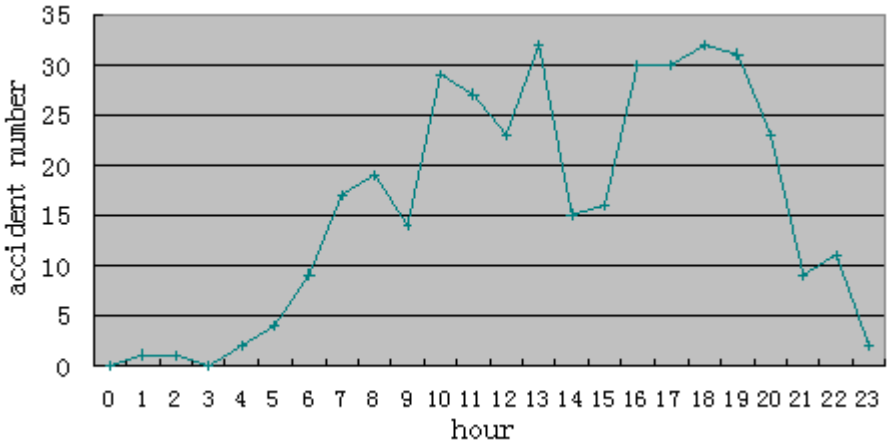

Fig.6 time distribution of bicycle accident

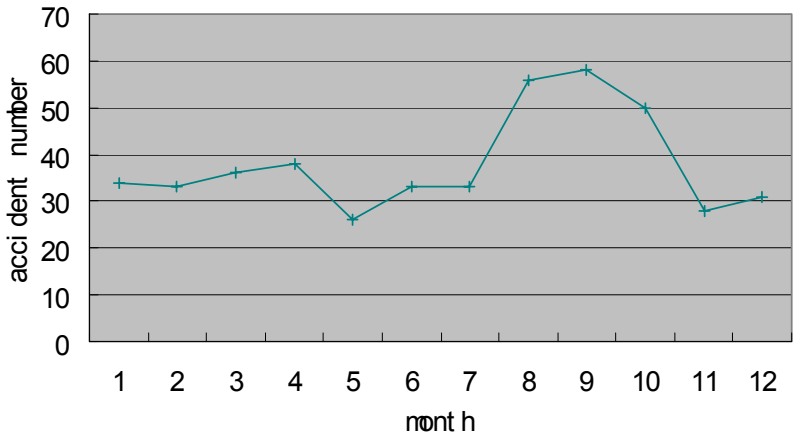

Fig.7 month distribution of bicycle accident

(3) Sex distribution (table6): there were 119 woman-victims in the entire bicycle accidents in the five years, and the number accounted for 30.4%, the corresponding numbers of man-victims were 273 and 69.6%.

Table6 victims' sex comparison in bicycle accidents on Ping-Zhong section from 2001 to 2005

	2001	2002	2003	2004	2005	total
man-victims	77	57	67	46	26	273
woman-victims	34	30	24	16	15	119
Total number	111	87	91	62	41	392

(4) Age distribution: comparing fig.3 with fig.8, we could see that it was different from pedestrian accident, the age distribution of men and women in the bicycle accidents was disagree: woman-victims centralize in youth(11~20 years old) and middle age(46~50 years old), the number of these two group accounted for 33.7% and 13.5% in the total woman-victims, the proportions were higher then that of man-victims with the same age; there were three notable groups of man-victims: juveniles of 11~15 years old, youth and middle age of 21~40, and senile people of 50~70, the number of these group accounted for 8.9%, 37.9%

and 39.8% in the total man-victims. Compared with man-victims, woman-victims of middle age and youth were not notable, and the accident proportion of older women was very low, there was nearly not old woman-victim who was older than 60 years old in the bicycle accidents, but old man-victims were in the opposite side, this group was very notable, the eldest man-victim was 84 years in the bicycle accidents. The above-mentioned condition appeared in respect that there was rarely elder bicycler (aged above 60) in women group, even if there were, they were more cautel, correspondingly the number of elder-men bicyclers were higher, so the number of accidents would naturally be higher with the factors of senility and slow reaction.

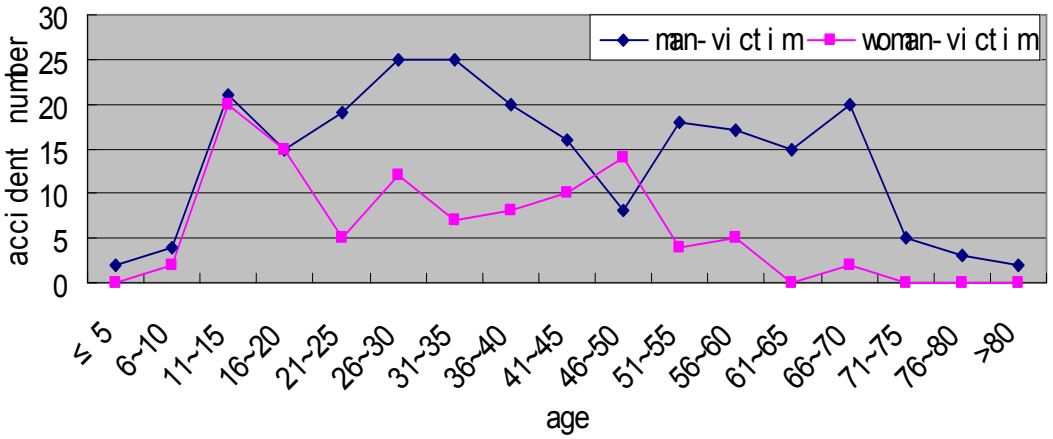

Fig.8 age distribution of bicycle accident

(5) Spot distribution: the proportion of bicycle accident was higher in vital sections, the accidents happening in junctions and curves accounted for 31.7% in the total number in five years.

Table7 bicycle accident in junctions and curves

	2001	2002	2003	2004	2005	total
Total number	128	100	96	70	51	445
junction and curve accidents	23	37	40	24	17	141
proportion	18.0	37.0	41.7	34.3	34.0	31.7

(6) Accident types: the accidents in which bicycle came into collision with car take the tiptop proportion: 36.2%, the next highest were with motorcycle, farming vehicles, heavy truck and light truck, their proportions were 23.9%, 9.6%, 9.4% and 8.5% respectively, then were with other types of automobiles, nonmotorized vehicles and pedestrians, their proportion was 12.5% totally (fig9).

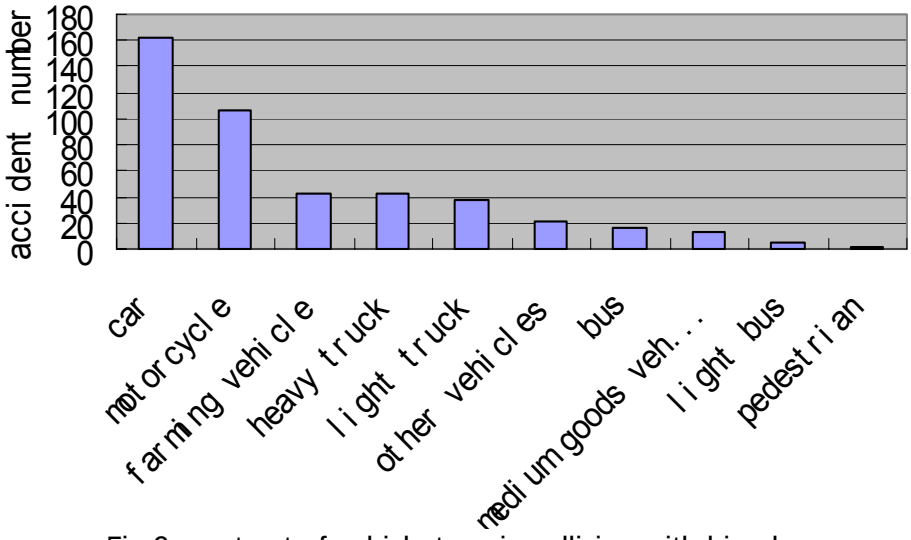

Fig.9 contrast of vehicle type in collision with bicycle

(7) Accident reasons(fig.10): bicycle accidents were mainly caused by the factors of people, vehicle drivers' factors accounted for 87% approximately, and the factors included speeding, not giving way according to the traffic rules and not holding safe distance; the factors of nonmotorized vehicle drivers and pedestrian accounted for 9% and 4%, and the factor was mainly traversing roads illicitly.

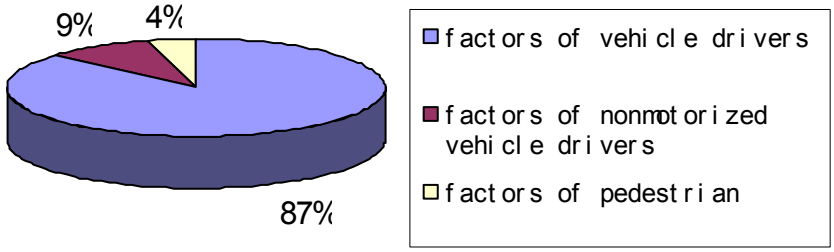

Fig.10 proportion of people's factor in bicycle accidents

Conclusion and suggestion

Most of the dwellers living along the western highways in China adopt two kinds of traffic modes in their daily life: walking and cycling, compared with the group adopting other trip modes they are VRUs obviously, but in China there is little attention and relational study on this group, so it is very meaningful to learn the characters and reasons of the traffic accident resulting from these two kinds of trip modes.

From above analysis, we know: walking and cycling along the western highways have the similar risk, and the accidents related with these trip modes have obvious characters: happening time and spot, victims' age and sex; pursuing the reasons, most of the accidents were caused by the factor of people, and vehicle drivers take the main responsibility. To reduce these bad accidents, we should adopt the following measures to prevent and manage them.

1. Establishing highway code and executing the law strictly;
2. Safety education for road VRUs;
3. Developing road safety audit;
4. Monitoring the traffic accidents;
5. Improving traffic conditions;
6. Educating and training for the automobile drivers especially the motorcycle and car users;
7. Improving the automobile's performance.

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