

Behavior and Psychological Analysis of Electric Bike Rider Turning Left to Cross the Street at Signal Intersections

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ABSTRACT

As a more convenient and environmentally friendly green way of travel, electric bicycle has shown a rapid development trend in many cities in China in recent years [1-3], the impact on urban traffic is also increasing, especially in the signal intersection with traffic flow, electric vehicles is an important factor affecting the capacity of signal intersection, and the illegal behavior of electric vehicles is widespread, which has become one of the main causes of traffic accidents. This paper uses the combination of video survey method and questionnaire survey method to analyze the behavior and psychology of the motorcyclists with the left turn of the signal intersection. First, the field video survey is used to collect the behavior data of the riders, and then the questionnaire survey is used to analyze the psychological activities of the riders, and to compare the actual behavior results with the psychological analysis results, so as to establish the connection between behavior and psychology. To optimize the traffic and improve traffic safety and strengthen the standard management.

Keywords: signal intersection; electric bike rider; behavior; psychology.

INTRODUCTION

Non-motor vehicles are an important part of urban traffic and play an irreplaceable role in our urban traffic system. However, the large number of non-motor vehicles and difficult to manage has become an important reason for the disorder of urban traffic order.

At present, the studies on electric bicycles at home and abroad mostly start with the basic characteristics and traffic efficiency of electric bicycles, and pay relatively limited attention to the safety issues of electric bicycles, and most of them are analyzed from the perspective of accident characteristics [4-8]. This paper through the method of field investigation, obtain electric vehicles in the signal intersection real behavior data, combined with the data through questionnaire survey, using the method of statistical analysis, to find the cause of frequent accidents and violations, between different riders through behavior comparison, analyze the causes of the difference, and the main danger through behavior factors further synthesis.

BEHAVIOR CHARACTERISTICS OF THE CYCLISTS

Investigation Method

This paper mainly uses the method of field observation to collect relevant data, obtains the video recording by taking field images at the signal intersection, and then extracts the required data by recording the video playback.

When recording riding electric vehicles in the left street behavior, the method is a staff will video equipment in signal cross east exit south of the bicycle, can have open

perspective, in order to achieve the purpose of the whole left process complete recording, convenient to ride electric vehicles left across the street of various behavior characteristics to conduct a comprehensive and detailed study.

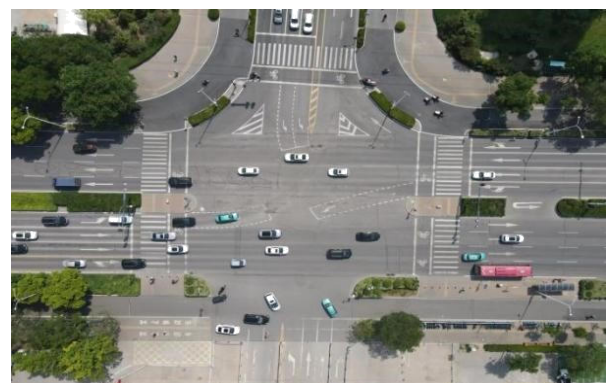


FIGURE 1: South Import Survey Area.

Elephant Characteristics of Rider Behavior Studies

Basic Behavioral Characteristics of Electric Riders:

- (1) The passing path chosen by the motorcyclist when crossing the street to the left.
- (2) The passing speed of the electric rider when crossing the street to the left.
- (3) Whether the motorcyclist violates the traffic laws and regulations when crossing the street on the left.
- (4) Whether the motorcyclist runs a red light when crossing the street to the left.

- (5) Whether the motorcyclist has a conflict with the right-turning motor vehicle when crossing the street on the left side.
- (6) The number of electric vehicle riders passing in the phase of a signal intersection.
- (7) Parameters of Street Crossing Facilities for Electric

Vehicle Cyclists :

The length of the two pedestrian crossings: the distance of the two pedestrian crossings separated by the safety island. Signal lamp type: countdown signal lamp.

Phase and green light duration of the left turn signal light. Phase of crosswalk signal: different light color control status of pedestrian signal.

Red light length: pedestrian light red light length in seconds. Green light length of crosswalk: green light length of pedestrian signal light in seconds.

Signal intersection all red time: signal intersection all signal lights are red time, the unit is seconds

Traffic Behavior Characteristic Parameters of Electric Vehicle Cyclists :

Pass distance: the length of the line crossing the intersection by turning left.

Pass speed: the cycling speed of a motorbike rider turning left across the intersection in meters per second.

Track of left turn crossing: average pedestrian speed in two crossings in m / s.

Probability of left turn violation: probability of crossing the street by cyclists of different gender and ages.

Illegal Behavior by Cyclists

Minimum Distance from the Motor Vehicle:

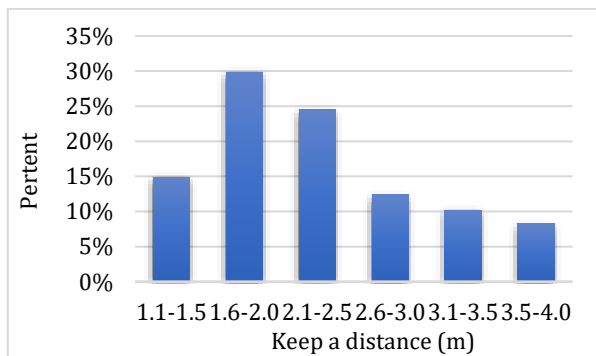


FIGURE 2: The Minimum Distance Between A Motorcyclist On The Left Turn.

From this chart can be very intuitive, with the distance of motor vehicles within two meters of electric cyclists accounted for 44.72% of the total number of cyclists, the proportion of within three meters reached 81.56%, more than half of the cyclists and vehicle distance is too close, so close distance is likely to make electric vehicles and motor vehicle accident touch, and electric cyclists if accidental fall, is likely to be hit by motor vehicles, secondary damage.

Speed Interval Distribution :

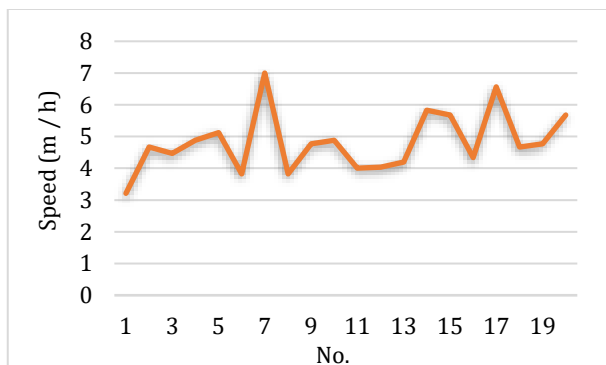


FIGURE 3: Change Of Left Turn Cycle Of Electric Vehicle.

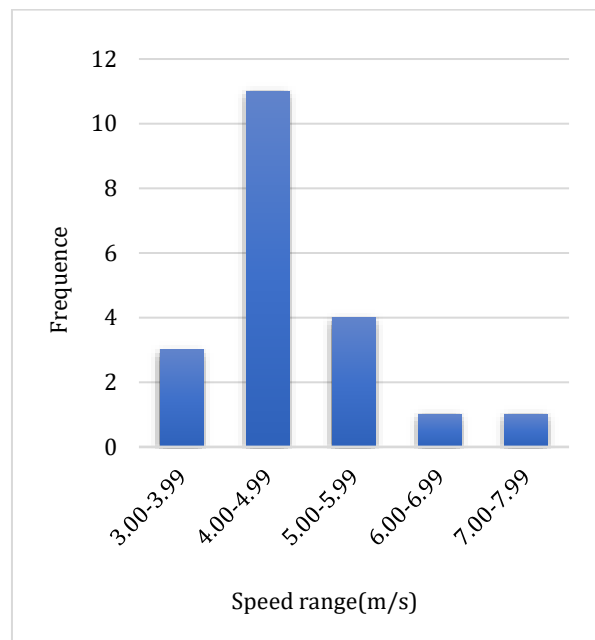


FIGURE 4: Distribution Diagram Of The Left-Turn Speed Range Of Electric Vehicles.

Riders speed mainly concentrated in 4 meters per second to 6 meters per second, electric cyclists in left after the intersection because left is an independent phase, the direction of the direction of the turn is single, basically from northwest to southeast, no conflict to the car, and the traffic area is wide, cyclists more free, cycling faster.

Turn Left Track :

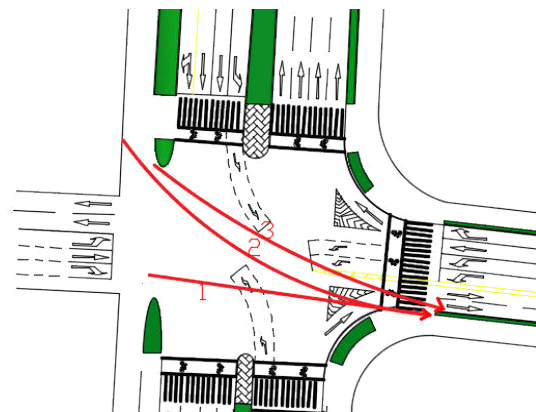


FIGURE 5: Left-Turn Track Diagram Of The Electric Vehicle.

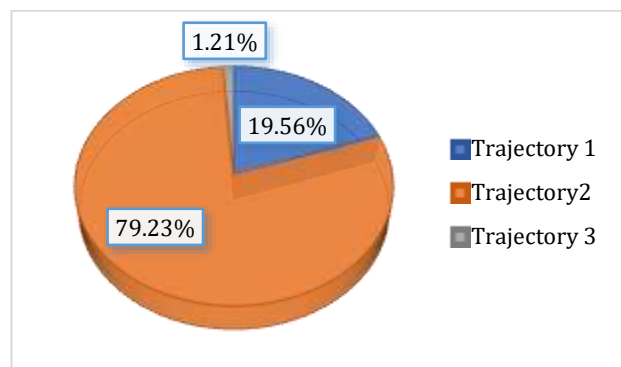


FIGURE 6: Proportion Diagram Of The Left-Turn Trajectory Of Electric Vehicles.

The First Goes Straight From The South Side Of The Opening Of Shandong University Of Technology To The Non-Motor Lane Of Daxi Eighth Road.

The Second Track Is A Left Turn Along The Normal Left Turn Track Of The Motor Vehicle. The Starting Point Of Track 3 Is The Same As That Of Track Two, But The Destination Is Different, That Is, From The North Side Of The Opening Of The East Gate To The Southernmost Side Of The Communist Youth League Road. In Addition To The Movement Route Of Track 2, The Crossing Track In Accordance With Traffic Regulations, The Cycling Behaviors Represented By Track 1 And Track 3 Are All Violations. Track A All Of The Left Route Proportion Reached 19.56%, Trajectory Two Accounted For 79.23%, Trajectory In Survey Data Only Accounted For 1.21%, Most Of The Electric Bike Riders Involved In The Process Of Traffic In Accordance With The Requirements Of The Traffic Regulations, Along The Prescribed Route, Suggesting That Citizens 'Traffic Safety Consciousness Is Higher, Into The Lane Will Inevitably Conflict With The Road Normal Driving Motor Vehicles, Affect The Normal Driving Of Motor Vehicles, Will Also Affect The Ride's Own Life Safety.

Conflict Between Left Electric Vehicle and Right Motor Vehicle :

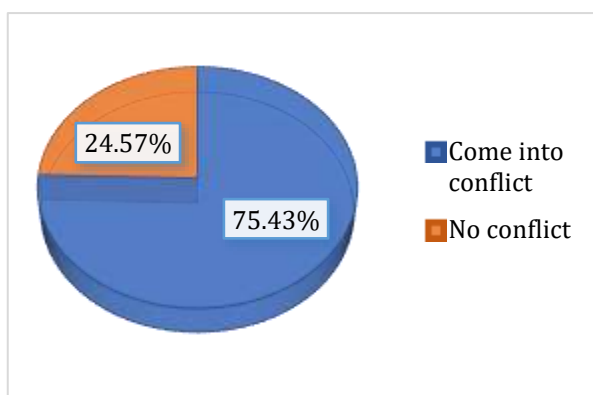


FIGURE 7: Scale Diagram Of The Conflict Period Between Electric Vehicles And Right-Turn Motor Vehicles.

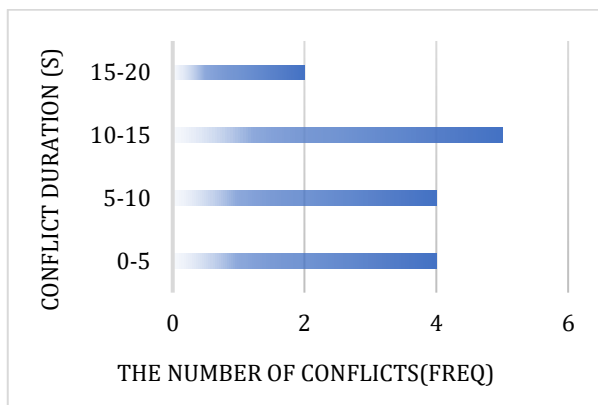


FIGURE 8: Number Of Conflicts In The Duration Of Conflict.

Left left electric vehicles and motor vehicle conflict cycle accounted for 75.43% of the total, it can be seen that most of the cycle, electric vehicles and right motor vehicle conflict between conflict, this is because the survey time is morning peak, travel motor vehicles and electric vehicles are more, traffic is higher, the utilization rate of the road is high, conflict is difficult to avoid.

From the point of the duration of the conflict, most of the conflict duration is low, the longest time for more than 20 seconds, the right vehicle traffic obstacles and influence or within the scope of the motor vehicle, most did not appear horns warning or forced through, the duration of the

conflict or within motor vehicle drivers tolerable limit, it also shows that motor vehicle drivers can strictly abide by traffic regulations, and have good safety awareness.

PSYCHOLOGICAL CHARACTERISTICS OF CYCLISTS

Investigation Method

The questionnaire was designed according to the different behavioral characteristics of the cyclists in the waiting stage before crossing the street, the driving stage of crossing the street and the completion stage of crossing the street.

Psychological Activities of Cyclists

TABLE 1: Left Turn Street Rider Questionnaire.

Question	Answer	Scale
How do you choose to cross the street when you ride an electric bike?	Go straight through it and go in a straight line	12.52%
	Go through the crosswalk twice, and break the line	87.48%
When you turn left, the minimum distance between you and the same left turn vehicle is ___ meters	1.5	13.36%
	2	36.98%
	3	22.48%
	5	27.18%
What are you like when you are about to complete the left turn and you may have a conflict with a right turn vehicle?	Accelerate through	75.72%
	Actively stop or slow down to avoid	24.28%

When riding an electric car will choose how way through the intersection, 12.52% of respondents chose the direct oblique crossing diagonal, walk straight line through they choose the reason of the "fast and convenient", "time", "twice more trouble", another 87.48% of respondents chose twice through the crosswalk, broken line, their reason "safe" "comply with the requirements of traffic regulations".

At the left turn, the minimum distance between the vehicle and the same left vehicle is several meters, and the minimum distance between nearly half of the cyclists and the left vehicle is 2 meters, 2 meters is the safety bottom line that most people think, and the minimum distance between the cyclists with the highest safety requirements is 5 meters. The minimum distance from the motor vehicle is related to the safety of the left motorcyclist across the street. This distance does not mean that the bigger the better, but less than 2 meters, it is easy to have traffic accidents with the left-turn motor vehicle.

When riding an electric car is about to complete the left street, may conflict with right motor vehicle problems, classified questionnaire, 75.72% chose accelerated through, the reason of their choice is can reduce the conflict time, left pass time short must pass as soon as possible, stay in the motorway is too dangerous, motor vehicles should take the initiative to avoid, 24.28% active stop or slow down, their reason is to avoid traffic accidents, forced through too dangerous.

CONCLUSION

Can be seen from the analysis of video data, in the process of turning left 44.72% of electric cyclists and the minimum distance is less than 2 meters, 81.56% of electric cyclists and the minimum distance is less than 3 meters, from the results of the questionnaire is the minimum distance below

2 meters is 50.28%, and the minimum distance below 3 meters accounted for 72.82%, video collected data consistent with the questionnaire results. But when the left to choose close to the motor vehicle or as far as possible away from the motor vehicle driving problems, many respondents said when riding electric vehicles left and left vehicles to keep a certain distance, and the actual data has certain deviation, that their original psychological expectations and actual behavior gap, they in the actual street and the minimum distance below their psychological expectations. This is related to the mental activity of cyclists eager to cross the street quickly and take the shortest path. On the choice of left turn route, electric cyclists have a clear cognition on this issue, just cyclists to make the right choice is affected by the following psychological activities, to ensure their own life safety, into the motorway ride is too dangerous, obey the traffic regulations to the provisions of the road. Their mental activity is consistent with their behavioral performance. It is these psychological activities that help cyclists make the right choices, comply with traffic laws and reduce the risk of cycling.

Through the comprehensive comparison of motorcyclists actual crossing behavior and psychological analysis, turn left electric vehicles and right turn vehicle conflict, appear most is motor vehicle active deceleration to stop to avoid pedestrians, motorcyclists because of fear is reluctant to stay in the motorway for a long time, traffic laws to ride cyclists protection makes the cyclists affected by adventure psychology is magnified, granted that motor vehicles should take the initiative to avoid them, so chose to ignore the motor vehicle to turn right, as often through or accelerate through. Of course, there are also some cyclists receiving the influence of safety psychology and fear psychology choose to slow down and avoid concessions, when this part of the group is relatively small.

To sum up, in the signal intersection of the electric bike left across the street, the electric bike has the fear of the psychology, fluke psychology and non-mobile violation of non-punishment psychology.

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