Research on automobile driver’s safe evaluation technology

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Abstract: Traffic accidents are closely related to the level of drivers’ safe driving skills. Many countries will add the evaluation of drivers’ safe driving quality to the evaluation of driving suitability. Safe driving quality refers to the driver’s own ideological quality, psychological quality and innate physiological quality which have an important impact on the safety of driving work. Including: awareness of compliance with traffic laws and regulations, strong sense of safety responsibility, agility in responding to sudden dangerous situations, whether the ability to judge road conditions is keen, character, personality, emotion, emotion, ability, attention, willpower, self-control, road rage, road rage, etc. At present, many countries in the world will test the safe driving level of drivers. Therefore, this paper combs the safe driving detection technology and methods of typical countries to explore the effective means and methods of safe driving and ensure traffic safety from the source.

1. Introduction

In view of the important position and role of road transport in the development of national economy, developed countries (Japan, South Korea, Germany, Australia, Russia, etc.) attach great importance to the basic research on road transport safety. In addition to improving the safety of roads and vehicles, they also attach great importance to the research on the suitability screening and testing technology of professional drivers and the training and management of professional drivers[1].

Mansensterbug, an American psychology professor, initiated the driver suitability test in 1912. Up to now, there are many methods to detect driver suitability in the world, including: the driver suitability test compiled by the Japanese Police Research Institute and the Police Department, the ART-90 test in Australia, the Wilson driver selection test in the United States, the TOST test in the United Kingdom, the driver test of the Institute of Traffic Medicine and Traffic Psychology in the former Yugoslavia, and the employment selection method formulated by the Gorky Institute of Health, Labor and Occupational Diseases in the former Soviet Union[2-9].

Based on the previous research results, it is found that the evaluation indexes are different due to the different testing methods of driving suitability in different countries. The testing indexes of Japan, Germany, Australia, South Korea, Russia and other countries are selected to sort out. Therefore, it is necessary to study the research and application status of automobile driver’s occupational suitability evaluation technology to ensure traffic safety from the source.

2. Comprehensive driving ability

In Japan, drivers must accept the OD-type safe driving test. It includes four testing contents: driving function, health and maturity, personality characteristics and driving etiquette. In the comprehensive evaluation of OD-type safety test, from the two evaluation axes of driving ability (evaluation of psychological work required for driving) and safe driving degree (evaluation of personality characteristics and physical and mental health required for safe driving), the driving modes are divided into four driving types to comprehensively diagnose the students’ safe driving ability.

One is the type of safe driving (people with high driving ability and safe driving): it is a type that can drive relatively safely. Second, the accident-prone type (people with low driving ability but high driving safety): although the possibility of safe driving is high, it is easy to get involved in accidents due to shaking driving operations. Third, it is prone to major accidents (people with high driving adaptability but low driving safety): driving operations can be completed relatively skillfully, but it is easy to cause major accidents because of ignoring safety. Fourth, the tendency of frequent accidents and violations (people with low driving ability and safe driving): the possibility of this type of accident is very high.

3. Vehicle handling ability

Japan: The test items of vehicle handling ability in Japan include acceleration response check, steering wheel operation check, throttle and brake response check. The
examination of accelerator response refers to the detection of blue and red stimuli, and the subjects check the pedal response to the stimuli. The circular blue and red stimuli were given at random intervals and in sequence, and the right foot response action was carried out to test the speed, uniformity and correctness of the selective response action.

Steering wheel operation inspection is used to measure the accuracy and speed of operation. Through the cursor that the handle moves freely to the left or right on the screen, a vertical straight line is quickly inserted between two rectangles, and the time interval is taken as one of the evaluation indexes to measure the accuracy of perception, the accuracy of operation speed, and the proficiency and adaptability of fine operation according to the situation.

Throttle and brake response inspection is a stimulus selective response test, which is used to measure the accuracy and speed of blue, yellow and red stimuli. Give round blue, yellow and red stimuli at random intervals and in sequence, and react with your right foot, in which blue continues to press the accelerator pedal, yellow lifts the accelerator pedal, and red stimuli measure the operation speed, reaction smoothness and reaction accuracy of selective reaction.

Germany: Germany checked the driving ability of the subjects through technical operation ability. The examination of technical operation ability requires the subjects to choose the answers that can be installed in the blank according to the requirements, so that the components can move in the direction indicated by the arrow.

Korea: The stop distance prediction considers the moving speed of the vehicle and measures the vehicle control ability check stopped at an appropriate position. The yellow moving line at the top of the screen begins to move in the driving line, and the red ending line on the screen is the target location. At the beginning of the test, the yellow moving line will move to the position of the red ending line, and the subject will step on the brake pedal when the yellow line approaches the red ending line. There are three speeds when the yellow moving line moves: fast, normal and slow. It should be noted that even if you step on the brake pedal, it will not stop suddenly like the actual driving. You need to be familiar with the brake pedal in advance.

In addition to stepping on the brake pedal to stop the vehicle immediately, other brakes will generate a certain braking distance according to the vehicle speed.

4 The ability to concentrate

Germany: the concentration test is used to test the concentration level of subjects. The test requires the subjects to select all the same symbols in the row according to the symbols in the gray grid in the first column.

Australia: Australia measures the subjects’ driving concentration through four indicators: concentration, continuous attention, signal detection and vigilance test. The test of concentration is to let the subjects compare the graphic contents of the first line and the second line. If the flashing graphic in the second line is the same as any graphic in the first line, click the green button, otherwise click the red button.

Continuous attention ability is a general ability to measure long-term selective attention and attention. The test method is that a series of five or seven triangles appear on the screen, and their arrangement may be orderly or disorderly, and the vertex angles of the triangles are up and down. When only two or three triangles point downward, the subjects need to press the button to react.

Simultaneous multi-capacity and multi-task testing is used to check the situation of coordinating and updating multiple tasks at the same time, which involves distracting attention during activities. The test consists of three different parts. The first part measures the baseline of working accuracy and speed, and the symbols displayed on the screen. Each line contains five abstract symbols or a combination of letters or numbers. The subjects need to click on all the elements crossed out in the left column on the right side of the corresponding line. In the second part, the subjects performed simple intellectual tasks, which were published by voice, and the respondents chose the correct answers from the options. The third part measures the synchronization ability. Respondents will perform multiple tasks at the same time, and the tasks are similar to those in the first two parts.

Signal detection is used to test the long-term concentration and visual differences of subjects in the presence of interference signals. Detect the situation that people can detect the existence of weak signals in the background of irrelevant signals or other signals that may be confused with related signals. Some dots will appear and disappear randomly on the screen. When four dots form a square, the subject must respond immediately.

Alert tests are used to assess long-term attention. The test method is to set a bright spot on a black background, and the bright spot moves along a circular track. When the bright spot jumps irregularly twice, the subjects need to press the button to react.

5 Reaction ability

Japan: The test of response ability can be divided into signal confirmation check and response ability in emergency, and the check of response ability in emergency can be divided into emergency response check and continuous emergency response check.

Signal confirmation test is a response test to determine the three stimulus choices of blue, yellow and red response actions of hands and right feet. In a certain period of time, circular blue, yellow and red stimuli will be displayed in random order, and the subjects will stimulate their hands and right feet to react respectively to test the speed, uniformity and correctness of selective reaction.

The emergency response test is a test to measure the muscle action response. The test is a circular red stimulus displayed continuously at a fixed time interval, and the subject uses his right foot to react, so as to measure the speed and reaction uniformity of simple visual single muscle action response.

Continuous emergency response inspection is an inspection to measure the expected, predicted and
estimated action degree. When the circular red stimulus is displayed continuously at a fixed time interval, the subjects react with their right feet to measure the reaction speed, reaction unevenness, expectation, prediction and possible behavior of simple visual single muscle movement.

**Germany:** The response ability of subjects is measured by accuracy and speed. The inspection method is that four kinds of graphics, namely blue rectangle, red triangle, green circle and yellow plus sign, appear irregularly at any position in the grid. When the graphics appear, the subjects click the color button with the same color as the graphics below the grid, and 50 graphics will appear in the whole test. If the graphics are not selected within a certain time, the system will judge that new graphics will appear after being omitted.

**Australia:** Australia measures driving reaction ability through simple reaction ability and determination test. Simple reaction ability (reaction behavior and visual function) requires subjects to respond to optical or acoustic signals as quickly as possible. Press or release the button as soon as possible when there is a simple light signal (yellow or red light), tone or two stimuli (yellow and tone, yellow and red). Determination test is a complex multi-stimulus response test, which is used to evaluate reactivity, stress tolerance and response ability under complex stimulus conditions. The test method is that the subjects respond to color stimuli and sound signals by pressing the button or stepping on the pedal.

**Korea:** The response ability of the subjects was tested by speed prediction test, response adjustment test and attention conversion test. Speed prediction inspection is the ability to predict the speed of moving objects such as vehicles or pedestrians during driving. The detection item is carried out by the vehicle in the picture, and the vehicle will drive left or right according to the direction of the arrow. There is a tunnel at the end of the road. At the beginning of the inspection, the driving direction will be given in the picture, and the vehicle will drive into the tunnel at a certain speed. Although the vehicles entering the tunnel are blocked, they will keep the speed before entering. Vehicle speed can be divided into three types: fast, medium and slow, which appear in a random form. Subjects should consider the speed of the vehicle, press the speed button when they think that the vehicle will reach the end of the tunnel, and the subjects should aim at the end of the tunnel as accurately as possible.

Reaction regulation inspection pays attention to the stimulation needed when driving, so as to measure the rapid and accurate response ability of the subjects. In the test, red and green balls will appear at random positions in the picture, and the subjects should press the corresponding buttons (red on the left and green on the right) as soon as possible according to the color of the balls, and the positions where the balls appear may be consistent or inconsistent with the positions of the color buttons. Subjects need to press the button that matches the color of the ball, not the button where the ball appears. The preparation posture for inspection is that the left hand is on the red button and the right hand is on the green button.

Attention conversion inspection tests the ability to recognize objects, unexpected emergencies and free distraction while driving. At first, the word "#" will appear in the picture, then there will be an arrow and seven figures similar to the arrow, and eight figures will form a circle, which can be divided into two types: a big circle expanding around and a small circle focusing on the center of the picture. The subject’s task is to find the arrows in eight figures and choose the direction of the arrows.

### 6 Perception of the surroundings

**Japan:** Japan tested the subjects’ perception of the surrounding environment through side alert detection. The side guard inspection refers to the concentration and distribution inspection that judges the information of the center and periphery of the visual field. In the center of the visual field, (0,1,2,3,...,9) and a serial number are repeatedly displayed at fixed time intervals. Repeating numbers or missing part of serial numbers at random time intervals, and performing reaction operations when repeating or missing. At the same time, the graphics (×○△□) in the peripheral part of the visual field will change at random intervals, and the response operation will be performed when the × appears in the stimulus at random positions to test the concentrated response of attention and the distribution of attention.

**Australia:** Australia measures the perception of the surroundings while driving through perception test and perception speed test. Peripheral perception ability detection is used to evaluate the ability to receive and process peripheral visual information. Test two subtasks: central tracking task and peripheral perception task. Light-emitting diodes will produce light stimuli that move at a specified speed in the peripheral visual field, and critical stimuli will appear at predefined time intervals, and the subjects will step on the pedals to respond to the key stimuli. At the same time, subjects also need to perform tracking tasks on the screen.

Perceptual speed test is used to measure perceptual speed and peripheral vision. Its core connotation is the comparative test of quick test pictures, which can distinguish the central vision and peripheral vision of subjects. The test is to let the subjects see two pictures in a short time interval, and the two pictures are different in three details. Subjects must point out the differences.

**Korea:** South Korea tested the subjects’ perception of the surrounding environment through change detection and perceptual tendency inspection. Change detection is to check the ability to remember and detect changes when driving in complex situations. At the same time, there will be five graphics with different colors and shapes in the picture, which are round, square, triangle, cross and diamond, and the colors are red, green, blue and pink. Graphics composed of different shapes and colors will appear in different positions at the same time and then disappear. Then the same pattern will appear again. Subjects need to judge the difference between the graphics in the first picture and the graphics in the following picture, and if they think they are the same, press the "Yes" button (red dotted line); If you think it is different, press the "No" button (yellow dotted line).
Perceptual tendency test is to test the perceptual discrimination ability of subjects to identify objects in panorama, background and panorama under driving conditions. The task of perceptual tendency checking is to find complex graphics and simple graphics. The task of finding simple graphics is to find out the options that can form a part of the complex graphics from the given simple graphics.

7 Visual ability

**Australia:** Australia measures the visual ability of subjects through visual memory test, visual tracking test and general neurological function test. Visual memory test is used to evaluate short-term visual memory. The test will show a city plan in a short time, with various symbols on the floor plan, such as the cross of the hospital and the books in the library. Subjects must remember the type and location of symbols, and the staff will ask about the location of their specific symbols. Subjects need to mark the location of symbols on the urban planning map, and will tell the answer immediately after completion.

Visual tracking test is used to measure visual orientation performance and visual perception. Subjects will see some random and disorderly lines and ask them to identify the ends of specific lines as soon as possible. General neurological function tests are used to evaluate general neuropsychological functions, such as visual motor processing speed and cognitive flexibility.

8 Anti-interference ability

Anti-interference test is used to test the influence of information interference on reading speed or color recognition. At the beginning of the test, the response speed and accuracy of the subjects will be set as the benchmark. In the test, words are presented in appropriate colors first, and then in various opposing colors. Subjects should respond to the meaning of font color or color words according to specific tasks, and quickly press the color key on the response board or touch screen.

9 Discussion and Conclusion

The quality of safe driving refers to all kinds of ideological quality, psychological quality and innate physiological quality that the driver himself has an important influence on the safety in his driving work. Including: awareness of obeying traffic laws and regulations, strong awareness of safety responsibility, agility in responding to sudden dangerous situations, acute ability to judge road conditions, character, personality, emotion, emotion, ability, attention, willpower, self-control, road mania, road anger and so on.

Therefore, in order to ensure traffic safety, China should fully consider the requirements of these countries on the safe driving quality of drivers, increase the detection of safe driving quality and skills before driving, screen out suitable drivers and eliminate unsafe drivers, and ensure traffic safety from the source.

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References