# FORM 4: NEW WORK ITEM PROPOSAL (NP)

Circulation date 2021-11-11	Reference number: Enter Number (to be given by ISO Central Secretariat)
Closing date for voting 2021-02-03.	ISO/TC Enter Number /SC Enter Number
Proposer	■ Proposal for a new PC
■ ISO member body: SAC □ Committee, liaison or other¹: Click here to enter text.	N Click here to enter text.
Secretariat Click here to enter text.	

A proposal for a new work item within the scope of an existing committee shall be submitted to the secretariat of that committee.

The proposer(s) of the new work item proposal shall:

- make every effort to provide a first working draft for discussion, or at least an outline of a working draft;
- nominate a project leader;
- discuss the proposal with the committee leadership prior to submitting the appropriate form, to decide on an appropriate development track (based on market needs) and draft a project plan including key milestones and the proposed date of the first meeting.

The proposal will be circulated to the P-members of the technical committee or subcommittee for voting, and to the O-members for information.

### **IMPORTANT NOTE**

Proposals without adequate justification risk rejection or referral to originator.

Guidelines for proposing and justifying a new work item are contained in Annex C of the ISO/IEC Directives, Part 1.

The proposer has considered the guidance given in the Annex C during the preparation of the NP.

#### Resource availability:

There are resources available to allow the development of the project to start immediately after project approval\* (i.e. project leader, related WG or committee work programme).

<sup>&</sup>lt;sup>1</sup> The proposer of a new work item may be a member body of ISO, the secretariat itself, another technical committee or subcommittee, an organization in liaison, the Technical Management Board or one of the advisory groups, or the Secretary-General. See ISO/IEC Directives Part 1, <u>Clause 2.3.2</u>.

<sup>\*</sup> if not, it is recommended that the project be first registered as a preliminary work item (a Form 4 is not required for this) and, when the development can start, Form 4 should be completed to initiate the NP ballot.

**Proposal** (to be completed by the proposer, following discussion with the committee leadership)

# Title of the proposed deliverable

#### English title

Driver training — Intelligent training system for vehicle driving

# French title (if available)

Click here to enter text.

(In the case of an amendment, revision or a new part of an existing document, include the reference number and current title)

# Scope of the proposed deliverable

The document specifies the terms and definitions, requirements (including the function requirements and performance requirements), test methods, packaging, transportation and storage of the intelligent training system for vehicle driving, not including the equipments of this system. This document is applicable to the design, development and delivery of the intelligent training system for vehicle driving.

# Purpose and justification of the proposal

Vehicle driver training is the first safety protection to road traffic safety. As a typical traditional industry, the research and application of intelligent technology in driving training and driving test is relatively late. In recent years, some equipment and systems with the help of electronic technology have appeared in the field of driving test. With the help of satellite positioning system and computer logic program, the test can be judged by artificial examiners, and the electronic driving qualification examination is partially realized. A number of driving school enrolment system platforms based on Internet technology began to appear, which promoted the process of information construction of driving training and driving test industry. However, the application of these technologies is only focused on the electronic driving training enrolment, driving school management and driving test process, without systematic in-depth research on artificial intelligence technology in driver driving ability training. In recent years, with the progress of artificial intelligence technology and the increasing demand of driver training industry for improving training quality, improving training experience and reducing training cost, the technical conditions for applying artificial intelligence technology to driver training industry and developing and applying robot coach instead of artificial coach are becoming more and more mature, and the social demand is becoming more and more urgent. Many countries and regions in the world have successively carried out relevant research, product development and application in this regard. Among them, China released the first generation of intelligent driving training system (robot coach) on January 26, 2016. The system uses multi-sensor information fusion and human-computer interaction functions to provide training guidance. It has been applied in more than 150 driving schools and has trained more than one million students. The paper An Intelligent Driver Training System Based on Real Cars introducing the development technology of the product was published in the international academic journal sensor in February 2019. Some teams in Germany have also explored the application of virtual reality and data analysis technology to vehicle driver training. Microsoft has also carried out research on driver assistance training technology based on mobile computing platform in India. At the previous "International Forum on vehicle driving training and road traffic safety" held from 2016 to 2021, intelligent driving training technology was one of the hot topics discussed at the meeting and received universal attention. Representatives of Germany, Sweden, Netherland, Japan and other countries introduced their work related to the application of artificial intelligence, virtual reality and augmented reality technology to driver training. It can be seen that the digitization and intellectualization of driver training, as the technical development direction in this field, has a high international consensus.

Although there are some differences in traffic rules for different countries, the basic requirements for safe driving skills are common, which also determines that the functions of the intelligent training system are similar and have unified standard requirements. The development of international standard for vehicle driving intelligent training system will help to promote the technological progress of driving training industry all over the world. It is more conducive to promoting the exchange and cooperation of relevant technologies in the field of driver training, promoting the application of this technology to the world, improving the quality of driving training in various countries and protecting road traffic safety.

# Consider the following:

Is there a verified market need for the proposal? What problem does this document solve? What value will the document bring to end-users?

See Annex C of the ISO/IEC Directives, Part 1 for more information.

See the following guidance on justification statements in the brochure 'Guidance on New work': https://www.iso.org/publication/PUB100438.html

Form 4: New work item proposal (NP) Page 4				
	Please select any UN Sustainable Development Goals (SDGs) that this document will support. For more information on SDGs, please visit our website at <a href="www.iso.org/SDGs">www.iso.org/SDGs</a> ."			
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	paratory work outline should be included with the proposal)			
	A draft is attached			
	An outline is attached			
	An existing document will serve as the initial basis			
	proposer or the proposer's organization is prepared to undertake the preparatory k required: ■ Yes □ No			
If a	draft is attached to this proposal			
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# Is this a Management Systems Standard (MSS)?

☐ Yes ■ No

**NOTE:** if Yes, the NP along with the Justification study (see Annex SL of the Consolidated ISO Supplement) must be sent to the MSS Task Force secretariat (<a href="mailto:tmb@iso.org">tmb@iso.org</a>) for approval before the NP ballot can be launched.

Indication of the preferred type to be developed
■ International Standard
□ Technical Specification
□ Publicly Available Specification
Proposed Standard Development Track (SDT)
To be discussed between proposer and committee manager considering, for example, when the market (the users) needs the document to be available, the maturity of the subject etc.
□ 18 months* □ 24 months ■ 36 months
* Projects using SDT 18 are eligible for the 'Direct publication process' offered by ISO /CS which reduces publication processing time by approximately 1 month.
Draft project plan (as discussed with committee leadership)
Proposed date for first meeting: 2022-01-10
Proposed dates for key milestones: Circulation of 1 <sup>st</sup> Working Draft (if any) to experts: 2022-08-10 Committee Draft ballot (if any): 2023-06-10 DIS submission*: 2023-12-10 Publication*: 2024-12-10
* Target Dates for DIS submission and Publication should preferably be set a few weeks ahead of the limit dates (automatically given by the selected SDT).
For guidance and support on project management, descriptions of the key milestones and to help you define your project plan and select the appropriate development track, see: go.iso.org/projectmanagement
<b>NOTE:</b> The draft project plan is later used to create a detailed project plan, when the project is approved.
Known patented items (see ISO/IEC Directives, Part 1, clause 2.14 for important guidance)
□ Yes ■ No
If "Yes", provide full information as annex
Co-ordination of work To the best of your knowledge, has this or a similar proposal been submitted to another standards development organization?
□ Yes ■ No
If "Yes", please specify which one(s):
Click here to enter text.

A statement from the proposer as to how the proposed work may relate to or impact on existing work, especially existing ISO and IEC deliverables. The proposer should explain how the work differs from apparently similar work, or explain how duplication and conflict will be minimized

There is no existing ISO and IEC deliverables and no similar work so far. This has affected the communication, cooperation, promotion and application of intelligent driving training technology in the world.

In ISO/TC 22, the scope is all questions of standardization concerning compatibility, interchangeability and safety, with particular reference to terminology and test procedures (including the characteristics of instrumentation) for evaluating the performance of the following types of road vehicles and their equipment as defined in the relevant items of Article 1 of the convention on Road Traffic, Vienna in 1968 concluded under the auspices of the United Nations, not including the intelligent training system for vehicle driving.

In ISO/TC 204, the scope is standardization of information, communication and control systems in the field of urban and rural surface transportation, including intermodal and multimodal aspects thereof, traveller information, traffic management, public transport, commercial transport, emergency services and commercial services in the intelligent transport systems (ITS) field. This scope is not including driver training system.

In ISO/TC 241, the scope is standardization in the field of RTS, Road traffic safety, management standards, needs, to be effective, to consist of a requirement standard (which ISO 39001 will be), RTS specific auditing requirements in third party certification, and implementation and guidance documents. This scope is not including driver training system. In ISO/IEC JTC1/SC42, the scope is Standardization in the area of Artificial Intelligence, serve as the focus and proponent for JTC 1's standardization program on Artificial Intelligence and provide guidance to JTC 1, IEC, and ISO committees developing Artificial Intelligence applications. This scope is not including driver training system as well.

In this situation, no existing TC or SC in ISO/IEC for this proposer. We prefer to set a new PC to develop this international standard.

# A listing of relevant existing documents at the international, regional and national levels

Chinese association standard: T/ZGCJM 001-2019 Intelligent training system for vehicle driving

Please fill out the relevant parts of the table below to identify relevant affected stakeholder categories and how they will each benefit from or be impacted by the proposed deliverable

	Benefits/impacts	Examples of organizations/companies to be contacted
Industry and commerce – large industry	Click here to enter text.	Click here to enter text.

Industry and commerce – SMEs	Benefits: It is helpful to train better drivers, train students more scientifically, improve the operation efficiency and benefit of the school, reduce the cost, and promote the transformation and upgrading of the driver training industry from the traditional mode based on artificial training to the advanced training mode based on artificial intelligence	Vehicle driving school
Government	Benefits: It helps to provide government departments with scientific evaluation and supervision of driver training effect and training quality. It is beneficial to traffic management, with high quality of drivers and less traffic accidents	Transportation Bureaus, Police department
Consumers	Benefits, It is helpful for drivers to develop good driving habits and improve the training quality of driving school	Driving school, Driving school students
Labour	Benefits: Provide advanced means for the teaching process, reduce the workload of manual coaches and improve work efficiency	Driver instructor
Academic and research bodies	Benefits: Promote academic exchanges on the research and application of artificial intelligence technology in driver training industry	Related university and institute
Standards application businesses	Benefits: It is helpful to improve the quality of driving training.	Vehicle driving training
Non-governmental organizations	Benefits: Conducive to the supervision and management of driving school	Vehicle training school associations
Other (please specify)	Click here to enter text.	Click here to enter text.

Liaisons	Joint/parallel work	
A listing of relevant external international organizations or internal parties (other ISO and/or IEC committees) to be engaged as liaisons in the development of the deliverable.	Possible joint/parallel work with  ☐ IEC (please specify committee ID) Click here to enter text.	
ISO/IEC JTC1/SC42, ISO/TC22, ISO/TC204, ISO/TC241	☐ CEN (please specify committee ID) Click here to enter text.	
	☐ Other (please specify) Click here to enter text.	
A listing of relevant countries which are not	already P-members of the committee	
No		
<b>NOTE:</b> The committee manager shall distribute listed above to ask if they wish to participate in		
Proposed Project Leader (name and e-mail address)	Name of the Proposer (include contact information)	
Jun Li jli97@163.com	Dr. LI Yubing Deputy Director General, Department of Standards Innovative Management, SAMR; Secretary General of Chinese Member Body of ISO, SAC Liyb@sac.gov.cn	
This proposal will be developed by		
<ul> <li>□ An existing Working Group (please specify which one: Click here to enter text.)</li> <li>□ A new Working Group (title: Click here to enter text.)</li> <li>(Note: establishment of a new WG must be approved by committee resolution)</li> <li>□ The TC/SC directly</li> <li>□ To be determined</li> </ul>		
Supplementary information relating to the p	roposal	
<ul> <li>This proposal relates to a new ISO document;</li> <li>This proposal relates to the adoption as an active project of an item currently registered as a Preliminary Work Item;</li> <li>This proposal relates to the re-establishment of a cancelled project as an active project.</li> </ul>		
☐ Other:		

Click here to enter text.

Maintenance agencies (MA) and registration authorities (RA)
☐ This proposal requires the service of a <b>maintenance agency</b> .  If yes, please identify the potential candidate:  Click here to enter text.
☐ This proposal requires the service of a <b>registration authority</b> .  If yes, please identify the potential candidate:  Click here to enter text.
<b>NOTE:</b> Selection and appointment of the MA or RA is subject to the procedure outlined in the <u>ISO/IEC Directives</u> , Annex G and Annex H, and the RA policy in the ISO Supplement, Annex SN.
□Annex(es) are included with this proposal (provide details)
Click here to enter text.
Additional information/questions

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ISO TC ##/SC ##/WG #

Secretariat: ##

# Driver training — Intelligent training system for vehicle driving

# WD stage

#### Warning for WDs and CDs

This document is not an ISO International Standard. It is distributed for review and comment. It is subject to change without notice and may not be referred to as an International Standard.

Recipients of this draft are invited to submit, with their comments, notification of any relevant patent rights of which they are aware and to provide supporting documentation.

To help you, this guide on writing standards was produced by the ISO/TMB and is available at <a href="https://www.iso.org/iso/how-to-write-standards.pdf">https://www.iso.org/iso/how-to-write-standards.pdf</a>

A model manuscript of a draft International Standard (known as "The Rice Model") is available at <a href="https://www.iso.org/iso/model document-rice model.pdf">https://www.iso.org/iso/model document-rice model.pdf</a>

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### Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see <a href="https://www.iso.org/directives">www.iso.org/directives</a>).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see <a href="https://www.iso.org/patents">www.iso.org/patents</a>).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see <a href="https://www.iso.org/iso/foreword.html">www.iso.org/iso/foreword.html</a>.

This document was prepared by Technical Committee ISO/TC XX, XXX Subcommittee SC ##, [name of subcommittee].

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at <a href="https://www.iso.org/members.html">www.iso.org/members.html</a>.

# Driver training — Intelligent training system for vehicle driving

# 1 Scope

This document specifies the terms, definitions, requirements (including the function requirements and performance requirements), test methods, packaging, transportation and storage of intelligent training system for vehicle driving, but not including the components of this system.

This document is applicable to intelligent training system for vehicle driving.

## 2 Normative references

There are no normative references in this document.

# 3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- ISO Online browsing platform: available at <a href="https://www.iso.org/obp">https://www.iso.org/obp</a>
- IEC Electropedia: available at <a href="http://www.electropedia.org/">http://www.electropedia.org/</a>

#### 3.1

#### intelligent training system for vehicle driving

teaching robot for vehicle driving training, which is installed and operated on a coach car, and completely replaces the manual teaching

#### 3.2

# intelligent training function system

all the teaching functions collection which aiming at cultivating the safety awareness and driving skills of motor vehicle drivers, including basic teaching contents, examination contents, introduction of safe driving behaviour habits, training safety guarantee, intelligent human-computer interaction and other elements

# 3.3

# human-machine interacting instructor

the personnel who are responsible for guiding the trainees to correctly use the real vehicle intelligent training system and ensuring the effect of human-computer interaction in the process of driving training and teaching

# 4 System composition

The intelligent training system for vehicle driving is mainly composed of the following six subsystems:

- a) Intelligent teaching subsystem;
- b) Safety driving behavior habits import subsystem;

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- c) Teaching process recording subsystem;
- d) Student help subsystem;
- e) Teaching security subsystem;
- f) Equipment self-test and fault diagnosis subsystem.

Organizations can add or delete the above subsystems according to the specific situation.

# 5 Requirements

# 5.1 Functional requirements

# 5.1.1 Intelligent teaching function system

The intelligent teaching function system of intelligent training system for vehicle driving shall at least include the following functions:

- a) Intelligent teaching;
- b) Safe driving habits leading-in;
- c) Teaching security guarantee;
- d) Students' help seeking;
- e) Teaching process recording;
- f) Equipment self-checking and fault diagnosis.

#### 5.1.2 Intelligent teaching

The function of intelligent teaching shall use artificial intelligence, data analysis, intelligent sensing, augmented reality and other advanced technologies to carry out driving teaching. The specific requirements are as follows:

- a) The teaching content shall cover the contents specified in the syllabus for teaching and examination of motor vehicle driving training;
- b) Real time perception of the status information of vehicles, trainees and venues;
- c) Real time intelligent analysis, evaluation, diagnosis and feedback of driving behaviour of trainees;
- d) Driving skill transfer based on 3D intelligent scene matching, visual guidance and intelligent voice interaction technology is realized;
- e) The teaching method based on scene intelligent matching is provided, which can push the adapted teaching content according to the trainees' training status and scene. At the same time, the trainees can obtain the required teaching content through convenient trigger;
- f) It provides remote intelligent monitoring of intelligent teaching process.

## 5.1.3 Safe driving habits leading-in

The function of safe driving habits leading-in shall be able to implant and develop safe driving habits in combination with the training process. The behaviour habits that should be imported at least include:

- a) Safety belt wearing habits;
- b) Observation habit in blind area of visual field;
- c) Rearview mirror observation habit;
- d) Open and close the door to observe the habit actively;
- e) Safe starting habit of vehicles.

#### 5.1.4 Teaching security guarantee

The function of teaching security guarantee shall have the ability of identifying, predicting and preventing dangerous situations. The specific requirements are as follows:

- a) It shall be able to automatically identify and predict the following dangerous situations:
  - 1) Objects and pedestrians in front, back, left and right of the driver-training car;
  - 2) Vehicle sliding on the ramp;
  - 3) Students mistook the accelerator for the brake, resulting in abnormal acceleration of the vehicle;
  - 4) The door is opened when the vehicle is moving;
  - 5) The safety belt is unfastened when the vehicle is moving;
  - 6) Exceeding the limited speed threshold which can ensure the safety of driving school training ground;
  - 7) When the steering wheel of the vehicle rapidly turns towards the dangerous obstacle;
  - 8) Driving out of the specified training area;
- b) It shall be able to take automatic safety control measures for dangerous situations;
- c) It shall be able to realize remote dialogue reminder, braking and locking vehicle and other safety measures.

# 5.1.5 Students' help seeking

The function of students' help seeking shall be able to realize the two-way communication between students, human-machine interacting instructor and remote supervisors. The specific requirements are as follows:

- a) Students can actively call human-machine interacting instructor and remote supervisors, and conduct voice and/or video interaction;
- b) The remote supervisor actively calls the trainees and carries out video and voice interaction.

## 5.1.6 Teaching process recording

The function of teaching process recording shall be able to record and archive the teaching, training process and class hours comprehensively. The specific requirements are as follows:

- a) Record the teaching and training process and class hours completely, truly and accurately;
- b) Be able to query and count the teaching log and training record.

# 5.1.7 Equipment self-checking and fault diagnosis

- **5.2.7.1** The function of equipment self-checking and fault diagnosis shall be able to realize equipment self-checking during power on and real-time self-checking during normal operation, upload self-checking results to human-machine interaction terminal for display and voice broadcast at the same time. The specific requirements are as follows:
- a) Power on self-checking;
- b) Real time self-checking in teaching process;
- c) Upload and display the self-checking results;
- d) Voice broadcast of equipment failure.
- **5.2.7.2** Self-checking items shall include but not limited to the following items:
- a) Distance measuring equipment for pedestrians and obstacles outside vehicles;
- b) Vehicle signal acquisition equipment;
- c) Service brake control equipment;
- d) GPS vehicle positioning equipment.

## **5.2** Performance requirements

#### 5.2.1 Safety performance of teaching driving

The evaluation of the teaching safety performance of the intelligent training system shall cover the following elements:

- a) Front braking;
- b) Left braking;
- c) Right braking;
- d) Left turn braking;
- e) Right turn braking;
- f) Rear braking;
- g) Rear left braking;

- h) Rear right braking;
- i) Rear left reverse braking;
- j) Rear right reverse braking;
- k) Decelerating braking;
- l) Wrong accelerator braking;
- m) Rolling braking.

The evaluation elements of the safety performance shall be set according to the relevant traffic rules of the local government.

#### 5.2.2 Equipment stability

- **5.3.2.1** The intelligent training system for vehicle driving shall be able to work continuously for 8 h per day. The mean time between failures (MTBF) is 3 months.
- **5.3.2.2** The software system of the intelligent training system for vehicle driving shall be able to work continuously and stably for 8 h per day without crash and restart, and record the log information completely.

#### 6 Test method

#### 6.1 Functional requirements

# 6.1.1 Test conditions

After the intelligent training system is installed in the normal state of the driver-training car, the function test is carried out.

Before the test, the intelligent training system for vehicle driving shall be started and put into operation.

## 6.1.2 Intelligent teaching

Check the functional modules related to training and teaching, and check whether the functional requirements listed in 5.2.2 can be realized.

#### 6.1.3 Safe driving habits leading-in

Check whether the intelligent training system for vehicle driving has the functions related to the driver's habits, such as wearing seat belt, observing the blind area of vision, observing the rear-view mirror, opening and closing the door, starting safely, etc.

#### 6.1.4 Teaching security guarantee

Set the dangerous situations listed in 5.2.4a), check whether the intelligent training system for vehicle driving can automatically identify and predict, and check the treatment and remote safety control of the driver-training car in dangerous situations.

#### 6.1.5 Students' help seeking

Simulate the situation of students actively calling human-machine interacting instructor and remote supervisor, and remote supervisor actively calling students, observe whether the interaction process is smooth, whether the image and voice are clear and fluent.

# 6.1.6 Teaching process recording

Check the teaching and training records stored in the teaching log of the intelligent training system for vehicle driving, as well as the implementation of query and statistics functions. Focus on whether the records are complete, true and accurate, and whether the statistical query function is complete.

# 6.1.7 Equipment self-checking and fault diagnosis

According to the self-checking items listed in 5.2.7.2, set fault scenarios, check whether the real vehicle intelligent training system can self-checking the fault, upload the self-checking results to the human-computer interaction terminal for display, and broadcast them by voice.

# 6.2 Performance requirements

#### 6.2.1 Test conditions

When the driver-training car is in the normal state, the intelligent training system for vehicle driving is installed on the car, and then the performance test is carried out.

# 6.2.2 Safety performance of teaching driving

According to the items in 5.3.1, operate the front brake, left brake and other items one by one, and record the corresponding test results.

# 6.2.3 Equipment stability

Start the intelligent training system for vehicle driving, keep working continuously for 8 hours every day for 3 months, observe the operation of equipment and software, record and save the log information, record the fault occurrence and time, and calculate the mean time between failure (MTBF) of the system.

# 7 Packaging, transportation and storage

# 7.1 Packaging

The intelligent training system for vehicle driving shall be attached with qualification certificate when leaving the factory. The certificate shall indicate:

- a) Name of manufacturer;
- b) Product name;
- c) Product model;
- d) Product number;

- e) Production date;
- f) Inspector's seal.

# 7.2 Transportation

- **7.2.1** The qualified intelligent training system for vehicle driving shall be packaged with shockproof and moisture-proof materials, and shall be packed in cartons or wooden cases when long-distance transportation is required.
- **7.2.2** In the process of transportation and storage, take anti shock and anti damage measures.

# 7.3 Storage

The intelligent training system for vehicle driving shall be stored in a dry, clean, ventilated and non corrosive gas warehouse before the real vehicle is installed. The temperature and relative humidity of the warehouse shall meet the following requirements:

- a) Temperature: 5 °C  $\square$  30 °C;
- b) Relative humidity:  $20\% \square 75\%$ .