
**Road vehicles — Measurement of
driver visual behaviour with respect
to transport information and control
systems —**

**Part 1:
Definitions and parameters**

*Véhicules routiers — Mesurage du comportement visuel du
conducteur en relation avec les systèmes de commande et
d'information du transport —*

ISO 15007-1:2014

Partie 1: Définitions et paramètres

<https://standards.iteh.ai/catalog/standards/sist/15007/15007-1-2014>
fe848e37ec76/iso-15007-1-2014



iTeh STANDARD PREVIEW
(standards.iteh.ai)

ISO 15007-1:2014

<https://standards.iteh.ai/catalog/standards/sist/f65bf740-0e9c-4dc8-9ecf-fe848e37ec76/iso-15007-1-2014>



COPYRIGHT PROTECTED DOCUMENT

© ISO 2014

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized otherwise in any form or by any means, electronic or mechanical, including photocopying, or posting on the internet or an intranet, without prior written permission. Permission can be requested from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office
Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.org
Web www.iso.org

Published in Switzerland

Contents

	Page
Foreword	iv
Introduction	v
1 Scope	1
2 Normative references	1
3 Terms and definitions	1
4 Definition of measures and metrics	4
4.1 Basic Direct Measures	5
4.2 Glance Metrics Derived From Basic Measures	5
5 Data collection and analysis	7
6 Data presentation	7
Annex A (informative) Supporting Figures to explain terms and definitions	9
Bibliography	13

iTeh STANDARD PREVIEW (standards.iteh.ai)

ISO 15007-1:2014

<https://standards.iteh.ai/catalog/standards/sist/f65bf740-0e9c-4dc8-9ecf-fe848e37ec76/iso-15007-1-2014>

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. www.iso.org/directives

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. www.iso.org/patents

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

For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT), see the following URL: [Foreword - Supplementary information](#)

The committee responsible for this document is ISO/TC 22, *Road vehicles*, Subcommittee SC 13, *Ergonomics applicable to road vehicles*.

This second edition cancels and replaces the first edition (ISO 15007-1:2002), of which it constitutes a minor revision.

ISO 15007 consists of the following parts, under the general title *Road vehicles — Measurement of driver visual behaviour with respect to transport information and control systems*:

- *Part 1: Definitions and parameters*
- *Part 2: Equipment and procedure* [Technical Specification]

Introduction

Vision provides the primary source of information available to a driver. Information is gathered by looking at objects and events and this in turn affords control and navigation of the vehicle in the road traffic environment. Assessment of a driver's visual behaviour provides a method of quantifying the driver's visual allocation to the roadway or in-vehicle information sources (see Reference^[1]).

Transport Information and Control Systems (TICS) applications for vehicles may have visual displays that can present a range of driver-selected information. If these visual displays have associated controls (e.g. to select a zoom level or menu option) then these associated hand-control activities may also be visually guided and become part of the visual behaviour associated with a display/TICS application. For this reason it may be important to consider not only the visual behaviour in relation to information display, but also the duration and frequency of glances following driver controlled actions.

Comparisons between specific vehicle systems have been made more difficult because the studies were conducted in different environments using different experimental techniques, different measurement definitions, and different analysis methods.

ISO 15007 has been developed to give guidance on the terms and measurements relating to the collection and analysis of driver visual behaviour data. This approach aims to assess how drivers respond to vehicle design, the road environment, or other driver-related tasks in both real and simulated road conditions. More specifically, the approach of this standard is based on the assumption that efficient processing of visual information is essential to the performance of the driving task.

ISO 15007-1 defines key terms and parameters applied in the analysis of driver visual behaviour focused on glance and glance related measurements. ISO 15007-2 gives guidelines on equipment and procedures for analysis of driver visual behaviour.

Practical assessments of drivers in real or simulated environments are conducted to quantify the allocation of visual behaviour to specified areas of interest. Visual behaviour may be quantified by the location, duration and frequency of glances to a specified area of interest in the visual scene (and, over time, between areas of interest). This approach often uses commonly available eye tracking and/or video-recording equipment. However, it does not preclude the use of more sophisticated technologies which may elicit additional driver visual behaviour information.

Results from such assessments should enable comparison of the relative influence of the TICS use with reference conditions.

iTeh STANDARD PREVIEW
(standards.iteh.ai)

[ISO 15007-1:2014](#)

<https://standards.iteh.ai/catalog/standards/sist/f65bf740-0e9c-4dc8-9ecf-fe848e37ec76/iso-15007-1-2014>

Road vehicles — Measurement of driver visual behaviour with respect to transport information and control systems —

Part 1: Definitions and parameters

1 Scope

This part of ISO 15007 defines key terms and parameters applied in the analysis of driver visual behaviour focused on glance and glance-related measures. These terms and parameters can be applied in environments from real-world driving experiments to laboratory-based driving simulator studies.

The procedures described in this part of ISO 15007 could also apply to more general assessments of driver visual behaviour without the introduction of TICS-specific systems. The parameters and definitions described below are intended to assist development of a common source of reference for driver visual behaviour data.

Minimum requirements for reporting the results of Transport Information and Control Systems (TICS) evaluations are provided.

Further guidance including the specification of how to analyse and present the results of studies of visual behaviour is available in other ISO publications (see, for example, ISO 2854 and ISO/TR 13425:2006). However, data collected and analysed according to this standard will allow comparisons to be performed across different TICS applications and experimental scenarios.

<https://standards.iteh.ai/catalog/standards/sist/f65bf740-0e9c-4dc8-9ecf-fe848e37ec76/iso-15007-1-2014>

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 2854, *Statistical interpretation of data — Techniques of estimation and tests relating to means and variances*

ISO/TR 13425:2006, *Guidelines for the selection of statistical methods in standardization and specification*¹⁾

ISO/TS 15007-2:2014, *Road vehicles — Measurement of driver visual behaviour with respect to transport information and control systems — Part 2: Equipment and procedures*

3 Terms and definitions

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

3.1

accommodation

adjustment of the lens of the eye to bring about focusing of an image of an object upon the retina

Note 1 to entry: The time for the eye to accommodate from one object to another depends on the distance between the objects.

1) Withdrawn.

**3.2
adaptation**

ability of the eye to adjust to changing light conditions

Note 1 to entry: Adaptation times to transition from dark to light and light to dark are different.

**3.3
direction of gaze**

area of interest to which the eyes are directed

**3.4
fixation**

alignment of the eyes so that the image of the fixated area of interest falls on the fovea (the middle of the retina responsible for our central, sharpest vision) for a given time period

Note 1 to entry: Typically, individual fixations last from 100 ms to 2 000 ms (see Reference[3]). Fixations are the briefest of pauses during which visual information extraction is done by the eyes-and-brain from spatial areas that fall on the fovea of the eye (and hence are quite small). During fixation, there are believed to be at least three processes taking place (see Reference[10]): 1) analysis of the image falling on the fovea, 2) selection of a new saccade target and 3) programming of the saccade to-be-made-next. It is not yet known how these processes are synchronized by the brain, nor how precisely they are synchronized – since fixation durations are not always long enough to comprehend completion of all the processes. (Sometimes the eyes move before information extraction from the site of fixation has been completed, as evidenced by frequent corrective return fixations to a site under some conditions that was fixated too briefly). There is evidence that the brain both pre-programs fixation duration, and also does “process-monitoring” during a fixation to determine if analysis of the foveal image is complete within the fixation’s duration.before moving on. Thus, fixation time is dependent on both the immediate stimulus and the history of prior fixations. The contribution of both components suggests that fixation time may depend on the task and the amount of useful information in the fixated display (or viewed information) (see Reference[4]).

See [A.1](#) to [A.4](#).

**3.5
glance**

maintaining of visual gaze within an area of interest, bounded by the perimeter of the area of interest; may be comprised of more than one fixation and saccades to and from it. Its duration is measured as “glance duration”

Note 1 to entry: A glance is a scientific construct that sums over one or more fixations that are made contiguously within a given area of interest (but one that is larger than the area corresponding to the eye’s foveal region – an area that usually requires more than one fixation to view). The construct of a glance, therefore, typically comprehends more than a single fixation and is a coarser unit of analysis than a single fixation (since it is summing over fixations that are contiguous in time and spatially proximal within an area of interest). (“Area of interest” is formally defined below in [3.11](#)). The construct of a “glance” is needed because often the salient questions in a study relate to the amount of contiguous time spent gazing at a particular area of interest (before the eyes move away from it). (Of course, in some instances, the “glance” construct is also necessary because some measurement approaches are not capable of the fine discriminations needed to identify individual fixations (spatially and temporally) – and can only discriminate at the spatial/temporal granularity of glances. Thus, “glances” are a coarser measure of visual information extraction by the eyes/brain from a continuously viewed but somewhat larger spatial region. Typical glance lengths vary by stimulus and task, but might (for example) range from 500 ms to 3 s for a task like “tuning the radio” (see Reference[7]).

See [A.1](#) to [A.4](#).

**3.6
saccade**

brief, fast movement of the eyes that changes the point of fixation

Note 1 to entry: Saccades reach velocities as high as 500/s (see Reference [6]), whereby the mean saccade ranges between 1° (text reading) to 5° (scene perception) (see Reference [9]).

See [A.1](#) to [A.4](#).

3.7

smooth pursuit movement

smooth, continuous movement of the eyes made to closely follow/pursue a moving object or signal;

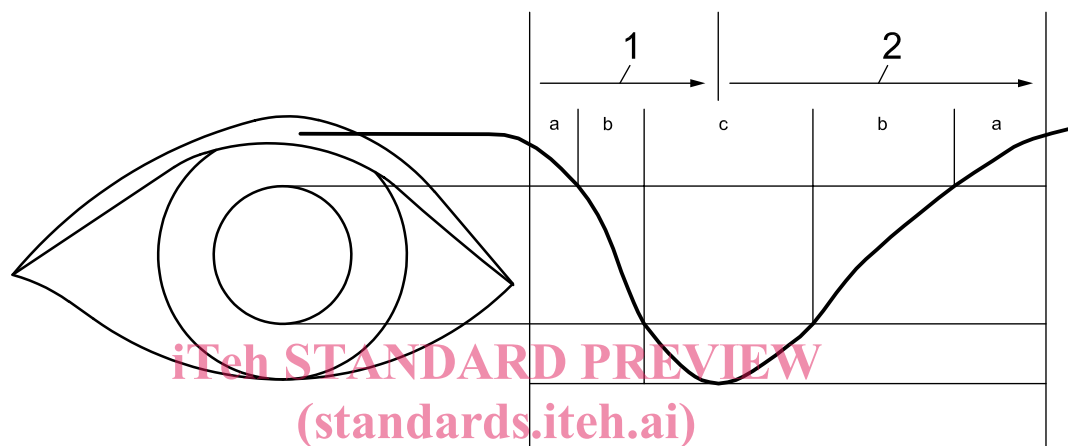
Note 1 to entry: Humans generally perform smooth pursuit movements better in the horizontal than vertical dimension, and better in the downward than upward direction. Smooth pursuit movements can have a velocity as high as 90°/s (see Reference [5]).

3.8

blink

short moment in which the eye is closed by the eyelid

Note 1 to entry: The blink starts when the eyelid starts moving downwards and ends when the eye is fully opened again. According to the duration for which the eye is closed the following classification applies (see Reference [8]):



- Normal blinks: ≤ 300 ms (mean duration 257 ms; standard deviation 11 ms)
- Long closed durations: 300 ms to 500 ms
- Eye-lid closures: ≥ 500 ms (indicating microsleeps)

Key

- 1 closing phase
- 2 opening phase
- a open
- b partially closed
- c closed

Figure 1 — Phases of a blink (see Reference [11])

3.9

fly through (artfactual fixation)

small 'snapshot' of a saccade (<120 ms) that may be an artefact captured when the eye is moving from one Area of Interest to another Area of Interest, and passing through one or more intermediate Areas of Interest in between (e.g. the eye moves from the road scene ahead to the instrument cluster and passes the head-up display)

Note 1 to entry: Sometimes a small 'snapshot' of such a saccade may appear to be a short fixation, when it is really still part of the saccade. Such fly throughs (<120 ms) are not treated as fixations. Fly throughs may be grouped with the saccade they are part of, if saccades are being measured.

Note 2 to entry: Research shows that fixations can't be shorter than 100 ms (See Reference [6]).

**3.10
sample interval**

time period that constitutes a sample of interest (e.g. an in-vehicle task) in the data; or, to put it differently, the epoch of time over which measurements are taken

Note 1 to entry: Usually, this will be the contiguous epoch of time that is associated with an event or task that is of interest in the study. The sample interval is the period of time (from start to end) during which data are extracted.

**3.11
area of interest**

AOI
pre-determined area within the visual scene, e.g. a rear-view mirror

Note 1 to entry: An AOI will be no smaller than the normal resolution of the eye-measurement system being used (e.g. no smaller than 0.5° for typical eye-tracking systems)

See [A.1](#).

**3.12
transition**

change in eye fixation location from one defined area of interest location to a different defined area of interest

SEE: [A.1](#) and [A.2](#).

**3.13
visual angle**

angle subtended at the eye by a viewed object or separation between viewed objects

Note 1 to entry: The figure below shows the visual angle α .

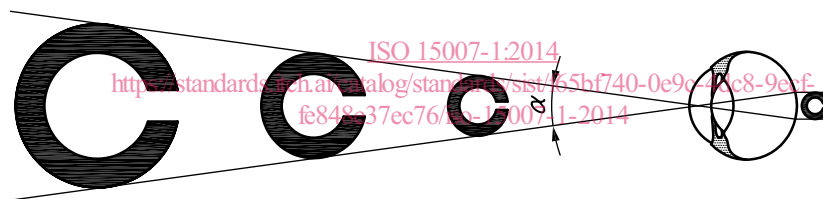


Figure 2 — Visual Angle α

**3.14
visual demand**

degree or quantity of visual activity (determined by e.g. number of glances, total glance time) required to extract information from an object to perform a specific task

SEE: [A.1](#).

**3.15
visual display**

device used to present visual information

SEE: [A.1](#).

4 Definition of measures and metrics

The measures and statistics defined in this clause utilize the terms and definitions defined in [Clause 3](#).

4.1 Basic Direct Measures

4.1.1 duration of diversion: period of glance duration(s) associated with directions of gaze away from one area of interest to another area of interest during a defined period of interest.

See [A.3](#).

4.1.2 dwell time: sum of consecutive individual fixation and saccade times to an area of interest in a single glance.

See [A.4](#).

4.1.3 glance duration: time from the moment at which the direction of gaze moves towards an area of interest (e.g. the inside rear-view mirror) to the moment it moves away from it.

NOTE Under certain specific conditions, this may be operationalized differently. See footnote in [A.2](#).

See [A.2](#).

4.1.4 transition time: duration between the end of the last fixation on an area of interest and the start of the first fixation on another area of interest.

See [A.2](#).

4.1.5 scan duration: time interval consisting of two or more glances that are linked in a consecutive set of fixations to areas of interest in the visual scene.

4.1.6 minimum glance duration: shortest possible duration for a fixation to an area of interest.

NOTE Fixations to an area of interest ≤ 120 ms are physically not possible; If an eye-tracker is in use and records such a duration it can be classified as part of a transition between areas of interest.

4.2 Glance Metrics Derived From Basic Measures

In this subclause, each derived metric is defined, a unit is specified, and an example is provided.

NOTE 1 Examples are illustrative only. Examples do not provide 'typical' values, since typical values depend strongly on the task and the AOI. They are meant only to illustrate the use of units.

NOTE 2 Definitions for the terms "road-scene ahead", "traffic related areas of interest" and "non-traffic related areas of interest" are given in ISO/TS 15007-2:2014, 7.1.

All glance measures except [4.2.1](#) shall be reported to the nearest hundredth of its respective unit, e.g. 17,88 s. (renumber items below)

4.2.1 number of glances: count of glances to an area of interest (or set of related Areas of Interest) during a condition, task, subtask or sub-subtask. Unit [count].

EXAMPLE 9 glances

4.2.2 total glance time: summation of all glance durations to an area of interest (or set of related Areas of Interest) during a condition, task, subtask or sub-subtask.

Total glance time = $\sum(\text{glance duration } 1, \text{ glance duration } 2, \dots, \text{ glance duration } n)$ unit [s]

EXAMPLE 17,88 s