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# Intelligent transport systems — Curve speed warning systems (CSWS) — Performance requirements and test procedures

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A list of organizations represented on this committee can be obtained on request to its secretary.

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# INTERNATIONAL STANDARD

# ISO 11067

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# Intelligent transport systems — Curve speed warning systems (CSWS) — Performance requirements and test procedures

*Systèmes intelligents de transport — Systèmes d'alerte de vitesse excessive en approche de virage (CSWS) — Exigences de performance et modes opératoires d'essai*

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# Foreword

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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 www.iso.org/directives).

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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 204, *Intelligent transport systems*.


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# Introduction

The main function of Curve Speed Warning Systems (CSWS) is to warn the driver against the danger caused by maintaining excessive speed to negotiate an upcoming curved road. The system computes the current location of the vehicle with respect to the upcoming curved road of interest and determines a warning threshold speed, below which the vehicle can safely negotiate the upcoming curves. If the vehicle speed exceeds the warning threshold speed, the system provides a warning to the driver, prompting the driver to react and lower the subject vehicle speed to a level suitable for negotiating the curved road ahead. The CSWS scope does not include automated intervention features or means for controlling the vehicle to match a desired speed.

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INTERNATIONAL STANDARD ISO 11067:2015(E)

# Intelligent transport systems — Curve speed warning systems (CSWS) — Performance requirements and test procedures

## 1 Scope

This International Standard contains the basic warning strategy, minimum functionality requirements, basic driver interface elements, minimum requirements for diagnostics and reaction to failure, and performance test procedures for Curve Speed Warning Systems (CSWS). CSWS warns the driver against the danger caused by maintaining excessive speed to negotiate the upcoming curved roads, so that the driver may reduce the speed. The system does not include the means to control the vehicle to meet the desired speed. The responsibility for safe operation of the vehicle always remains with the driver.

This International Standard applies to vehicles with four or more wheels.

## 2 Terms and definitions

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

**2.1**
**subject vehicle**
vehicle equipped with the CSWS and related to the topic of discussion

**2.2**
**subject vehicle speed**
longitudinal component of the subject vehicle velocity

**2.3**
**system states**
one of several stages or phases of system operation

Note 1 to entry: See Figure 1.

**2.3.1**
**CSWS off state**
state in which CSWS is off

Note 1 to entry: This state has one of the following three causes: the driver has selected the off condition, the ignition is off, or the CSWS is in failure.

**2.3.2**
**CSWS on state**
state in which CSWS is on

Note 1 to entry: This state is either in unavailable state or in available state.

**2.3.3**
**CSWS unavailable state**
system is in on state and the system has inadequate information

Note 1 to entry: The system cannot make a decision whether the warning criteria are met or not because of fault in GNSS device, lack of map data, or other reasons.

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**2.3.4**
**CSWS available state**
system is in on state and the system has sufficient information to make decisions on whether the warning criteria are fulfilled or not

**2.3.5**
**CSWS warning state**
system is in available state and the warning criteria are all met

Note 1 to entry: The CSWS starts warning(s) or is operating the warning(s). The system periodically judges whether the criteria are met in order to transition to the non-warning state.

**2.3.6**
**CSWS non-warning state**
system is in available state and the warning criteria are not all met

Note 1 to entry: The system periodically judges whether the criteria are met in order to transition to the warning state.

**2.4**
**curved road**
section where the radius of curvature is less than or equal to $R_C$

Note 1 to entry: $R_C$ denotes the maximum radius of curvature to be regarded as a curvature point of interest for potential warning for CSWS (see 5.2.2).

**2.5**
**curvature point**
arbitrary points on the curved road that has associated location and value of curvature

**2.6**
**curvature point of interest**
point of the curved road ahead where the distances from the subject vehicle to the curved roads are less than the look ahead distance, $S_{LAD}$

**2.7**
**curve start point**
location where the radius of curvature of the curved roadway ahead becomes less than $R_C$

Note 1 to entry: See 5.2.3.

**2.8**
**curve end point**
location where the radius of curvature of the curved roadway ahead becomes $\geq R_C$

Note 1 to entry: See 5.2.3.

**2.9**
**target curvature point of interest**
particular curvature point of interest on the roadway of the subject vehicle that CSWS is about to provide the warning to the driver

Note 1 to entry: CSWS selects the target curvature point of interest among the curvature points of interest and the curvature point of interest may vary depending upon the distance from the current location of the subject vehicle to the curvature point of interest and the current speed of the subject vehicle. If a section of the curved road has a constant radius of the curvature, the curve start point becomes the target point of interest. See 5.2.2.

**2.10**
**distance to curvature point of interest**
$S_{current}$
distance from the current position of the subject vehicle to the curvature point of interest


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**2.11**
**time to curvature point of interest**
$t_{TC}$
travel time from the current position of the subject vehicle to the curvature point of interest and defined as follows

$$t_{TC} = S_{current} / V_{current}$$

where

$V_{current}$ is the current speed of the subject vehicle

**2.12**
**warning threshold speed**
$V_{WT}$
vehicle speed threshold that is used to determine if the CSWS warning is required

Note 1 to entry: If the vehicle speed measurement is greater than this threshold value, the CSWS provides the warning to the driver. This threshold is below the maximum speed that is defined by designed lateral acceleration to negotiate the upcoming curve.

**2.13**
**warning end speed**
$V_{WT_end}$
vehicle speed at which the CSWS transitions from CSWS warning state to CSWS non-warning so that the CSWS ends the warning

**2.14**
**warning distance**
$S_{warn}$
distance from the location where the warning starts to the target curvature point of interest

**2.15**
**driver response time**
$t_{resp}$
reaction time of the driver which is the time from start of the speed changing event to the time that the driver starts applying brake

**2.16**
**minimum required deceleration**
$a_{d_req}$
deceleration that, if constant, would enable the subject vehicle to match the warning threshold speed for the target curvature point of interest

$$a_{d_req} = \frac{V_{current}^2 - V_{WT}^2}{2 \times (S_{current} - t_{resp} \times V_{current})}$$

**2.17**
**curve speed warning time**
$t_{csw}$
time when the curve speed warning starts which is greater than or equal to the minimum allowed curve speed warning time

$$t_{csw} \geq t_{csw_min}$$

Note 1 to entry: The $t_{CSW}$, $S_{warn}$, and $V_{current}$ has the following relationship:

$$t_{csw} = S_{warn} / V_{current}$$

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Note 2 to entry: The value of $t_{CSW}$ is selected by the manufacturer.

**2.18**
**minimum allowed curve speed warning time**
$t_{csw_min}$
lower threshold of the curve speed warning time

Note 1 to entry: The value of minimum allowed curve speed warning time is decided considering the amount of overspeed of the subject vehicle and the reaction delay of drivers.

**2.19**
**minimum operating speed**
$V_{min}$
minimum subject vehicle speed at which the CSWS shall operate

**2.20**
**maximum operating speed**
$V_{max}$
maximum subject vehicle speed at which the CSWS shall operate

**2.21**
**look ahead distance**
$S_{LAD}$
curve detection range of the CSWS

Note 1 to entry: For the curvature points that have radius of curvature $\leq R_C$ and the distances from the subject vehicle to the curved roads are $< S_{LAD}$, the curvature point is considered to be a curvature point of interest.

**2.22**
**single curve**
simple curved road with a constant radius of curvature separated from other curved roads

Note 1 to entry: The clothoid can be included.

**2.23**
**multiple curve**
curved road which is a combination of two or more closely located curved roads where the curved roads are constant radius curvatures

Note 1 to entry: The clothoid can be included.

Note 2 to entry: See Table A.1.

**2.24**
**variable radius curve**
curved road with two or more radii of curvature in the same direction

Note 1 to entry: See Table A.1.

**2.25**
**angle of curved road**
AOC
central angle between the curve start point and the curve end point

Note 1 to entry: See 5.2.3 for illustrative description.

**2.26**
**road shape points**
points that is composing roads in digital map

Note 1 to entry: Roads are composed of points and links which reflect the shape and position of the road in the digital map.


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