
**Intelligent transport systems —
Vehicle-to-vehicle intersection
collision warning systems (VVICW) —
Performance requirements and test
procedures**

*Systèmes de transport intelligents — Systèmes d'alerte de collision
aux intersections de véhicule-à-véhicule (VVICW) — Exigences de
performance et procédures d'essai*



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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 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 (see www.iso.org/patents).

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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 www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 204, *Intelligent transport systems*.

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 www.iso.org/members.html.

Introduction

Vehicle-to-vehicle intersection collision warning systems (VVICW) warn the driver to avoid potential collisions at intersections. The VVICW warns the driver of imminent crashes with other vehicles crossing at a road junction. The system relies on relative positioning, speed and heading between vehicles determined using vehicle-to-vehicle (V2V) communication, such as dedicated short-range communication (DSRC). It is intended to be used to avoid intersection crossing crashes, the most severe crashes based on fatality counts. Due to limited field of view sensing, on-board sensor systems such as camera, lidar and radar systems cannot be used efficiently for such systems. [Figure 1](#) illustrates the functional elements of VVICW.

The VVICW is a road level system that deals with conflict scenarios between vehicles driving on two connected road segments sharing a common intersection. VVICW positioning requirements are not demanding compared to those of red light violation warning systems, for example. A comprehensive set of intersection collision scenarios can be found in Reference [1].

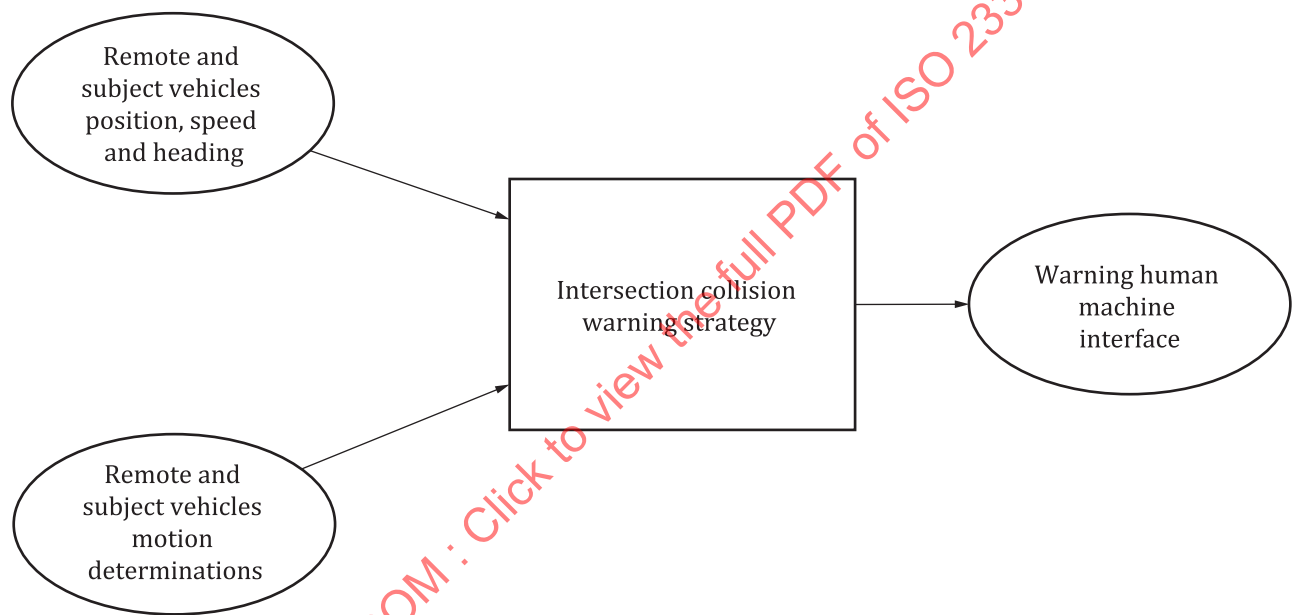


Figure 1 — Vehicle-to-vehicle intersection collision warning systems functional elements

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Intelligent transport systems — Vehicle-to-vehicle intersection collision warning systems (VVICW) — Performance requirements and test procedures

1 Scope

This document specifies performance requirements and test procedures for systems capable of warning the subject vehicle driver of a potential crossing-path collision with other vehicles at intersecting road segments.

Vehicle-to-vehicle intersection collision warning systems (VVICW) rely on vehicle-to-vehicle (V2V) communications and relative positioning between the subject vehicle and crossing-path vehicles (remote vehicles). V2V data, such as position, speed and heading are used to evaluate if an intersection collision is imminent between the subject and remote vehicles. The performance requirements laid out in this document specify the warning criteria for these systems.

In addition, VVICW operate in specified subject and remote vehicle speed ranges, road intersection geometries and target vehicle types. Moreover, the requirements for the V2V data will be specified. The scope of this document includes operations on intersecting road segments (physically intersecting roads), and motor vehicles including cars, trucks, buses and motorcycles. Responsibility for the safe operation of the vehicle remains with the driver.

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 terminology databases for use in standardization at the following addresses:

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

3.1 subject vehicle SV

motor vehicle equipped with a VVICW

Note 1 to entry: A subject vehicle can be also a remote vehicle for another subject vehicle.

3.2 subject vehicle speed subject vehicle velocity in the heading direction

3.3 remote vehicle RV

motor vehicle equipped at minimum with a V2V transmission device and localization system and that has the ability to possibly intersect the path of the subject vehicle

3.4

remote vehicle speed

longitudinal component of the remote vehicle velocity in the heading direction

3.5

intersecting road segment

physically intersecting roads that are described based on the number of road segments

Note 1 to entry: A road junction is where two or more road segments intersect.

Note 2 to entry: Roundabout, ramp/highway, street 4-way intersection and street 3-way intersection are examples of intersection road geometry.

EXAMPLE 1 A four-way intersection, or crossroads, usually involves a crossing of two streets or roads. In areas where there are rectilinear blocks and in some other cases, the crossing streets or roads are perpendicular to each other. However, two roads may cross at a different angle. In a few cases, the junction of two road segments can be offset from each other when reaching an intersection, even though both ends may be considered the same street.

EXAMPLE 2 A three-way intersection is a junction between three road segments, a T junction where two arms form one road, or a Y junction. The latter also known as a fork if approached from the stem of the Y.

3.6

time to collision

TTC

time that it takes a subject vehicle to collide with a remote vehicle assuming the relative velocity remains constant

Note 1 to entry: For the VVICW, TTC is the time needed for the subject vehicle to reach the collision point. TTC is therefore calculated using [Formula \(1\)](#):

$$t_c = -\frac{d_c}{v_{SV}} \quad (1)$$

where

t_c is the time to collision;

d_c is the distance of the subject vehicle from the collision point;

v_{SV} is the speed of the subject vehicle.

3.7

enhanced time to collision

ETTC

time that it takes a subject vehicle to collide with a remote vehicle assuming the relative acceleration between the subject vehicle and the remote vehicle remains constant

Note 1 to entry: For the VVICW, ETTC is the time needed for the subject vehicle to reach the collision point and not a remote vehicle. An enhanced arrival time therefore takes into consideration the acceleration of the subject vehicle. Since the collision point is fixed at any point in time, the value of zero is substituted for v_{RV} and a_{RV} . ETTC is calculated using [Formula \(2\)](#):

$$t_{c,e} = \frac{\left[-(v_{RV} - v_{SV}) - \sqrt{(v_{RV} - v_{SV})^2 - 2 * (a_{RV} - a_{SV}) * d_c} \right]}{(a_{RV} - a_{SV})} \quad (2)$$

where

- $t_{c,e}$ is the enhanced time to collision;
- v_{RV} is the speed of the remote vehicle;
- v_{SV} is the speed of the subject vehicle;
- d_c is the distance of the subject vehicle from the collision point;
- a_{RV} is the acceleration of the remote vehicle;
- a_{SV} is the acceleration of the subject vehicle.

3.8 required deceleration

A_{req}
minimum deceleration that, if constant, enables the subject vehicle to stop at a defined calculated distance from the current subject vehicle position

Note 1 to entry: A_{req} is calculated using [Formula \(3\)](#):

$$A_{req} = \frac{v_{SV}^2}{2(d_{sp} - d_r)} \quad (3)$$

where

- A_{req} is the required deceleration;
- v_{SV} is the speed of the subject vehicle;
- d_{sp} is the current distance from stopping point;
- d_r is the reaction travel distance.

4 Symbols and abbreviated terms

A_{req}	required deceleration
a_{RV}	acceleration of the remote vehicle
a_{SV}	acceleration of the subject vehicle
d_c	distance of the subject vehicle from the collision point
d_r	reaction travel distance
$d_{sl,min}$	minimum required distance measured from the stop line
d_{sp}	current distance from stopping point
DSRC	dedicated short-range communication
GNSS	global navigation satellite system

l_{RV}	length of the remote vehicle
l_{SV}	length of the subject vehicle
$T_{(1,2, \text{etc.})}$	tolerance
t_b	braking system response time
t_c	time to collision
$t_{c,e}$	enhanced time to collision
t_{resp}	driver brake reaction time
v_{SV}	speed of the subject vehicle
v_{RV}	speed of the remote vehicle
$v_{RV,p}$	projected speed of the remote vehicle at the arrival time
$v_{SV,max}$	maximum subject vehicle speed for VVICW operation
$v_{SV,min}$	minimum subject vehicle speed for VVICW operation
$v_{SV,p}$	projected speed of the subject vehicle at the arrival time
V2V	vehicle-to-vehicle
VVICW	vehicle-to-vehicle intersection collision warning system

5 Requirements

5.1 Minimum enable conditions

Vehicles equipped with VVICW shall be capable of the following:

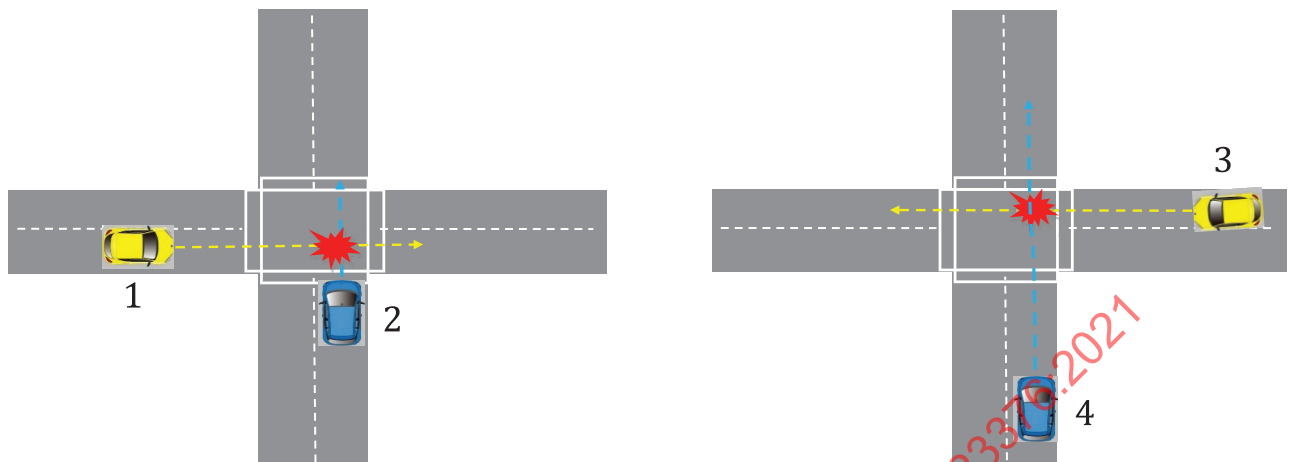
- determining if the V2V communication between the SV and RVs is available at the road junction;
- receiving valid V2V communication that provides the GNSS position, speed and heading of RVs approaching the road junction;
- determining GNSS position, speed and heading of the SV approaching the road junction.

5.2 Minimum required VVICW scenarios

The purpose of the VVICW is to provide the drivers of the SVs with alerts that assist them in avoiding or reducing the severity of impending collisions associated with the following scenarios:

- a) Crossing scenarios (illustrated in [Figure 2](#)):
 - 1) cross straight through an intersection, across the path of a vehicle approaching from a lateral direction;
 - 2) cross straight through an intersection, after initially being stopped, across the path of a vehicle approaching from a lateral direction.
- b) Oncoming scenarios (illustrated in [Figure 3](#)):
 - 1) turn left or right (depends on left or right driving rule) across the path of an oncoming vehicle approaching from the opposite direction;

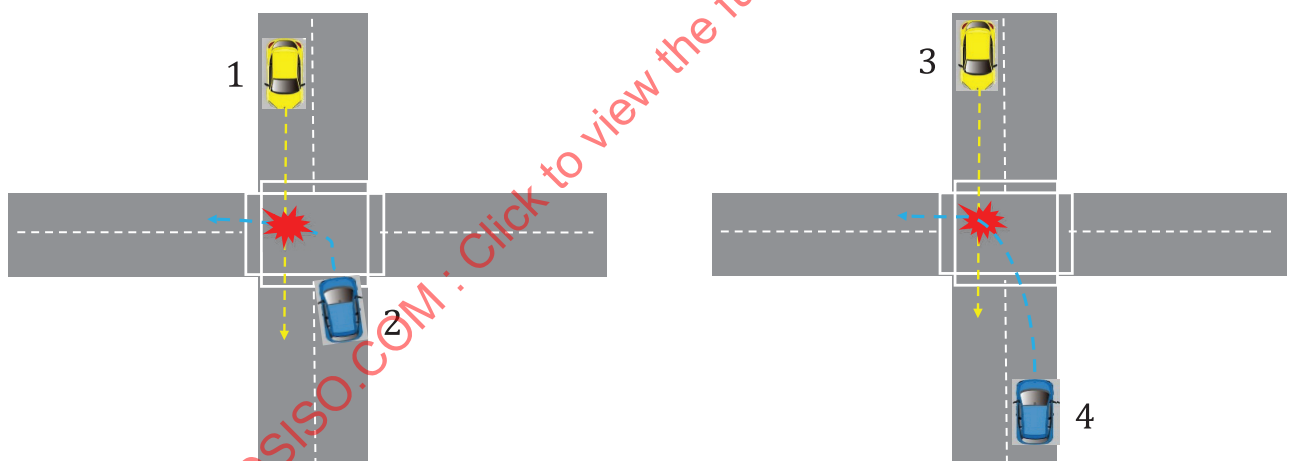
- 2) turn left or right (depends on left or right driving rule), after initially being stopped, across the path of an oncoming vehicle approaching from the opposite direction.



Key

- | | |
|---|-------------|
| 1 RV moving | 3 RV moving |
| 2 SV initially stopped, then accelerating | 4 SV moving |

Figure 2 — Crossing scenarios



Key

- | | |
|---|-------------|
| 1 RV moving | 3 RV moving |
| 2 SV initially stopped, then turning left | 4 SV moving |

Figure 3 — Oncoming scenarios

5.3 Necessary functions

Vehicles equipped with VVICW shall be equipped to fulfil the following functions:

- receive V2V messages from RVs that provide data representing the position, speed and heading of the RV;
- monitor SV and RV dynamics, including heading, heading change, speed and acceleration;
- determine the threat potential of collision with approaching RVs and evaluate the warning criteria;
- if needed, provide alerts to the driver of an impending collision with an RV in the intersection.

5.4 State transition diagram

5.4.1 General

The VVICW shall function according to the state transition diagram in [Figure 4](#). Specific implementation of the state transitions beyond that which is illustrated in [Figure 4](#) is left to the manufacturer.

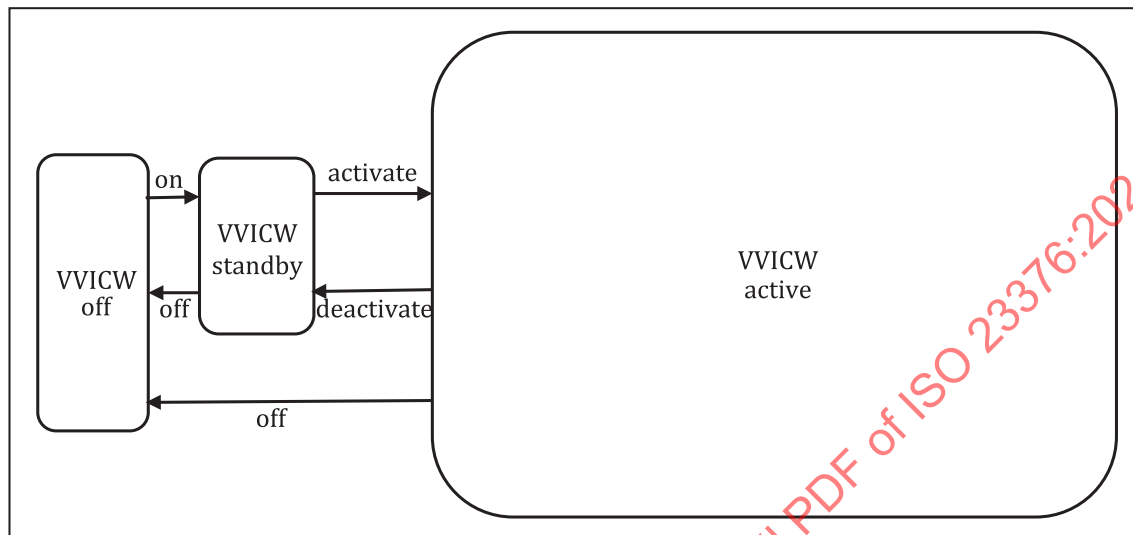


Figure 4 — VVICW state transition diagram

5.4.2 State functional description

5.4.2.1 Introduction

The VVICW state descriptions address the transition requirements of VVICW and identify which functions shall be performed in each state.

5.4.2.2 VVICW Off

VVICW do not perform VVICW functionality in the Off state.

The conditions under which VVICW transition from system Off state to system Standby state are as follows:

- for a VVICW-equipped vehicle with a driver on/off control, both the vehicle ignition and the on/off control are on and no faults are determined;
- for a VVICW-equipped vehicle that does not include a driver on/off control, the vehicle ignition is on and no faults are determined.

5.4.2.3 VVICW Standby

5.4.2.3.1 General

In the VVICW Standby state, the warning judgment is not determined. The subject vehicle data validity is monitored.

5.4.2.3.2 Transition to the system Off state

The conditions under which VVICW transition from system Standby state to system Off state are as follows:

- a) for a VVICW-equipped vehicle with a driver on/off-control-equipped vehicle, either the vehicle ignition or the driver on/off control is off;
- b) for a VVICW on vehicles not equipped with a driver on/off control, the vehicle ignition is off;
- c) VVICW-equipped vehicle data associated with a non-recoverable condition are detected. The description of fault notification conveyed to the driver remains up to the manufacturer.

5.4.2.3.3 Transition to the Active state

The VVICW function shall transition to the Active state when SV data are valid and gear position is forward.

5.4.2.4 VVICW Active

5.4.2.4.1 General

In the VVICW Active state, V2V data validity shall be assessed.

In the VVICW Active state, the predicted driving path for both SV and RVs shall be assessed using the SV's and RV's V2V data to determine if an intersection collision warning shall be issued to the driver.

In the VVICW Active state, the system shall issue an alert to the driver if the warning criteria are met.

5.4.2.4.2 Transition to the Standby state

When a VVICW recoverable system fault is detected, the Active state shall transition to VVICW Standby state.

When the VVICW gear position is not in forward position the Active state shall transition to VVICW Standby state.

5.4.2.4.3 Transition to the Off state

When a non-recoverable system fault is detected, VVICW Active state shall transition to VVICW Off state.

For a VVICW-equipped vehicle with a driver on/off-control-equipped vehicle, the system shall transition to Off state when either the vehicle ignition is off or the driver on/off control is off.

For VVICW on vehicles not equipped with a driver on/off control, the system shall transition to Off state when the vehicle ignition is off.

6 Warning provisions

6.1 VVICW output

VVICW shall provide a collision warning to the driver when warning criteria are met. A preliminary collision warning is optional.

6.2 Warning modality

6.2.1 VVICW collision warning shall contain a visual warning, as well as an audible and/or haptic.

6.2.2 VVICW preliminary collision warning, if used, shall contain visual or audible or a combination of visual and audible modalities. Supplemental haptic modalities are optional for preliminary collision warning.

6.2.3 It is recommended not to use haptic warning braking modality for collision warning if the subject vehicle driver is applying the brakes.

6.2.4 The warning braking modality may be used for collision warning and preliminary collision warning when automatic braking is applied by another system in the subject vehicle (i.e. when automatic braking action is underway).

6.2.5 Warning braking shall be applied for a duration of <1 sec. It shall result in a deceleration <0,5 g, and a maximum speed reduction of 2 m/sec. To ensure the effectiveness of the warning braking, a minimum average deceleration of 0,1 g for a minimum duration of 100 ms shall be fulfilled.

6.2.6 An audible warning tone should be selected such that it can be easily heard and distinguished from warnings unrelated to VVICW direction threats.

6.2.7 An actuation of seat-belt pretensioner may be used for VVICW collision warning.

6.3 Warning criteria for crossing scenarios

6.3.1 Warning requirements

6.3.1.1 Introduction

The following subclauses contain the warning criteria for the VVICW.

6.3.1.2 Arriving time requirements

The warning shall be issued if the SV and RV are predicted to arrive to the calculated collision point at the same time within a tolerance of T_1 and the other warning criteria specified in this subclause are met. For an SV that has been stationary and just sensed to be moving into the intersection, the tolerance value shall be set to T_2 . T_1 and T_2 are calculated as follows:

$$T_1 = \max(0,5 \text{ s}, l_{SV} / v_{SV,p}, l_{RV} / v_{RV,p})$$

$$T_2 = \max(1,5 \text{ s}, l_{SV} / v_{SV,p}, l_{RV} / v_{RV,p})$$

where

l_{SV} is the length of the subject vehicle;

l_{RV} is the length of the remote vehicle;

$v_{SV,p}$ is the projected speed of the subject vehicle at the arrival time;

$v_{RV,p}$ is the projected speed of the remote vehicle at the arrival time.

It is up to the manufacturer how to calculate the projected speeds for RV and SV.

T_1 and T_2 specify the minimum requirement of the arriving time overlap that is required to be met in order to proceed in evaluating warning timing.

6.3.1.3 Required deceleration requirements

VVICW shall issue a collision warning when the condition in 6.3.1.2 is satisfied and the required deceleration, A_{req} , to stop the subject vehicle at the intersection stop line exceeds a given threshold value. The given threshold value shall not be greater than $5,5 \text{ m/s}^2$ considering the response time values in 6.3.1.9 to 6.3.1.11 in dry road and warm weather conditions. The A_{req} requirement is to specify when the warning will be issued (warning timing) if the condition in 6.3.1.2 has been met.

6.3.1.4 Preliminary collision warning provisions: permissions

VVICW may issue a preliminary collision warning at a lower required deceleration threshold.

6.3.1.5 Warning timing adjustment requirement with respect to A_{req}

VVICW that provide a warning timing adjustment for the driver shall have at least one setting that satisfies the required deceleration threshold value requirement in 6.3.1.3.

6.3.1.6 Required deceleration adaptation provisions: permissions

The required deceleration threshold for collision and preliminary warnings may be adapted based on the detected road condition, environmental and driver state conditions, driver behaviour and different driving scenarios.

6.3.1.7 Stop line position requirements

The stop line position calculated from the subject vehicle current position is defined to be at least 10 m distance before the calculated collision point, assuming there is no other aiding data that determines the stop line location. For example, if the collision point is 50 m away from the SV, then the stop line is 40 m away from the SV. This is a virtual substitute for the physical intersection stop line.

6.3.1.8 Driver reaction time requirements

The driver reaction time to the warning (driver brake reaction time, t_{resp}) shall be incorporated in the calculation of the warning range. The t_{resp} value shall not be less than 0,8 s.

6.3.1.9 Warning timing adjustment requirements with respect to t_{resp}

VVICW that provide a warning timing adjustment for the driver shall have at least one setting that satisfies the t_{resp} requirement in 6.3.1.8.

6.3.1.10 Braking system response time provisions: permissions

The braking system response time, t_b , may be incorporated in the calculation of the required deceleration. The selection of the braking system response time value is left to the VVICW designer.

6.3.1.11 Adjustment of t_{resp} and t_b provisions: permissions

The driver brake reaction time, t_{resp} , and the braking system response time, t_b , may be set to zero if the SV driver is already applying the brakes.

6.3.1.12 Warning distance range calculation example

The calculation of the minimum required distance measured from the stop line, $d_{sl,min}$, can be performed based on the values $t_{resp}=0,8$ sec and $A_{req}=5,5$ m/s². Using the definition of A_{req} in 3.8 provides Formula (4):

$$d_{sl,min} = \frac{v^2}{2 * 5,5} + 0,8 * v \quad (4)$$

6.3.1.13 Equivalent warning triggering point

For systems that use different warning triggering methods (e.g. TTC or ETTC), the warning triggering time shall meet the requirements in 6.3.1.3 to 6.3.1.12 and 6.3.2.

6.3.2 No warning provisions

6.3.2.1 Subclauses 6.3.2.2 to 6.3.2.5 specify the conditions under which the VVICW shall not issue any type of warning. Subclauses 6.3.2.6 to 6.3.2.10 provide examples of when the VVICW warning may be suppressed or delayed.

6.3.2.2 The VVICW shall not issue any type of warning if the SV deceleration is greater than or equal to the required deceleration threshold specified in 6.3.1.3.

6.3.2.3 The VVICW shall not issue any type of warnings if the SV is not moving. A recommended speed threshold for not moving state is when the subject vehicle speed is below 0,5 m/s.

6.3.2.4 The VVICW shall not issue any type of warnings if both vehicles (subject and remote) are projected to arrive at the intersecting paths point at different times such that the collision will be clearly missed. The clearly missed criteria is left up to the manufacturer: for example, if conditions in 6.3.1.2 are not met.

6.3.2.5 The VVICW shall not issue any type of warnings for an RV that is on a road segment that is not connected with the SV road segment, assuming enough information is available to determine that the two road segments are not connected (for example, RV driving on overpass and SV is on highway).

6.3.2.6 The VVICW warning may be suppressed or delayed if the SV driver is applying the brakes.

6.3.2.7 The VVICW warning may be suppressed or delayed if the TTC is greater than 4,0 s or the required deceleration is less than 2 m/s².

6.3.2.8 The VVICW warning may be suppressed or delayed if the RV is detected to be performing or predicted to be performing a turn that makes it divert away from the projected path of the SV.

6.3.2.9 The VVICW warning may be suppressed if the RV speed is less than or equal to 9 m/s.

6.3.2.10 The VVICW warning may be suppressed if the absolute value of the difference in the heading angles between the SV and RVs is greater than 20° around the right angle (greater than [90 + 20]° and less than [90 - 20]°).

6.4 Warning criteria for oncoming scenarios

6.4.1 Warning requirements

6.4.1.1 Introduction

The following subclauses contain the warning criteria for the oncoming scenarios of the VVICW systems.

6.4.1.2 Warning provisions: requirements

VVICW shall issue a collision warning if:

- 1) the time before the subject vehicle and the remote vehicle reach one another (the relative down range distance is zero) is less than or equal to 3 s; and
- 2) the subject vehicle indicates a predicted motion towards the path of the remote vehicle via yaw motion sensed by sensors such as yaw rate, steering angle, etc.

This requirement states that if there is indication that subject vehicle is moving toward the remote vehicle driving path and this indication is happening within 3 s of having the two vehicles arriving at the same location, then a warning shall be issued.

6.4.1.3 Warning provisions: permissions

VVICW may issue a collision warning if:

- 1) the time before the subject vehicle and the remote vehicle reach one another is less than or equal 3 s; and
- 2) the subject vehicle indicates a predicted motion toward the path of the remote vehicle via turn signal.

6.4.2 No warning requirements

6.4.2.1 The following subclauses contain the "no warning" criteria for the oncoming scenarios of the VVICW systems.

6.4.2.2 The VVICW shall not issue any type of warnings if both vehicles (subject and remote) are projected to arrive at the intersecting paths point at different times, such that the collision will be clearly missed. The clearly missed criteria is left up to the manufacturer.

6.4.2.3 The VVICW shall not issue any type of warnings for a remote vehicle that is on a road segment that is not connected with the subject vehicle road segment assuming enough information is available to determine that the two road segments are not connected.

6.4.2.4 The VVICW warning may be suppressed if the subject vehicle is not moving.

6.4.2.5 The VVICW warning may be suppressed or delayed if the TTC is greater than 4,0 s.

6.4.2.6 The VVICW warning may be suppressed or delayed if the remote vehicle is detected to be performing or projected to be performing a turn that makes it divert away from the projected path of the subject vehicle.

6.4.2.7 The VVICW warning may be suppressed or delayed if the subject vehicle is detected to be performing or projected to be performing a turn that makes it divert away from the projected path of the remote vehicle.

6.4.2.8 The VVICW warning may be suppressed if the remote vehicle speed is less than or equal to 9 m/s.

6.4.2.9 The VVICW warning may be suppressed if the absolute value of the difference in the heading angles between the subject and remote vehicles is greater than 30° away from the 180° angle.

7 V2V data provisions: permissions

The wireless V2V data requirements of position, speed and heading should meet the BSM requirements specified in SAE J2945/1.

8 Testing procedures

8.1 General

All tests are run on straight flat roads and in dry road conditions.

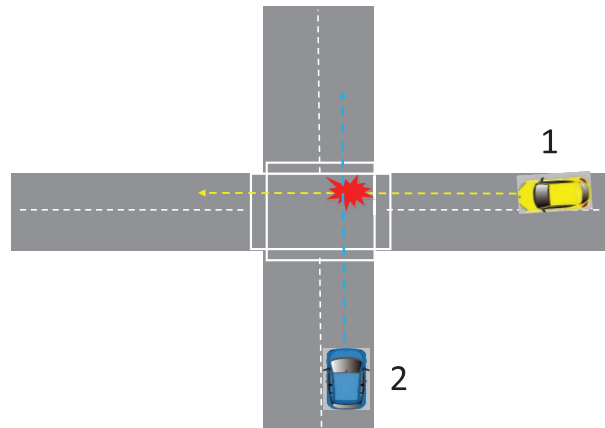
8.2 Crossing scenarios

8.2.1 Warning tests

Test 1: Both the SV and the RV are approaching the intersection at same speed of 15,6 m/s. To ensure that both vehicles arrive at almost the same time to the intersection, two conditions have to be satisfied during the test execution:

- Both vehicles have to reach a speed of 15,6 m/s ($\pm 0,2$ m/s) at a distance of 100 m measured from the point where the driving paths of both vehicles intersect. Both vehicles also have to arrive at the 100 m landmark at approximately the same time (within 0,2 s). Cruise control can be used to achieve the required speed accuracy.
- Both vehicles have to drive straight and maintain the same driving lane during the test as long as no emergency manoeuvre is needed for safety reasons. In case of emergency manoeuvre, the test is cancelled.

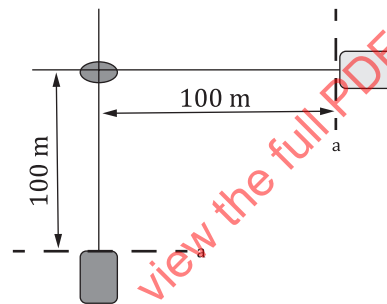
Test 1 is illustrated in [Figure 5](#). Five runs of this test shall be executed. The test run is passed if the warning is issued at a distance greater than the distance specified in [6.3.1.12](#). The test shall pass if four out of five runs are passed.



a) Test 1

Key

- 1 RV moving
- 2 SV moving



b) Illustration aid

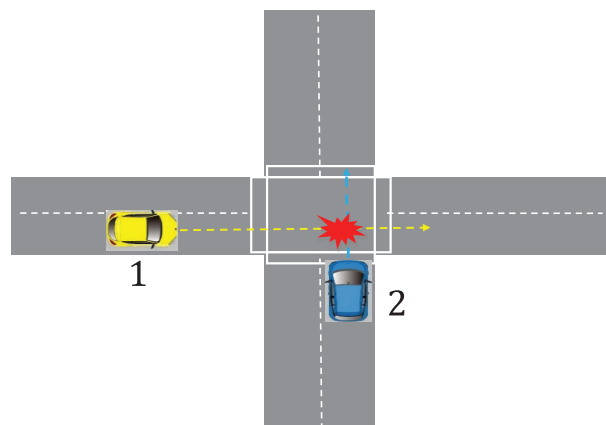
Key

- ^a Point at which both vehicles have to reach a speed of 15,6 m/s ($\pm 0,2$ m/s).

Figure 5 — Test 1

Test 2: The SV is initially stationary near the stop line at no more than 5 m behind the stop line. The RV is moving at a constant speed of 11,2 m/s. When the RV is at 45 m from the point where the driving paths of both vehicles intersect, the SV starts moving. The crossing path intersection point is at a distance ≤ 10 m from the defined stop line.

Test 2 is illustrated in [Figure 6](#). Five runs of this test shall be executed. The test run is passed if the warning is issued in less than 0,3 s after the SV starts moving. The test shall pass if four out of five runs are passed.



Key

- 1 RV moving
- 2 SV initially stopped, then accelerating

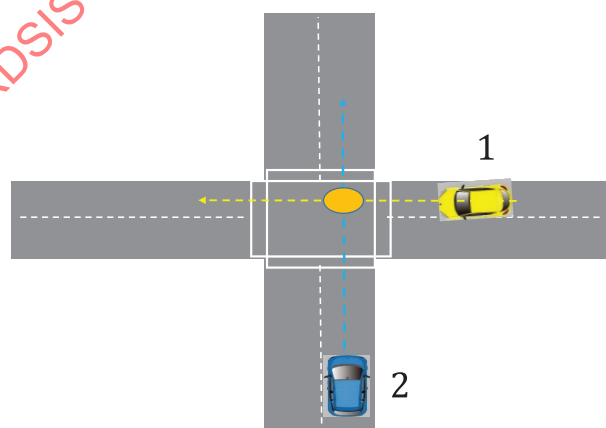
Figure 6 — Test 2

8.2.2 No warning tests

Test 3: Both the SV and the RV are approaching the intersection at a constant speed. The SV speed is 11,2 m/s and the RV speed is 15,6 m/s. To ensure the accuracy of the test:

- 1) Both vehicles have to reach their steady vehicle speed within $\pm 0,2$ m/s at a distance of 100 m measured from the point where the driving paths of both vehicles intersect. Both vehicles also have to arrive at the 100 m landmark at approximately the same time (within 0,2 s). Cruise control can be used to achieve the required speed accuracy.
- 2) Both vehicles have to drive straight and maintain the same driving lane during the test as long as there is no emergency manoeuvre needed for safety reasons. In case of emergency manoeuvre, the test is cancelled.

Test 3 is illustrated in [Figure 7](#). Five runs of this test shall be executed. The test run is passed if no warning is issued. The test shall pass if four out of five runs are passed.



Key

- 1 RV moving
- 2 SV moving

Figure 7 — Test 3