



BSI Standards Publication

Naturalistic driving studies — Vocabulary

Part 1: Safety critical events

National foreword

This Published Document is the UK implementation of ISO/TR 21974-1:2018.

The UK participation in its preparation was entrusted to Technical Committee AUE/12, Ergonomics (Road vehicles).

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

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

© The British Standards Institution 2018

Published by BSI Standards Limited 2018

ISBN 978 0 539 00801 2

ICS 43.020

Compliance with a British Standard cannot confer immunity from legal obligations.

This Published Document was published under the authority of the Standards Policy and Strategy Committee on 30 November 2018.

Amendments/corrigenda issued since publication

Date	Text affected
------	---------------

TECHNICAL REPORT

ISO/TR
21974-1

First edition
2018-11-14

Naturalistic driving studies — Vocabulary —

Part 1: Safety critical events

Études naturalistiques de conduite — Vocabulaire —

Partie 1: Événements critiques de sécurité



Reference number
ISO/TR 21974-1:2018(E)

© ISO 2018



COPYRIGHT PROTECTED DOCUMENT

© ISO 2018, Published in Switzerland

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
Ch. de Blandonnet 8 • CP 401
CH-1214 Vernier, Geneva, Switzerland
Tel. +41 22 749 01 11
Fax +41 22 749 09 47
copyright@iso.org
www.iso.org

Contents		Page
Foreword		iv
Introduction		v
1	Scope	1
2	Normative references	1
3	Terms and definitions	1
Annex A (informative) Conceptual Framework for Categorizing Safety-critical events (SCEs) in Naturalistic Driving Data		5
Annex B (informative) Principles of Conflict Classification		11
Annex C (informative) Additional Conflict Attributes		28
Bibliography		52

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).

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 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 the following URL: www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 22, *Road vehicles*, Subcommittee SC 39, *Ergonomics*.

A list of all parts in the ISO 21974 series can be found on the ISO website.

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

A better understanding of driver behaviour is critical to future improvements in transportation safety. Naturalistic Driving Studies (NDSs), which observe driver behaviour in a “natural” or uncontrolled driving environment, offer unique insight into drivers’ typical behaviour under both “normal” driving conditions and during the critical seconds before a crash or other safety-critical event (SCE). Much of the value and power of NDSs lies in the video that is recorded of the driver and the environment surrounding the vehicle. Although rich in information, video should be manually reviewed and coded by trained data coders before it is scientifically analyzed. Given the potential for human error and interpretation, coding protocols that are well-designed, thoroughly tested, and standardized across studies are essential.

Naturalistic driving data sets, such as the Second Strategic Highway Research Program (SHRP 2), are becoming more available to a diverse group of researchers. As a result, it is important to have a common terminology for monitoring, coding, and analyzing data to allow research protocols to be replicated and results to be compared across studies. In fact, the research community has called for the development of fully tested, common coding protocols for use in NDSs. This document addresses that need by providing a standard vocabulary for coding SCE characteristics in NDSs. The foundation for this document came from the SHRP 2 naturalistic driving study annotation effort and subsequent revisions to the SHRP 2 dictionary to accommodate heavy vehicles (trucks and buses)^[1]. Substantial improvements have been made to this document in both content and structure. However, large parts of this document are largely verbatim with the original foundational documents.

It is recommended that vehicles in these studies be instrumented with at least a forward-looking view and an in-vehicle view capturing the driver’s face and upper body. Rear- and side-facing views are often helpful when interpreting conflicts that occur behind or next to the instrumented vehicle. A view capturing the steering wheel, driver’s hands and/or dashboard can be helpful for additional analyses (which are outside the scope of this document). However, equipment and labor costs may make these additional views unfeasible. In addition, basic measurements of the kinematics of the instrumented vehicle should be available, including at least longitudinal acceleration, lateral acceleration, and vehicle speed. Other kinematic measurements that help assess conflict situations (if feasible) include brake and throttle pedal application and/or pressure, proximity to and speed of surrounding non-instrumented vehicles (e.g., via radar), latitude and longitude, and activation of key vehicle safety systems (e.g., anti-lock brakes).

The main objective of this document is to define different types of SCEs based on a taxonomy of general conflict classes and a set of basic variables for characterizing the events. The definitions supplied here apply to data collected from light and heavy vehicles [i.e., category M and N according to *Classification and definition of power-driven vehicles and trailers: Council Directive 70/156/EEC* (as amended by 92/53/EEC), *Annex 2*]. However, this does not preclude the definitions specified in this document from, with caution, being adapted for use with data collected from other vehicle types such as powered two-wheelers or an infrastructure-based (rather than vehicle-based) data collection system.

This document does not address methods for identifying candidate SCEs (also referred to as triggers), a complete set of annotations for these SCEs (e.g., driver distraction), or the recommended approach to analyzing this data. This document also does not address the definition, extraction, or annotation of controls. These controls, often called baselines in transportation literature, are selected for comparison to events of interest in epidemiological as well as other analyses. Since the definition, extraction, and annotation of these controls are highly dependent on the research question of interest, they have been excluded from the scope of this document. The scope of the present document is graphically illustrated in [Figure 1](#).

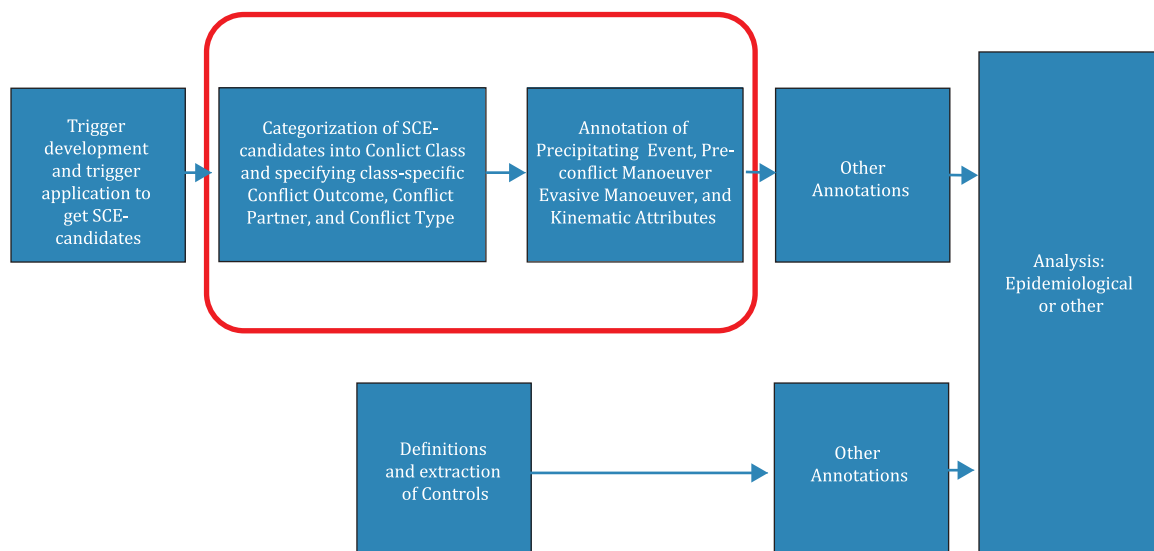


Figure 1 — Document scope

Naturalistic driving studies — Vocabulary —

Part 1: Safety critical events

1 Scope

This document defines terms and definitions commonly used for the annotation of video from NDSs collected during real-world driving in an uncontrolled setting.

2 Normative references

There are no normative references in this document.

3 Terms and definitions

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

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

3.1

combined avoidance capacity

total response capacity of all responding *conflict partners* (3.3)

Note 1 to entry: The capacity of a responding conflict partner takes into account both the abilities and limitations of the vehicle or road user as well as any environmental or infrastructural constraints, if present.

Note 2 to entry: Conflict partners that do not exhibit an observable response are not included in this construct.

3.2

conflict

situation where the trajectory(ies) of one or more road users or objects (*conflict partner*; 3.3) led to one of three results: 1) a *crash* (3.4) or *road departure* (3.12), 2) a situation where an *evasive manoeuvre(s)* (3.5) was required to avoid a crash or road departure, or 3) an unsafe proximity between the conflict partners

Note 1 to entry: The key concept underlying the present framework is that of conflict.

Note 2 to entry: Three general classes of traffic conflict are of interest in naturalistic driving analyses: *trajectory conflict* (3.2.1), *single-vehicle conflict* (3.2.2), and *proximity conflict* (3.2.3).

3.2.1

trajectory conflict

crash course between at least two *conflict partners* (3.3)

3.2.2

single-vehicle conflict

conflict (3.2) involving loss of vehicle control (e.g., horizontal and/or lateral skidding or rotation) or proximity to the road edges (e.g., *road departure*; 3.12) rather than proximity to another entity