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Naturalistic driving studies — Vocabulary —

Part 1: Safety critical events

Études naturalistiques de conduite — Vocabulaire —

Partie 1: Événements critiques de sécurité

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Foreword

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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.

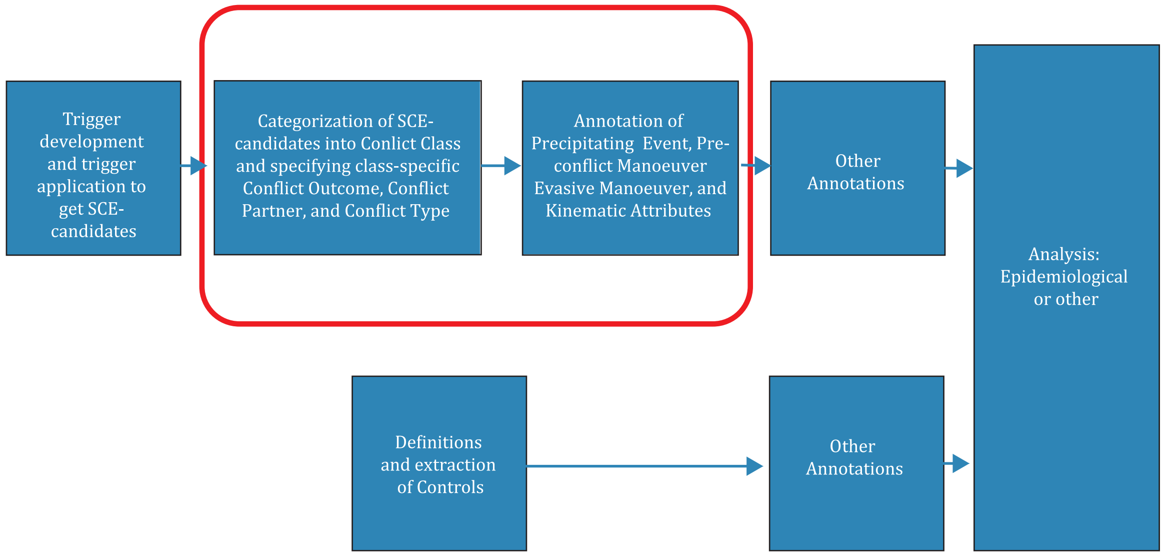


Figure 1 — Document scope

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

3.2.3
proximity conflict
conflict (3.2) involving two or more entities that are not on a crash course but nevertheless come in close temporal and/or spatial proximity to a *crash* (3.4)

3.3
conflict partner
any entity that is part of a *conflict* (3.2)

Note 1 to entry: This may include other *vehicles* (3.18), *pedestrians* (3.10), *pedal cyclists* (3.9), other *non-motorists* (3.8), other road users, animals, and objects (including roadside barriers that exceed the ground clearance of the affected vehicle).

Note 2 to entry: If a *conflict partner* (3.3) is present, then the conflict is either a *trajectory conflict* (3.2.1) or a *proximity conflict* (3.2.3).

Note 3 to entry: Low roadside barriers (e.g., curbs) within the ground clearance of the vehicle are not considered conflict partners.

3.4
crash
situation in which the subject vehicle (i.e., *instrumented vehicle*; 3.14) has any contact with at least one other *conflict partner* (3.3) either on or off the *trafficway* (3.15), either moving or stationary (fixed or non-fixed), that is observable or in which kinetic energy is measurably transferred or dissipated

Note 1 to entry: This excludes *roadway* (3.11) features meant to be driven over such as speed bumps and low roadside barriers (curbs, medians, etc.) within the ground clearance limitations of the vehicle.

Note 2 to entry: A crash may also be a *single-vehicle conflict* (3.2.2) that includes at least one of the following conditions: vehicle rollover, airbag deployment, injury, more than 90° degrees of horizontal vehicle rotation, or all four tires leaving the trafficway.

3.5
evasive manoeuvre
any action performed by any *conflict partner* (3.3) to change its trajectory or speed in an attempt to avoid or reduce the severity of a *potential crash* (3.4), avoid or reduce the severity of a *road departure* (3.12), or regain vehicular control after a loss of control

Note 1 to entry: Examples include steering, braking, accelerating, running, stopping, or a combination of these.

Note 2 to entry: At least one of the manoeuvres exceeds normal vehicle control inputs.

3.6
metadata
information that provides a description about the structural content of its referenced dataset or the methods with which the data were collected

Note 1 to entry: Examples of metadata include location (e.g., country, region) of data collection, sampling methods, units of measure, etc.

3.7
naturalistic driving study
NDS
any driving study where research subjects are recruited to drive on public roads (not in a simulator or on a test track), where there is no in-vehicle experimenter or confederate vehicles, and where driving conditions are not experimentally controlled or manipulated

Note 1 to entry: Subjects are not instructed to drive differently than they normally would, and the data collection instrumentation is unobtrusive.

Note 2 to entry: Typically, these studies last a minimum of several weeks for each subject and can go much longer.

3.8
non-motorist
non-motorized conveyance
person is being transported by a non-motorized conveyance, other than a *pedaled cycle* (3.9)/a human-powered device by which a non-motorist may move or may move another non-motorist

EXAMPLE Baby carriages, coasters, wagons, ice skates, roller skates, push carts, push scooters, skateboards, skis, sleds, non-motorized wheel chairs, rickshaws, etc.

3.9
pedal cyclist
person on any type of manually propelled pedaled cycle, as either the driver or the passenger, including bicycles, tricycles, and unicycles

Note 1 to entry: This category includes pedal cyclists holding on to a motorized vehicle.

Note 2 to entry: This category also includes power-assisted pedaled cycles that have limitations on speed (i.e., pedelecs). Pedaled cycles that are capable of propelling themselves and do not require pedaling for propulsion are not included in this category (see "Motorcycle or moped").

3.10
pedestrian
any person who is on or near a *roadway* (3.11) or a sidewalk, path, or other space that is contiguous with a roadway, or on areas beside the roadway into which a vehicle can travel, and who is not in or on either a motorized or a non-motorized conveyance

Note 1 to entry: This includes persons who are in contact with the ground, roadway, etc., but who are holding on to a vehicle.

3.11
roadway
portion of a *trafficway* (3.15) that is designed and ordinarily used for vehicular travel, including all designated or implied travel lanes (through lanes, turn lanes, acceleration and deceleration lanes), but not shoulders, painted (whether usable or not), medians of any type, roadsides, gore areas, etc., that are of a similar road surface to the parking lanes, parking areas, or driveways

3.12
road departure
conflict (3.2) in which the *subject vehicle* (3.14) is on a path toward and crosses, or is at risk of crossing, the road edge

Note 1 to entry: The road edge is the outside edge of the shoulder (if present) or a physical raised curb or median on the left or right side of the trafficway, including low barriers such as curbs and curb-style medians that are within the ground clearance of the vehicle.

3.13
safety-critical event
SCE
conflict (3.2) or series of related conflicts that involves the *subject vehicle* (3.14) either alone or in combination with another *vehicle* (3.18), *pedal cyclist* (3.9), *pedestrian* (3.10), object, or road edge

Note 1 to entry: This document describes the range of conflict types that may comprise an SCE, and an SCE may be composed of a single conflict type or multiple simultaneous or sequential conflict types. Conflicts should be non-intentional and non-premeditated (unplanned) by at least one *conflict partner* (3.3).

3.14
subject vehicle
vehicle (3.18) that has been instrumented and collects data

Note 1 to entry: Available videos will capture images from the subject vehicle's perspective.

Note 2 to entry: Kinematic data are typically available only from the subject vehicle or (in the case of radar data) the subject vehicle's perspective.

3.15
trafficway
any right-of-way designated for moving persons or property from one place to another, including the surface on which vehicles normally travel (i.e., the *roadway*; 3.11), plus the shoulders, painted medians, and painted gore areas at grade with the roadway

Note 1 to entry: The trafficway also includes parking lanes and parking areas (e.g., parking lots, driveways).

Note 2 to entry: The trafficway is bound by the outer edges of the shoulder or by raised roadside barriers (e.g., curb, guardrail, pylon) and thus does not include raised medians, grassy medians, sidewalks, etc.

3.16
trigger
data analysis method that includes the application of algorithms (e.g., acceleration thresholds) for searching time series driving data for key situational characteristics or thresholds in order to identify potential events of interest (e.g., kinematic threshold for potential *SCEs*; 3.13)

3.17
urgent response
urgency of response
situation in which the required *evasive manoeuvre* (3.5) approaches the *combined avoidance capacity* (3.1) of the responding *conflict partners* (3.3) required to prevent a crash

Note 1 to entry: Both the time available for response and the required response magnitude (e.g., level of deceleration) should be considered.

Note 2 to entry: While it may be possible to quantify the required urgency of the evasive manoeuvre (see Annex A for more discussion), the methods for doing so are not within the scope of this document. Quantification of the urgency is not required in order to use the concept as described in this document.

Note 3 to entry: The urgency of the response is independent of any evasive manoeuvres that are actually performed.

3.18
vehicle
any motorized means of transportation, excluding pedelecs, which are included in the *pedal cyclist* definition (3.9)

Annex A
(informative)

Conceptual Framework for Categorizing Safety-critical events (SCEs) in Naturalistic Driving Data

A.1 Introduction

Safety-critical events (SCEs) of interest in naturalistic driving studies (NDSs) traditionally include crashes and near-crashes, but also less-severe but still safety-relevant non-crash events, such as crash-relevant conflicts and proximity conflicts. The main objective of this document is to define and rank different types of SCEs based on a taxonomy of general conflict classes and a set of basic variables for characterizing the events. The objective of this Annex is to outline the conceptual basis for these definitions.

The key concept underlying the present framework is that of traffic *conflict*. There are at least three general classes of traffic conflict that are of interest in naturalistic driving analyses. First, a *trajectory conflict*, which is the main conflict class traditionally studied (e.g., Reference [1]), is defined in terms of a crash course between at least two conflict partners. Second, a *single-vehicle conflict* is defined in terms of loss of control or proximity to the road edges rather than by proximity to another conflict partner. Third, a *proximity conflict* involves two or more conflict partners that are not on a crash course but nevertheless come in close temporal and/or spatial proximity to a crash. Importantly, these general conflict types are not mutually exclusive and may coexist in a single SCE. Thus, an SCE may include several conflicts occurring in a series.

Furthermore, these conflict classes are characterized by two types of criteria. First, the *outcome criteria* state that conflicts result in some level of criticality or severity, and that conflicts within each class may be graded based on these severity levels. However, the definitions of these severity levels differ between the conflict classes, as further described below. Second, the *intentionality criterion* states that conflicts are always non-intended by at least one of the conflict partners. The following section further describes these two criteria, and the remainder of the Annex describes how they apply to each of the three conflict classes.

A.2 General conflict criteria

A.2.1 Outcome criteria

The basic criterion for an event to count as a crash is that it involves contact with another entity that extends above the ground clearance of the subject vehicle that is observable and in which kinetic energy is measurably transferred or dissipated. In the case of a single vehicle crash, the vehicle departs the road with all four tires, rolls over, results in an air bag deployment, or involves occupant injury. The crash can then be further characterized in terms of outcome criteria such as delta-V (the change in velocity during impact) and/or other observable outcomes such as injuries or property damage. In the context of naturalistic driving analysis, the choice of crash-severity criteria to be applied to a given conflict depends mainly on practical rather than conceptual considerations, in particular the types of outcomes that can be reliably observed in naturalistic data.

For non-crashes, the specific outcome criteria differ between the main conflict classes, but the common characteristic is that there is some degree of *kinematic proximity* to crash impact, or, in the case of single-vehicle conflicts, some degree of loss of control or proximity to the road edges. The specific criteria for each conflict class are further discussed below.

A.2.2 Intentionality criterion

The intentionality criterion requires that the conflict (i.e., crash impact or kinematic proximity) was *not intended* by at least one of the conflict partners. This criterion is important to exclude situations where a driver (or, in the case of trajectory and proximity conflicts, all conflict partners) intentionally produces a situation that satisfies the outcome criteria. For example, this may involve a driver leaving the road on purpose to take a shortcut. Importantly, it should be noted that the action leading up to a true conflict (e.g., initiating a pass on a blind corner) may have been intentional, but as long as the outcome [e.g., a small time-to-collision (TTC) to an oncoming vehicle] was not intended by at least one of the conflict partners, the event should be considered a conflict.

A.3 Trajectory conflict

In traditional conflict theory, a conflict is defined as “a situation where two or more conflict partners approach each other in time and space to such extent that a crash is imminent if their movements remain unchanged [2]”. Thus, the defining features of traditional conflicts are (1) that two or more *conflict partners* (which may be vehicles, other road users, or stationary objects) enter into a *collision course* with each other where (2) *collision is imminent*. This general situation is referred to as a *trajectory conflict*, which includes the main types of SCEs traditionally analyzed in NDSs, such as crashes, near-crashes, and crash-relevant conflicts.

Given this conceptualization of a trajectory conflict, a key further issue is to characterize the degree of imminence of a crash. Here, imminence is conceptualized in terms of the *urgency of the conflict situation*. Urgency is here defined as given the point of time of the avoidance manoeuvre, what is the *required magnitude of the avoidance response* relative to the possible (or available) avoidance response magnitude of the involved responding conflict partners. More specifically, a response is urgent when the magnitude of the evasive manoeuvre required to avoid a crash approaches the *combined avoidance capacity* of all *responding conflict partners* in the given situation.

There are two key concepts here: the required evasive manoeuvre magnitude, and the combined avoidance capacity of all responding conflict partners. The required evasive manoeuvre magnitude is discussed in greater detail in the paragraphs that follow, but in short it represents the “minimum” that should be done to avoid a crash. It is dependent on the relative speed of the conflict partners and the angle of their approach. It is independent of the actual response(s) performed and may be of greater (in the case of crashes) or lesser (in the case of non-crash conflicts) magnitude than the actual response(s).

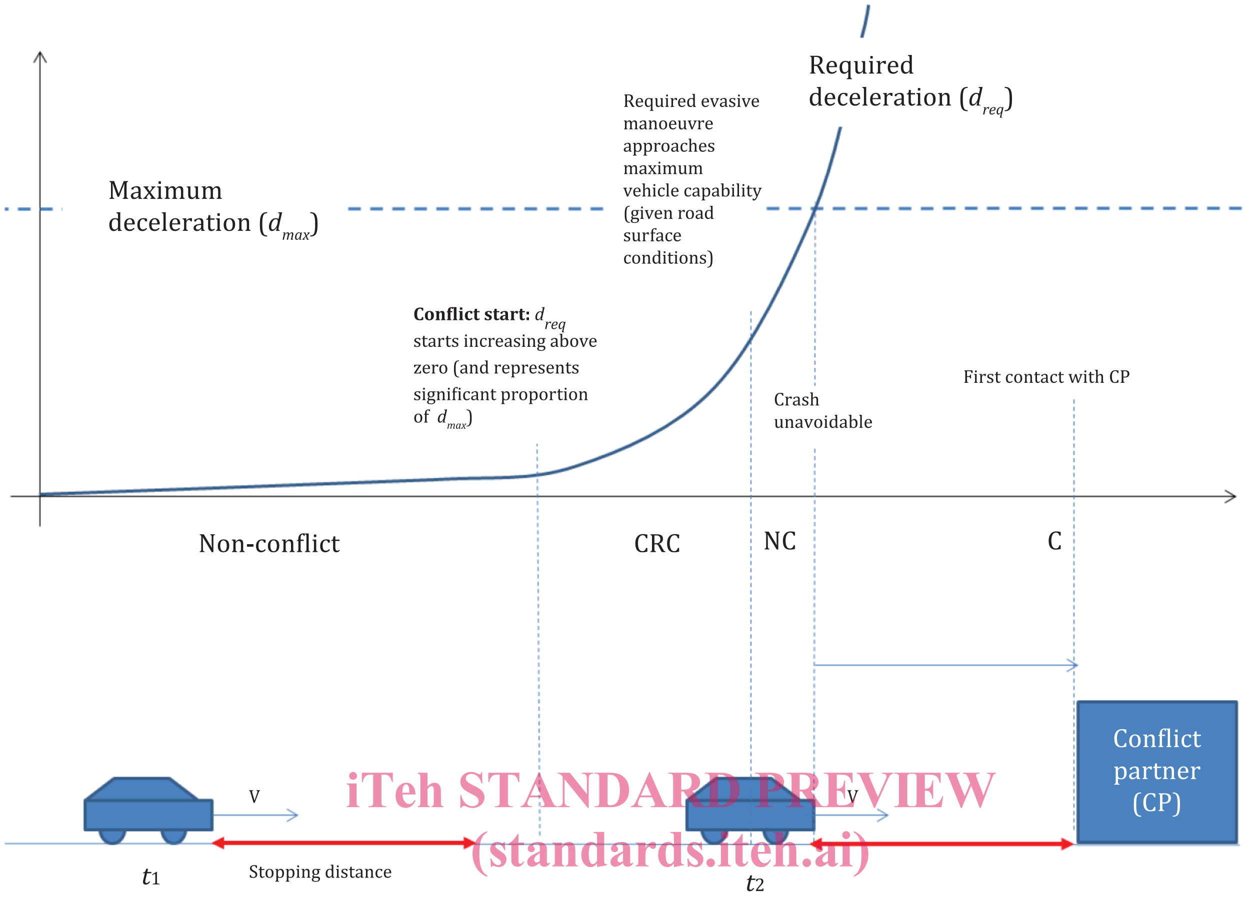
Avoidance capacity is here defined as the ability of a conflict partner to execute an *evasive manoeuvre*, where an evasive manoeuvre is any action performed to avoid a potential crash by changing the trajectory or speed, such as steering, braking, accelerating, running (pedestrian and animals), or stopping. The *combined* avoidance capacity refers to the combined ability of all responding conflict partners to change their trajectories to avoid a crash. It is also independent of the actual response(s) performed, but dependent on the characteristics both of the responding conflict partners themselves (e.g., brake condition, tire tread, vehicle specifications, braking and steering capabilities, pedestrian mobility, etc.), and the environment in which the conflict takes place (e.g., road surface condition, presence of other road users or obstacles). For example, the combined avoidance capacity of a vehicle that brakes and/or swerves as it heads toward a pole is less than the combined avoidance capacity in a situation where the same vehicle approaches a pedestrian and both conflict partners respond to the situation, everything else being equal (since the pedestrian but not the pole can move). Finally, a responding conflict partner is defined as a conflict partner exhibiting a visible response to the conflict. If a conflict partner does not exhibit such a response, it is excluded from the conceptualization of “combined avoidance capacity” for the given conflict. Thus, if the pedestrian in the example above does not move, then the combined avoidance capacity is the same as in the situation with the pole.

A useful way to think about the urgency of a situation is in terms of the proximity to the *point-of-no-return* (PONR). The PONR refers to the point in time during the conflict envelope when the crash becomes unavoidable given the maximum avoidance capacities of the responding conflict partners. Thus, for example, for a given set of kinematics (locations, speeds, and accelerations) of the involved conflict partners, the urgency of the situation increases with reduced road friction (thus reducing the avoidance capacities of the conflict partners). Consequently, the PONR will be reached earlier, and the situation will be more urgent, when the road is wet or icy compared to when it is dry. This conceptualization of urgency may be used as the basis for characterizing different types of non-crash conflicts. For example, *near-crashes* (NCs) may be defined as situations with high urgency. That is, the magnitude of the required evasive manoeuvre approaches the maximum combined avoidance capability of the responding conflict partners (see B.2.1.4 and B.2.1.5). In other words, a near crash corresponds to a situation with a small margin to the PONR. By contrast, a crash-relevant conflict may be characterized as a less urgent conflict situation, where there is a need for a larger-than-normal avoidance response to avoid a crash but there is still a relatively large margin to the PONR.

When coding naturalistic data, the determination of urgency normally has to rely on judgment rather than precise quantification (where the margin to the PONR may be a useful guiding principle). However, even if coding cannot normally rely on objective quantification, it is still useful to operationalize these concepts in mathematical terms. For instance, the required magnitude of the avoidance response may be operationalized in terms of the minimum lateral and/or longitudinal *acceleration* (which is negative when braking) required to avoid a crash. Conversely, avoidance capacity may be operationalized as *the maximum possible lateral and/or longitudinal acceleration the range of vehicle and environment factors discussed above*[3]. Thus, urgency at any point in time may be defined as the required acceleration (at that point in time) divided by the maximum possible acceleration (which is relatively constant over time, depending on vehicle and environment factors). This is further illustrated in Figure A.1 for the basic longitudinal case of a vehicle approaching a stationary conflict partner (a moving conflict partner such as a braking lead vehicle would greatly complicate the mathematical description of the situation but the key concepts still hold).

Figure A.1 pictures a scenario where the vehicle (shown at times t_1 and t_2) approaches the stationary conflict partner (CP; box at far right) from a distance. As shown, the deceleration (i.e., negative acceleration) required by the approaching vehicle, d_{req}, grows with the spatiotemporal proximity to the crash. Trajectory conflicts may be theoretically separated from non-conflicts at the point where d_{req} starts to grow significantly above zero and represents a certain proportion of the maximum possible avoidance capacity, d_{max}. Thus, prior to this point, although the conflict partners may be on a crash course, the timing of an evasive manoeuvre is not critical (i.e., the urgency is close to zero). However, after this point any delay in the corrective action will significantly increase the urgency of the situation. Hence, the *urgency* of a trajectory conflict (i.e., the need for an avoidance manoeuvre) may thus be defined as d_{req} divided by d_{max}. At the other end of the conflict envelope, there is a point where d_{req} exceeds the maximum deceleration (d_{max}) and the crash thus becomes unavoidable. This corresponds to the PONR discussed above.

The question remains what level of urgency (i.e., as d_{req}/d_{max}) should be used as a kinematic criterion separating conflicts from non-conflicts. As outlined above and in the main document, it is here suggested to define conflicts as situations where the urgency is judged to be outside the normal range. While this is not an exact criterion, it takes into account the fact that the precise level of urgency is hard to judge from video recording alone. If, in the future, all relevant kinematic values can be estimated with sufficient precision, it may be possible to define a more precise value of urgency defining a conflict.



NOTE This example is developed for the longitudinal case (braking avoidance), but the same principles apply for the lateral case (steering avoidance) or a combination of the two.

Figure A.1 — Conceptualization of a trajectory conflict in terms of the minimum deceleration required to avoid a crash (d_{req}) relative to the maximum possible deceleration (d_{max})

A.4 Single-vehicle conflict

Single-vehicle conflicts are conflicts involving only a single vehicle (of a type included in the scope of this document Clause 1) and no other conflict partner. Thus, in contrast to trajectory conflicts, there is no crash course between objects. Rather a single-vehicle conflict is defined in terms of the proximity to the road edges and/or in terms of a loss of control on or off the road.

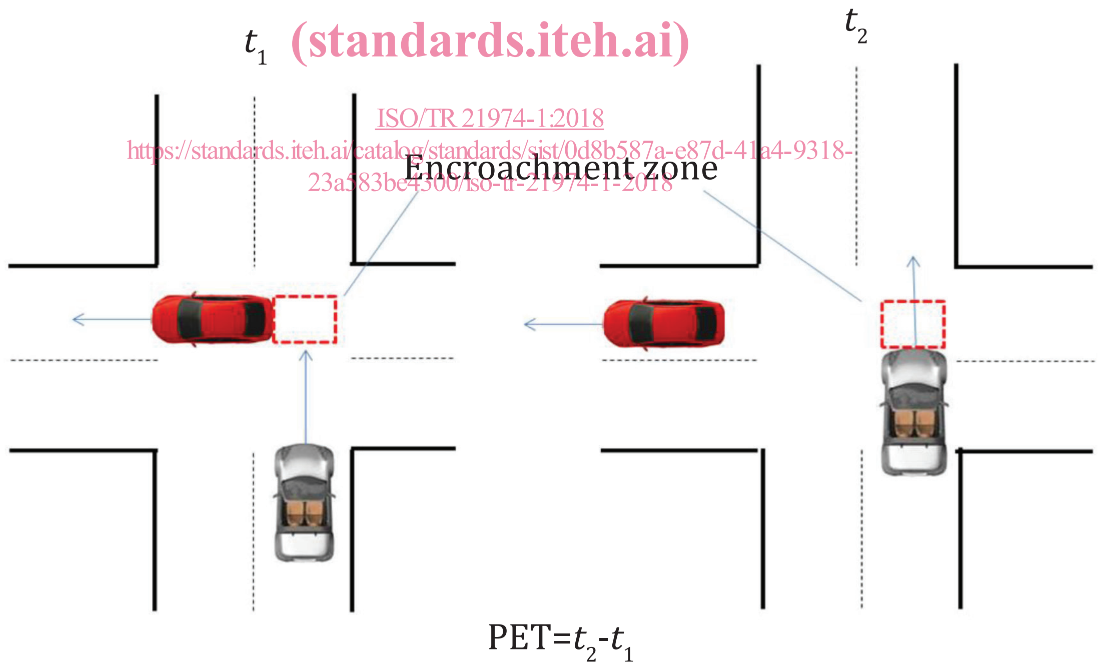
Thus, a single-vehicle conflict never results in a crash with another entity above the ground clearance of the vehicle but could, for example, result on a roll-over crash, a curb strike, a road departure, or a critical loss of control. If the single-vehicle conflict (such as a road departure) is followed by a crash with an object (such as, a tree), the latter should be regarded as a trajectory conflict and coded separately (i.e., Conflict 1 = single-vehicle conflict, Conflict 2 = trajectory conflict).

The severity of single-vehicle conflicts may be conceptualized in terms of the extent of the road departure (or the proximity to the road edge for non-road departures) and the degree of loss of control, as outlined in the main body of this document.

A.5 Proximity conflict

The term proximity conflict refers to a case involving at least two conflict partners who are not on a crash course in such a way that a crash is imminent (as defined above) but that nevertheless involves a small (spatial or temporal) kinematic proximity to a crash. Like the other conflict types, proximity conflicts also should satisfy the intentionality criterion: the resulting close kinematic proximity is unintended by at least one of the conflict partners. An example of a proximity conflict would be a distracted car driver approaching an intersection and failing to detect an approaching pedal cyclist, but where the pedal cyclist just makes it across the road before the vehicle passes, and neither conflict partner was required to change their trajectory in any way to avoid impact. This could be distinguished (based on the intentionality criterion) from the non-conflict case where the car driver is aware of the cyclist (and vice versa) and intentionally passes closely behind the cyclist on the assumption by the car driver that the cyclist will not slow or stop and by the cyclist that the car will not accelerate.

Since the conflict partners in a proximity conflict are not on a crash course, the concepts derived above for kinematic proximity of trajectory conflicts (based on urgency) do not apply. Rather, the kinematic proximity in situations such as the example above are instead conceptualized in terms of the *post-encroachment time* (PET), illustrated in Figure A.2. Situations where a vehicle is unintentionally passing a pole, or even a pedal cyclist or pedestrian, with a very small lateral margin (clearance), are considered proximity conflicts. For such events, distance is a more suitable metric than PET (which would be undefined in such an event). The severity of proximity conflicts can thus be defined in terms of different threshold values of PET, or distance/clearance. However, in contrast to trajectory conflicts, there is no non-arbitrary point in time defining the start of the conflict. Rather, a PET/distance value should be defined that establishes a lower boundary for criticality. Further research is needed to establish such boundaries and to operationalize them in a way that they can be estimated based on video coding.



NOTE PET is defined as the difference between the time t_1 when the first conflict partner leaves the conflict zone and the time t_2 when the second conflict partner enters it.

Figure A.2 — Illustration of the concept of PET

A.6 Summary

Table A.1 summarizes the three main conflict classes outlined above, in terms of the number of involved objects, the presence of a crash course, and the criteria used to code conflict severity.

