International Standard

ISO 23795-2

First edition
2024-02

Intelligent transport systems — Extracting trip data using nomadic and mobile devices for estimating CO_2 emissions —

Part 2: Information provision for eco-friendly driving behaviour

Systèmes de transport intelligents — Extraction de données de trajet à l'aide de dispositifs nomades et mobiles pour l'estimation des émissions de CO_2 —

Partie 2: Fourniture d'informations pour un comportement de conduite respectueux de l'environnement

Reference number
ISO 23795-2:2024(en)

ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Email: copyright@iso.org
Website: www.iso.org

Published in Switzerland

Contents

Page

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 document 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).

ISO draws attention to the possibility that the implementation of this document may involve the use of (a) patent(s). ISO takes no position concerning the evidence, validity or applicability of any claimed patent rights in respect thereof. As of the date of publication of this document, ISO had not received notice of (a) patent(s) which may be required to implement this document. However, implementers are cautioned that this may not represent the latest information, which may be obtained from the patent database available at www.iso.org/patents. ISO shall not be held responsible for identifying any or all such patent rights.

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

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.*

A list of all parts in the ISO 23795 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

Vehicle emission has become a main air pollution contributor, producing carbon dioxide and greenhouse gases. This document has been established to define criteria for measuring carbon dioxide emissions in relation to driving behaviours.

The international community has been actively pursuing greenhouse gas reduction policies[1][2][3][4][5][6] etc. since the Paris Agreement adopted by the CMA(Conference of the parties serving as the Meeting of the parties to Paris Agreement) as a comprehensive policy direction to cope with climate change.

In addition, the U.S., Europe and Asia are implementing a greenhouse gas ETS(emission trading system) to boost it.

In particular, greenhouse gases emitted from the transportation sector for greenhouse gas emission trading need to be quantified according to national policies. This standard is a basic document that can support the quantification of greenhouse gases emitted from vehicles.

The document aims to extract driving information based on driving patterns of drivers needed to provide eco-friendly driving behaviour services as part of achieving goals related to global carbon reduction policies.

It is intended to be used as a basis for interaction between vehicles, nomadic devices and cloud servers. Carbon dioxide emission measurement in relation to driving behaviours is determined by different events: speeding, long speeding, sudden acceleration/deceleration, sudden start/stop, idling, fuel-cut, economical driving, etc.

This document provides all documents and references required to support the implementation of the requirements related to standardized access to nomadic device service for estimating carbon dioxide emissions. The document contains functional requirements and datasets required by use cases.

Intelligent transport systems — Extracting trip data using nomadic and mobile devices for estimating CO_2 emissions —

Part 2: Information provision for eco-friendly driving behaviour

1 Scope

This document defines the extraction of vehicle trip data via nomadic devices to measure CO_2 emissions in relation to driving behaviours. The extracted data can then be analysed and provided to drivers to serve as eco-friendly driving guidance. In this document the following items are defined:

— use cases for different events (speeding, long speeding, sudden start and stop, sudden acceleration and deceleration, idling, fuel-cut, economical driving);

— functional requirements for collecting data for driving behaviour pattern analysis;

— data sets for each use case for measuring vehicle emissions (CO_2) and for being provided to drivers via nomadic devices.

Vehicle types such as passenger cars, vans, utility vehicles, etc. are concerned in this document.

2 Normative references

There are no normative references in this document.

3 Terms, definitions and abbreviated terms

3.1 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/

3.1.1
nomadic device
ND
implementation of a personal ITS station which provides communication connectivity via portable equipment such as cellular telephones, wireless communication network (3G, 4G and 5G), mobile wireless broadband (WIMAX, HC-SDMA, etc.), etc. and includes short range links, such as IEEE 802.11x, etc. to connect portable devices to the motor vehicle communications system network

3.1.2
nomadic device identification
ND ID
unique identifier assigned to nomadic device by the nomadic device's manufacturer

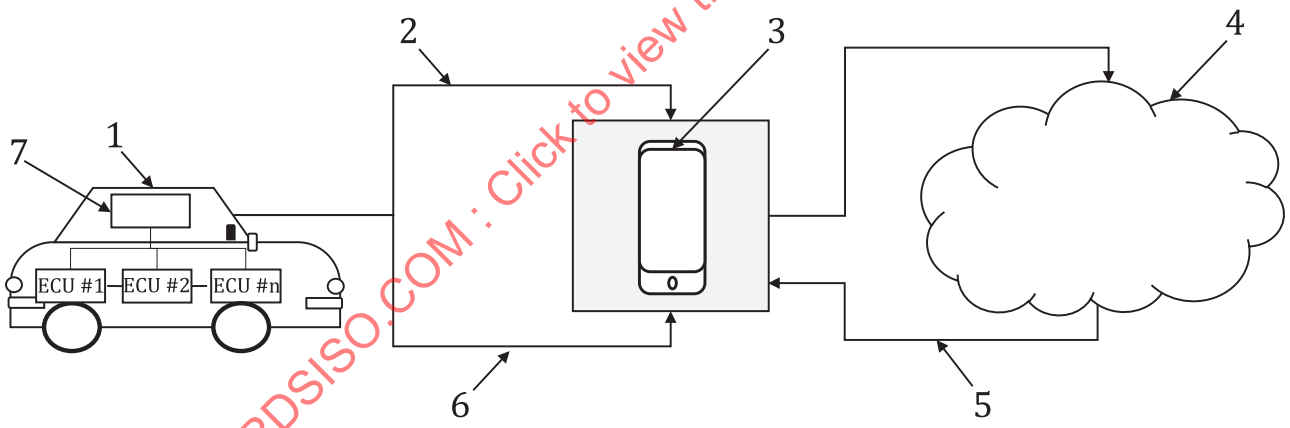
3.2 Abbreviated terms

ID	identification
UVIP	unified vehicle interface protocol
RPM	revolutions per minute
GNSS	global navigation satellite system
cc	cubic centimetres (cm^3)
uint8_t	unsigned character
uint16_t	unsigned short integer
uint32_t	unsigned integer
uint64_t	unsigned long integer

4 General information

4.1 Purpose of information provision for eco-friendly driving behaviour

The main purpose of providing information on eco-friendly driving behaviour is to give eco-friendly driving behaviour guidance to drivers so that they can reduce their carbon dioxide emissions from vehicles. In order to meet this aim, it is necessary to conduct driving behaviour analysis by monitoring data gathered from the ND in a vehicle. Figure 1 provides an overview of this process.



Key

1 vehicle data (speed, RPM, etc)
2 wireless communication(3G, LTE, 5G, etc.)
3 nomadic device
4 cloud server
5 driving behaviour information
6 short-range wireless communication (IEEE 802.11x series)
7 UVIP

Figure 1 — Service system overview

The carbon emissions produced by a vehicle are proportional to the speed, sudden acceleration, sudden deceleration, idling, etc. of that vehicle. Driving behaviours are therefore categorized by driving events

such as speeding, long speeding, sudden start/stop, sudden acceleration/deceleration, idling, fuel-cut, and economical driving.

4.2 Overview of use cases

For the purpose stated in 4.1, various use cases are defined as follows:

— UC1: Speeding – Act of driving faster than is legally allowed;

— UC2: Long speeding – Act of driving faster than is legally allowed for a long duration;

— UC3: Sudden acceleration – Acceleration in a brief time;

— UC4: Sudden start – Acceleration from a stop position in a brief time;

— UC5: Sudden deceleration – Deceleration in a brief time;

— UC6: Sudden stop – Deceleration to stop in a brief time;

— UC7: Idling – Running a vehicle's engine in a stop position;

— UC8: Fuel-cut – Maintain RPM without stepping on a pedal;

— UC9: Economical driving – Maintaining speed in the specified range of speed allowed.

4.3 Functional requirement

This document defines functional requirement for providing driving behaviour information using an ND.

The functional requirements of an ND are as follows:

— the ND shall be reliably and consistently connected with a vehicle in order to gather trip information;

— the ND shall receive vehicle status data such as vehicle speed, fuel injection amount, RPM, etc., which is collected through vehicle ITS station, and shall transfer it to a cloud server;

— the ND shall be reliably and consistently connected with a vehicle;

— the ND shall provide power supply interfaces for stable nomadic device operation.

5 Use cases definitions

5.1 Overview

This clause defines all use cases for providing a driver's driving habit information through an ND. There are nine use cases in total, shown in Tables 1 to 10.

5.2 UC 1: Speeding

Speeding is a case where the vehicle has been driven at more than 20 km/h above the legal road speed limit, for a duration of 2 min or less.

Table 1 — Use case 1: Speeding

Use case name	Vehicle information provision service for speeding
Actor(s)	Vehicle, driver, ND
Goal	Providing vehicle speeding information to driver
Use case input	Automatic request by ND
Use case output	Vehicle speeding data displayed on ND
Brief description	This use case defines basic data for providing the driver with information on speeding of the vehicle driver via the ND. This information can be used for calculating CO_2 emissions and eco-friendly driving habits.
Data required	a) Trip ID b) ND ID c) Vehicle speed d) Fuel injection amount e) GNSS (longitude, latitude, altitude) values f) Vehicle driving time g) Speeding driving time h) Number of times for speeding defined in 5.2 during driving

5.3 UC 2: Long speeding

Long speeding is a case where the vehicle has been driven at more than 20 km/h above the legal road speed limit, and for a duration of 2 min or longer.

Table 2 — Use case 2: Long speeding

Use case name	Vehicle information provision service for long speeding
Actor(s)	Vehicle, driver, ND
Goal	Indicate vehicle long speeding information
Use case input	Automatic request by ND or manual request made by driver
Use case output	Vehicle long speeding data displayed on ND
Brief description	This use case defines basic data for providing the driver with information on long speeding of the vehicle driver via the ND. This information can be used for calculating CO_2 emissions and eco-friendly driving habits.
Data required	a) Trip ID b) ND ID c) Vehicle speed d) Fuel injection amount e) GNSS (longitude, latitude, altitude) values f) Vehicle driving time g) Long speeding driving time h) Number of times for long speeding defined in 5.3 during driving

5.4 UC 3: Sudden acceleration

Sudden acceleration is a case where the vehicle accelerates at a rate of ≥1,39 m/s^2 at a speed of more than 5 km/h.

Table 3 — Use case 3: Sudden acceleration

Use case name	Vehicle information provision service for sudden acceleration
Actor(s)	Vehicle, driver, ND
Goal	Indicate vehicle sudden acceleration information
Use case input	Automatic request by ND or manual request made by driver
Use case output	Vehicle sudden acceleration data displayed on ND
Brief description	This use case defines basic data for providing the driver with information on the sudden acceleration of the vehicle via the ND. This information can be used for calculating CO_2 emission and eco-friendly driving habits.
Data required	a) Trip ID b) ND ID c) Vehicle speed d) Fuel injection amount e) GNSS (longitude, latitude, altitude) values f) Vehicle driving time g) Sudden acceleration driving time h) Number of times for sudden acceleration defined in 5.4 during driving

5.5 UC 4: Sudden start

Sudden start is a case where the vehicle starts at a speed of 5 km/h or less and accelerates at a rate of ≥2,78 m/s^2 or more.

Table 4 — Use case 4: Sudden start

Use case name	Vehicle information provision service for sudden start
Actor(s)	Vehicle, driver, ND
Goal	Indicate vehicle sudden start information
Use case input	Automatic request by ND or manual request made by driver
Use case output	Vehicle sudden start data displayed on ND
Brief description	This use case defines basic data for providing the driver with information on sudden start of the vehicle via the ND. This information can be used for calculating CO_2 emissions and eco-friendly driving habits.
Data required	a) Trip ID b) ND ID c) Vehicle speed d) Fuel injection amount e) GNSS (longitude, latitude, altitude) values f) Vehicle driving time g) Sudden start driving time h) Number of times for sudden start defined in 5.5 during driving

5.6 UC 5: Sudden deceleration

Sudden deceleration is a case where the vehicle slows down at a rate of ≥2,78 m/s^2 or more and the speed is 5 km/h or more.

Table 5 — Use case 5: Sudden deceleration

Use case name	Vehicle information provision service for sudden deceleration
Actor(s)	Vehicle, driver, ND
Goal	Indicate vehicle sudden deceleration information
Use case input	Automatic request by ND or manual request made by driver
Use case output	Vehicle sudden deceleration data displayed on ND
Brief description	This use case defines basic data for providing the driver with information on sudden deceleration of the vehicle via the ND. This information can be used for calculating CO_2 emissions and eco-friendly driving habits.
Data required	a) Trip ID b) ND ID c) Vehicle speed d) Fuel injection amount e) GNSS (longitude, latitude, altitude) values f) Vehicle driving time g) Sudden deceleration driving time h) Number of times for sudden deceleration defined in 5.6 during driving

5.7 UC 6: Sudden stop

Sudden stop is a case where the vehicle decelerates at a rate of ≥2,78 m/s^2 or more, resulting in a speed of less than 5 km/h.

Table 6 — Use case 6: Sudden stop

Use case name	Vehicle information provision service for sudden stop
Actor(s)	Vehicle, driver, ND
Goal	Indicate vehicle sudden stop information
Use case input	Automatic request by ND or manual request made by driver
Use case output	Vehicle stop data displayed on ND
Brief description	This use case defines basic data for providing the driver with information on sudden stop of the vehicle via the ND. This information can be used for calculating CO_2 emissions and eco-friendly driving habits.
Data required	a) Trip ID b) ND ID c) Vehicle speed d) Fuel injection amount e) GNSS (longitude, latitude, altitude) values f) Vehicle driving time g) Sudden stop driving time h) Number of times for sudden stop defined in 5.7 during driving

5.8 UC 7: Idling

Idling is a case where the vehicle has been driven at an acceleration of 0 m/s^2, but the fuel injection and RPM are greater than zero.

Table 7 — Use case 7: Idling

Use case name	Vehicle information provision service for idling
Actor(s)	Vehicle, driver, ND
Goal	Indicate vehicle idling information
Use case input	Automatic request by ND or manual request made by driver
Use case output	Vehicle idling data displayed on ND
Brief description	This use case defines basic data for providing the driver with information on Idling of the vehicle via the ND. This information can be used for calculating CO_2 emissions and eco-friendly driving habits.
Data required	a) Trip ID b) ND ID c) Vehicle speed d) Fuel injection amount e) GNSS (longitude, latitude, altitude) values f) Vehicle driving time g) Idle driving time h) Number of times for idling defined in 5.8 during driving

5.9 UC 8: Fuel-cut

Fuel-cut is a case where the vehicle has been driven at a speed ≥0 km/h with an RPM greater than zero and a fuel injection of zero.

Table 8 — Use case 8: Fuel-cut

Use case name	Vehicle information provision service for fuel-cut
Actor	Vehicle, driver, ND
Goal	Indicate vehicle fuel-cut information
Use case input	Automatic request by ND or manual request made by driver
Use case output	Vehicle fuel-cut data displayed on ND
Brief description	This use case defines basic data for providing the driver with information on fuel-cut of the vehicle via the ND. This information can be used as information for calculating CO_2 emissions and eco-friendly driving habits.
Data required	a) Trip ID b) ND ID c) Vehicle speed d) Fuel injection amount e) GNSS (longitude, latitude, altitude) values f) Vehicle driving time g) RPM (revolutions per minute) h) Fuel-cut driving time i) Number of times for fuel-cut defined in 5.9 during driving

5.10 UC 9: Economical driving

Economical driving is a case where the vehicle has been driven within the economic speed range applicable in the country of driving or less as shown in Table 9.

Table 9 — Example of relevant economical speed range for some countries

Country	Economical speed range
Australia	(50 to 60) km/h
Austria	(50 to 80) km/h
Canada	(50 to 80) km/h (30 to 50 mph)
China	(60 to 80) km/h
Cyprus	(50 to 80) km/h
Czech Republic	(50 to 80) km/h
Denmark	(50 to 80) km/h
Finland	(50 to 80) km/h
France	(50 to 80) km/h
Germany	(50 to 80) km/h
Hungary	(50 to 80) km/h
Iran, Islamic Republic of	(50 to 70) km/h
Japan	(60 to 80) km/h
Korea, Republic of	(60 to 80) km/h
New Zealand	(60 to 80) km/h
South Africa	(60 to 80) km/h
United Kingdom	(50 to 80) km/h [(30 to 50) mph]
United States	(60 to 80) km/h [(40 to 55 mph]

Table 10 — Use case 9: Economical driving

Use case name	Vehicle information provision service for economical driving
Actor	Vehicle, driver, ND
Goal	Indicate vehicle economical driving information
Use case input	Automatic request by ND or manual request made by driver
Use case output	Vehicle economical driving data displayed on ND
Brief description	This use case defines basic data for providing the driver with information on economical driving of the vehicle via the ND. This information can be used for calculating CO_2 emissions and eco-friendly driving habits.
Data required	a) Trip ID b) ND ID c) Vehicle speed d) Fuel injection amount e) GNSS(longitude, latitude, altitude) values f) Vehicle driving time g) Economical driving time h) Number of times for economical driving defined in 5.10 during driving

6 Datasets definitions

6.1 Overview

This clause provides definitions of datasets which can contain required data in each use case defined in Clause 5 to provide information for eco-friendly driving behaviour.

6.2 Data type

Data types, used to define the dataset for a vehicle's CO_2 emission estimating service, should include string, date (time), and, binary number. This document subdivides the required data by use case and provides the related definitions.

6.3 Datasets definitions in use cases

6.3.1 UC 1: Speeding

Table 11 shows the size and description of the dataset required for UC 1. In Table 11, Trip ID is shown by use case, to accumulate and identify data in each trip, which consists of travel time and travel distance. For example, if Trip ID is used in UC 1, the type consists of UC 1, trip sequential number and time stamp.

Table 11 — Size and description of dataset required for UC 1

No.	Name		M/O[a]	Size of data (byte)	Data type	Description
1	Trip ID		M	4	uint32_t	UC 1 + trip sequential number +time stamp
2	ND ID		M	17	uint8_t	Nomadic device identification number
3	Vehicle speed		M	1	uint8_t	km/h (0 to 999)
4	Fuel injection amount		M	2	uint8_t	cc
5	GNSS values	longitude	M	8	uint32_t	GNSS coordinates of ND (longitude)
		latitude	M	8	uint32_t	GNSS coordinates of ND (latitude)
		altitude	M	8	uint32_t	GNSS coordinates of ND (altitude)
6	Vehicle driving time		M	4	uint32_t	second
7	Speeding driving time		M	4	uint32_t	second
8	Numbers of speeding		M	2	uint16_t	Number of times
Total size of data				62		Total size of data for UC 1

[a] The data object is mandatory (M) or optional (O).

6.3.2 UC 2: Long speeding

Table 12 shows the size and description of the dataset required for UC 2.

Table 12 — Size and description of dataset required for UC 2

No.	Name		M/O[a]	Size of data (byte)	Data type	Description
1	Trip ID		M	4	uint32_t	UC 2 + trip sequential number +time stamp
2	ND ID		M	17	uint8_t	Nomadic device identification number
3	Vehicle speed		M	1	uint8_t	km/h (0 to 999)
4	Fuel injection amount		M	2	uint8_t	cc
5	GNSS values	longitude	M	8	uint32_t	GNSS coordinates of ND (longitude)
		latitude	M	8	uint32_t	GNSS coordinates of ND (latitude)
		altitude	M	8	uint32_t	GNSS coordinates of ND (altitude)
6	Vehicle driving time		M	4	uint32_t	second
7	Long speeding driving time		M	4	uint32_t	second
8	Number of long speeding		M	2	uint16_t	Number of times
Total size of data				62		Total size of data for UC 2

[a] The data object is mandatory (M) or optional (O).

6.3.3 UC 3: Sudden acceleration

Table 13 shows the size and description of the dataset required for UC 3.

Table 13 — Size and description of dataset required for UC 3

No.	Name		M/O[a]	Size of data (byte)	Data type	Description
1	Trip ID		M	4	uint32_t	UC 3 + trip sequential number +time stamp
2	ND ID		M	17	uint8_t	Nomadic device identification number
3	Vehicle speed		M	1	uint8_t	km/h (0 to 999)
4	Fuel injection amount		M	2	uint8_t	cc
5	GNSS values	longitude	M	8	uint32_t	GNSS coordinates of ND (longitude)
		latitude	M	8	uint32_t	GNSS coordinates of ND (latitude)
		altitude	M	8	uint32_t	GNSS coordinates of ND (altitude)
6	Vehicle driving time		M	4	uint32_t	second
7	Sudden acceleration driving time		M	4	uint32_t	second
8	Number of sudden acceleration		M	2	uint16_t	Number of times
Total size of data				62		Total size of data for UC 3

[a] Thee data object is mandatory (M) or optional (O).

6.3.4 UC 4: Sudden start

Table 14 shows the size and description of the dataset required for UC 4.