FINAL
DRAFT

INTERNATIONAL
STANDARD

**ISO/FDIS
23795-2**

ISO/TC **204**

Secretariat: **ANSI**

Voting begins on:
2023-11-09

Voting terminates on:
2024-01-04

Intelligent transport systems (ITS) — 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 (ITS) — 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/FDIS 23795-2:2023(E)

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Published in Switzerland

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Foreword

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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 (ITS) — 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

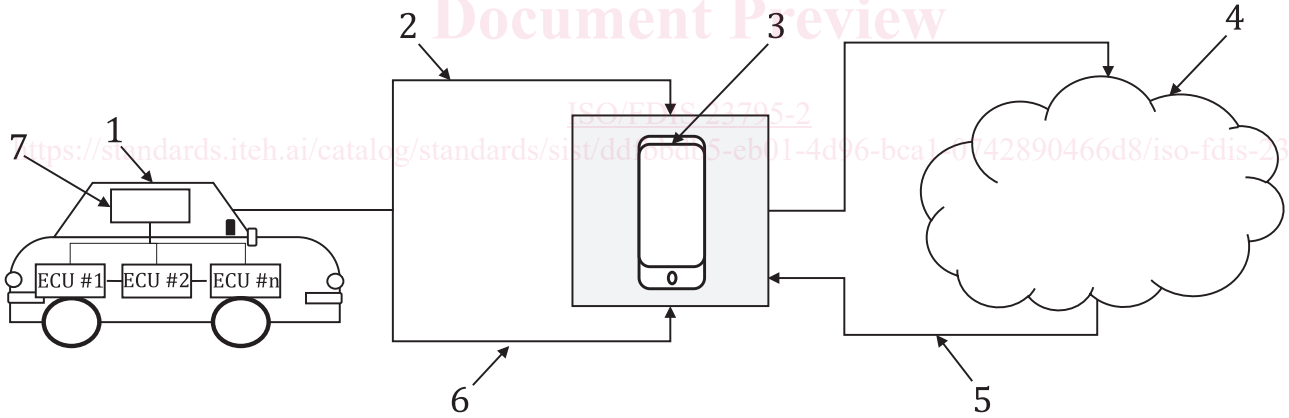
3.2 Abbreviated terms

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