FINAL DRAFT

TECHNICAL REPORT

ISO/DTR 12770

ISO/TC **204**

Secretariat: **ANSI**

Voting begins on:
2023-05-26

Voting terminates on:
2023-07-21

Intelligent transport systems — Mobility integration — ITS data aggregation role and functional model

Systèmes de transport intelligents — Intégration de la mobilité — Rôle d'agrégation de données et modèle fonctionnel des systèmes de transport intelligents

Reference number
ISO/DTR 12770:2023(E)

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Foreword

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

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Introduction

Currently, more than 70 % of the world's people live in cities. The proportion of people living in cities is rising around the world as civilisations develop and congregate around cities where there are more employment opportunities. Societies develop more innovatively and rapidly in cities, and they present better entertainment opportunities, adding to their attraction. The Economist magazine recently forecast that by 2045, an extra 2 billion people will live in urban areas. The resulting concentration of population creates various issues such as road congestion due to an increase in vehicle population and environmental pollution due to exhaust gas and tyre erosion. These issues have been attributed to increases in the number of delivery trucks, taxis and town centre traffic and are further exacerbated by obstacles to the effective use of urban space due to the private ownership of cars (parking lots, street parking).

The pressures caused by scientific advice that significant action and change of behaviour is needed to ameliorate the adverse effects of climate change require a more environmentally friendly use of the transport system.

It is recognized that there is also road infrastructure deterioration, a lack of provision of information on the use of public transportation, driver shortages due to the increase in the number of elderly people and the inconvenience of multimodal fare payments, and action to improve the situation is urgently needed.

The International Data Corporation forecasts that of the USD 81 billion that will be spent on smart city technology in 2020, nearly a quarter will go into fixed visual surveillance, smart outdoor lighting, and advanced public transit.

Eventually, this is likely to mean high speed trains and driverless cars. Consultancy McKinsey forecasts that up to 15 % of passenger vehicles sold globally in 2030 will be fully automated, while revenues in the automotive sector could nearly double to USD 6,7 trillion thanks to shared mobility (car-sharing, e-hailing) and data connectivity services (including apps and car software upgrades).

Changing consumer tastes are also calling for new types of infrastructure. Today's city dwellers, for example, increasingly shop online and expect ever faster delivery times. To meet their needs, modern urban areas need the support of last-minute distribution centres, backed by out-of-town warehouses.

Therefore, in recent years, in Europe, studies on the development of mobility integration standards have been active to solve urban problems. There are various movements around the world making efforts to address these issues. In the United States, intelligent transport systems (ITS) technology is used to try to solve these urban problems, as in the Smart City Pilot Project. Columbus, Ohio has been selected as a smart city pilot project which is currently being designed in detail. Important key factors here are the core architectural elements of smart cities, and urban ITS sharing of probe data (also called sensor data), connected cars and automated driving. In addition, new issues have been recognized with the introduction of the connected car to the real world in respect of privacy protection, the need to strengthen security measures, big data collection and processing measures, which are becoming important considerations.

In terms of the effective use of urban space, it is hoped that the introduction of connected cars and automated driving can significantly reduce the requirements for urban parking lots (redistribution of road space). If technology can eliminate congestion, the city road area usage can also be minimized and reallocated (space utilization improvement) to improve the living environment of, and quality of life in, the city. In addition, the environment around the road will be improved by improving enforcement (e.g. overloaded vehicles). On the other hand, even in rural areas, it is possible to introduce automated driving robot taxis and other shared mobility that saves labour (and is therefore more affordable) and improves the mobility of elderly people.

To achieve this requires the realization of various issues, for example:

— cooperation with harmonization of de-jure standards such as ISO and industry de facto standards;

— recognition of the significance of international standardization (e.g., to reduce implementation costs);

— recognition of the significance of harmonization activities by countries around the world;

— cooperation and contribution between ISO/TC 22 for in-vehicle systems and ISO/TC 204 for ITS technology.

As mentioned above, automated driving mobility is expected to play an important role both in cities and in rural areas. The main effects are, as described above, the reduction of traffic accidents, reduction of environmental burden, elimination of traffic congestion, realization of effective use of urban space, etc.

ITS technology is an important element for realizing smart cities, and it is important to clearly understand the role model of ITS service applications when developing standards to achieve these objectives.

This document gives an important overview of the options for this objective. Considering the emerging direction of mobility electrification, automated driving, and the direction of an environmentally friendly society, incorporating other urban data such as traffic management into the city management will improve the mobility of urban society. It is important to consider the creation of a common open role model for smart city data platforms (such as the ISO 15638 series service framework). Similar platforms will be necessary for the realization of the future mobility such as automated driving and electrification of vehicles. A common role model will be developed for all modes of vehicle, including public transport, general passenger vehicles and heavy vehicles. The incorporation of electronic regulation is especially important for automated vehicles, and it is essential to incorporate it as a core element of urban ITS.

This document describes how ITS data can be presented, interchanged, and used by smart cities. This document does not describe smart city use cases for ITS data in any detail nor does it describe in detail any specific ITS use cases. It is focused on the generic role model for data exchange between ITS and smart cities.

The necessary security and data exchange protocols have now been finalized to provide a secure ITS interface, with the approval of ISO/TS 21177, i.e. exchange information with bi-directional protection.

Intelligent transport systems — Mobility integration — ITS data aggregation role and functional model

1 Scope

This document describes a basic role and functional model of the intelligent transport systems (ITS) data aggregation role, which is a basic role of ISO/TR 4445. It provides a paradigm describing:

a) a framework for the provision of ITS data aggregation for cooperative ITS service application;

b) a description of the concept of a role and functional model for such roles;

c) a conceptual architecture between actors involved in the provision/receipt of ITS data aggregation;

d) references for the key documents on which the architecture is based;

e) a taxonomy of the organization of generic procedures.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO/TS 14812, *Intelligent transport systems — Vocabulary*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO/TS 14812 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/

4 Abbreviated terms

CONOPS	concept of operations
ITS	intelligent transport system
MaaS	mobility as a service
OBE	on-board equipment
OEM	original equipment manufacturer
SCMS	security credentials management system

5 Issues concerning data aggregation and sharing in smart city

5.1 General

ITS mobility service applications require open data aggregation of ITS data. The role and functional definition for this service is described in this document.

The ITS data aggregation role is required when combining internal data with the one externally inputted from other sources. The combining data requires a data sharing function, privacy protection and security controls.

5.2 Data sharing

ISO/TR 4286 describes the concept of data sharing in ITS service applications.

5.3 Open-source concept

For effective ITS data aggregation, utilising open source technology is key to success in developing smart mobility solutions. Deploying digital twins concept and data space platform is also a part of open source digital transformation.

Only technologies and methods standardized within an acknowledged global standards body are appropriate for consideration. Such technologies are considered to display some track record of sustainability and robustness to satisfy the global long-term deployment and operational nature of ITS.

5.4 Open-source API concept

Although the data API from external and sensor data is out of scope, open-source API concept is essential for effective data sharing and utilization.

Data API to service providers is out of scope of this document.

5.5 Privacy control and security controls

Procedures regulating privacy control and security controls are usually governed by national authorities.

5.6 Trustworthiness and data accountability

It is necessary to consider data trustworthiness and data accountability within all data flows.

6 General overview and framework

6.1 Objective

Emerging ITS service applications such as parking (including AVPS: Automated valet parking systems), CAV (connected and automated vehicle) (including LSAD: Low speed automated driving), Kerb operations need structured data created from smart city big data through the effective use of AI (artificial intelligence) and support from digital infrastructure which is described in ISO/TR 7872 for secured and safety operations. And there are several independent related ongoing standardization work items within ISO/TC 204. Therefore, there is a need of a guidebook-style technical report that describe the basic role and functional model of the ITS data aggregation.

This will lead to digital twin operation for smart city; create digitality formed society twining real physical world to process big data and analyse to send out data stream to real world.

In actual deployment, distributed security technology such as block chain will be introduced for efficient and speedy transactions with secure privacy controls.

This document suggests investigating ITS as a component part of a smart city and that the ITS data can focus on data originated by ITS components and available for sharing with other smart city services and commercial interests.

This subclause describes a generic framework for the provision of digital infrastructure service for cooperative telematics application services for ITS service applications.

(Clause 7 provides the general concept of operations for which this architecture is designed. Clause 6 provides a framework, role definition and summary of the architecture at a conceptual level.)

6.2 National variations

The instantiation of interoperable on-board platforms for ITS service applications with common features is expected to vary from country to country, as will the provision of regulated, or supported, services.

6.3 Mandatory, optional, and cooperative issues

6.3.1 No mandated requirements

This Document does not impose any requirements on Nations in respect of which services for ITS service applications countries will require, or which they will support as an option, but provides a generic common framework architecture within which countries can achieve their own objectives in respect of application services for ITS supported service applications in cities, and provide standardised sets of requirements descriptions for the exchange of data to enable consistent and cost efficient implementations where instantiated.

6.3.2 Common platform

Cooperative ITS application, in this context, is the use of a common platform to meet both regulated and commercial service provision providing collaboration between transport systems and smart cities.

6.4 Specification of service provision

Cooperative ITS applications for ITS service applications (both commercial services and regulated services) are specified in terms of the service provision, and not in terms of the hardware and software.

6.5 Architecture options

Architecturally, it needs to be possible for a vehicle user/OBE to use the services of different application services. The in-vehicle system will be a vehicle original equipment specification option, inbuilt at the time of manufacture of the vehicle, with service provider selection being a subsequent service-user choice (much as we select an internet service provider today) or will be aftermarket equipment that has access rights to the required data. An ITS application service will be based in the infrastructure. Other options are possible and can be supported within the conceptual architecture. The objective of this role model is the accessibility of the use of ITS data generated in ITS application services in smart city application services.

7 Concept of operations

7.1 General

This clause describes the characteristics of a proposed system from the viewpoint of an individual who will use that system. Its objective is to communicate the quantitative and qualitative system characteristics to all stakeholders.

ISO/TR 4445 describes the roles and responsibilities of the classes and actors involved in the provision of digital infrastructure for ITS services for ITS service applications using a secure vehicle interface.

This Document recognises that there will be variations between jurisdictions, a role in ISO/TR 4445. It does not attempt, nor recommend, homogeneity between jurisdictions, it is designed to provide common standard features to enable equipment of common specification, that supports a standardised 'Secure ITS Interface' to be used, and the common features of service provision to be able to be referenced