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Smart community infrastructures — Guidance on smart transportation for energy saving in transportation services

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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).

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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 268, *Sustainable cities and communities*, Subcommittee SC 1, *Smart community infrastructures*.

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

Energy saving is one of the typical and measurable issues to be addressed in every city in the world. Energy is consumed whenever citizens move within and between cities by using transportation services for their daily living and business activities. This energy consumption volume is higher than that of other city functions such as water and ICT systems, as transportation systems convey a large number of passengers and delivery items or freight – which can sometimes be enormous – resulting in large, heavy vehicles travelling at high speed. Smart transportation is not necessarily an infrastructure but definitely a solution to existing or future city issues, as explained in ISO 37154. Transportation operation itself will be targeted and expected to produce drastic energy savings, but there is also large energy consumption and waste in transport procedures besides operation. Smart transportation for energy saving is, therefore, an important factor in enhancing city performance, quality and potential.

The principle of smart transportation for energy saving depends not only on transportation modes but also on methods of traction for running transportation vehicles, because energy is consumed mainly when driving vehicles. In addition to vehicle operation, energy is used to support dispatch operations and organize entire transportation systems. Therefore, to successfully reduce energy consumption, the entire structure of transportation systems needs to be studied. This would involve identifying where energy can be saved in the system and the people who can make arrangements for or directly contribute to energy saving. Different energy-saving options are available. By combing these methods, energy can be more effectively saved in transportation which consists of a variety of technical and service fields supporting the system.

This document describes what smart transportation for energy saving targets and how it works in transportation systems, according to the general guidelines on smart transportation of ISO 37154, which fully explain the structures, aspects and features of transportation operation, services and technical/business content from the different viewpoints of those who use, plan and provide or operate transportation systems. This document also identifies specific ways to save energy consumed in transportation operation and services.

In the development of this document, ISO Guide 82 has been taken into account in addressing sustainability issues.

Smart community infrastructures — Guidance on smart transportation for energy saving in transportation services

1 Scope

This document provides guidance on reducing the energy consumed by transportation for passengers, delivery items, freight and postal item services in cities and city zones.

This document does not designate specific procedures to save energy but suggests energy-saving options to be adopted in transportation systems normally organized in different locations, on different scales and for different purposes.

NOTE Some typical energy-saving options are listed in 6.2.2.

2 Normative references

There are no normative references in this document.

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

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

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at http://www.electropedia.org/

3.1
transportation energy
energy consumed in transportation operations and services

3.2
city zone
area that comprises a single core city or more than one core city connected or related for/with business, economic and political activities

Note 1 to entry: A city zone comprising more than one core city is called a megalopolis. Some well-known examples are BosWash (USA), Blue Banana (Europe) and the Tokaido Megalopolis (Japan).

4 Fundamentals

4.1 Basic ideas and goals

As stated in ISO 37154, any smart transportation has basic ideas and goals. They are considered according to the criteria listed below:

— to improve the status of a city;

— to lower environmental load;

— to realize transportation facilities based on concrete planning (e.g. payable budget scales, environmental harmonization);

— to preserve and enhance scenic, aesthetic, historic, community and environmental resources.

Smart transportation for energy saving in transportation operation and services in cities and city zones should also be organized to achieve the basic ideas and goals derived from the criteria.

Smart transportation for energy saving contributes to the United Nations Sustainable Development Goals, specifically goal 3, "Good health and well-being," goal 7, "Affordable and clean energy," goal 8, "Decent work and economic growth," goal 9, "Industry, innovation and infrastructure," goal 11, "Sustainable cities and communities," goal 12, "Responsible consumption and production," goal 13, "Climate action" and goal 15, "Life on land."

4.2 Location and objectives of smart transportation for energy saving

4.2.1 General

For successful energy saving through smart transportation, transportation organizations and structures should be studied in order to properly introduce smart transportation in suitable locations in transportation systems. Transportation in cities and city zones consists of single carriers, independent service lines, local transportation systems and/or large transportation networks. Thus, energy-saving options can be adopted in all of these elements as well as in entire transportation systems.

Besides transportation system route extents, the energy to be saved is not necessarily only the energy consumed by running transportation vehicles but also that used indirectly or additionally for vehicle operation. This includes the energy used for lighting, air-conditioning, passenger access assistance equipment in stations, ticketing and ticket inspection systems, passenger addressing systems, vehicle accommodation, transportation operation and maintenance systems (e.g. signalling, communication, powering and safety systems, all being work done at maintenance facilities and on service lines) and waste disposal and recycling of batteries if sustainable and economically viable.

4.2.2 Locations where smart transportation can be introduced

Smart transportation for energy saving can be introduced in the following locations:

— within a region of a city or city zone;

— on routes that connect regions;

— on interfaces of transportation inside/outside cities and city zones.

For transportation customers, the factors that shape the locational needs of smart transportation are:

— current costs of the transportation system;

— environmental impact of current transportation activities.

4.2.3 Objectives of introducing smart transportation

Smart transportation can be introduced for the following purposes:

— to transport people, freight and goods safely, reliably, conveniently, efficiently and economically;

— to provide transportation services that satisfy demand;

— to reduce environmental impact without reducing the quality of the transportation services;

— to improve the efficiency of connections between different modes of transportation;

— to reduce the total energy usage of the transportation infrastructure;

— to make transportation operation economically sustainable while ensuring it is affordable and accessible to all customers;

— to improve communication to the public about all aspects of transportation services.

These objectives can be achieved by ensuring the transportation system's performance and ability to:

— convey passengers, delivery items and freight
  — safely;
  — when they are in a large lot;
  — at one time;
  — on time;
  — as planned;
  — at a low cost;
— provide dense networks for transport;
— provide frequent services for transport;
— provide successful and easy connection for transport between different transportation systems or modes;
— control total energy saving/consumption for transportation;
— lower environmental load without reducing the service quality of transport operations.

An integrated urban transportation plan enables:

— the transport of people and goods safely, reliably, efficiently and economically;
— the provision of networks appropriate for transportation needs, especially investing in and improving existing infrastructures;
— the creation of frequent services for transport;
— the provision of efficient connections for transport between different transportation systems or modes;
— the lowering of total energy usage/consumption for transportation;
— the lowering of environmental impact without degradation in service quality of transport operation;
— the economically stable operation of transportation with fares/fees reasonable or affordable for local citizens.

5 Targets of smart transportation for energy saving

5.1 General

As discussed in 4.2, energy saving targets should be carefully determined when introducing smart transportation in transportation system structures. ISO 37154 describes these structures according to the transportation modes used. Each transportation mode has specific transportation technical and business contents that provide characteristic transportation services to customers. Thus, smart transportation for energy saving targets all or part of the structures featured by transportation services, transportation technical and business contents and transportation modes.

5.2 Targets of smart transportation

5.2.1 Target transportation modes

Smart transportation for energy saving targets the following transportation modes, which are also the transportation modes of smart transportation in the general meaning defined in ISO 37154:2017, 3.7.

— rail;

— commuter buses, bus rapid transit and intercity buses;

— trucks;

— ferries;

— pipelines;

— air vehicles;

— walking;

— bicycles;

— motorbikes;

— automobiles;

— boats;

— transportation devices assisting passengers, delivery of items and freight for moving in stations and terminals (e.g. elevators, escalators, moving walkways, conveyors);

— vehicles or systems and their additional instruments assisting mobility-impaired persons (e.g. scooters, Segways).

5.2.2 Target technical and business contents of transportation

5.2.2.1 General

Any transportation mode has specific technical and business contents. Smart transportation for energy saving can be introduced in transportation organized for public or private purposes in cities and city zones by targeting the technical and business contents dependent on the transportation mode targeted.

5.2.2.2 Public transportation

Public transportation is organized for specific purposes, or what (e.g. people, items) the transportation conveys and from where to where. Smart transportation targets the technical and business contents of the transportation mode used in public transportation.

a) Rail mode

   — passengers, delivery of items and freight services (e.g. customer services at stations and freight yards, refrigeration for delivery items and freight);

   — accommodation preparation and management (e.g. water supply, cleaning, air-conditioning, coach brightness adjustment);

   — train operations (e.g. scheduling, dispatching, refuelling, train crew);

   — rolling stock (e.g. accommodation, maintenance, refrigeration for delivery of items and freight);

   — power/signalling;

- communication for train operations;
- facilities (e.g. stations, tracks, civil engineering structures);
- safety (e.g. surveillance);
- environment (e.g. noise, vibration, pollutants and greenhouse gas emission, sunlight);
- information availability (e.g. real-time information provision to passengers and senders/recipients on service frequency, routing, destinations and cost).

b) Bus/truck mode

- passengers, delivery of items and freight services (e.g. customer services at bus stations and delivery offices, refrigeration for delivery items and freight);
- bus and truck operations (e.g. scheduling, dispatching, drivers and conductors);
- refuelling/power charging;
- signalling and bus/truck tracking systems;
- communication for bus and truck operations;
- vehicles (e.g. accommodation, maintenance, refrigeration for delivery of items and freight);
- facilities (e.g. bus stations, freight yards, taxi stands, bus and truck lanes on public roads, bus tracks, civil engineering structures for bus and truck operations);
- information availability (e.g. real-time information provision to passengers and senders/recipients on service frequency, routing, destinations and cost).

c) Ferry mode

- passengers, delivery of items and freight services (e.g. customer services at ports, refrigeration for delivery items and freight);
- ferry operations (e.g. scheduling, dispatching, crew);
- refuelling and power charging;
- signalling;
- communication for ferry operations;
- vessels (e.g. accommodation, maintenance, refrigeration for delivery of items and freight);
- facilities (e.g. ports, ferry terminals, civil engineering structures for ferry operation);
- information availability (e.g. real-time information provision to passengers and senders/recipients on service frequency, routing, destinations and cost).

d) Air vehicle mode

- passengers, delivery of items and freight services (e.g. customer services at airports, refrigeration for delivery of items and freight);
- refuelling and power charging;
- air vehicle operations (e.g. scheduling, dispatching, crew);
- aircraft (e.g. pilotless aircraft);
- facilities (e.g. airports, civil engineering structures for aircraft operation);