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Smart community infrastructures — Smart transportation for rapid transit in and between large city zones and their surrounding areas

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National foreword

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Foreword

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This document was prepared by Technical Committee ISO/TC 268, *Sustainable cities and communities*, Subcommittee SC 1, *Smart community infrastructures*.

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Introduction

A megalopolis is a huge city zone covering a number of large and medium-sized cities, normally including a national capital, where political and economic functions and business activities are concentrated. The original megalopolis is the area located on the east coast of the United States, from Boston down to New York and Washington DC, which is known as BosWash. In Europe, the area covering London, Brussels and Paris is informally called Blue Banana. In Asia, the zone covering Tokyo and Osaka in Japan is known as the Tokaido Megalopolis. These three megalopolises have populations of 52 million, 100 million and 67 million, respectively, and include national capitals and commercial and industrial cities, as well as academic, scientific and educational facilities.

Huge numbers of people travel, including commuting, to and from cities and their surrounding areas in a megalopolis on a frequent or daily basis. To meet their needs and provide suitable transportation services, rapid surface transit systems have been developed, including highway buses and trains on enhanced rail tracks. The effectiveness of each mode of transport depends on the travel distance and the number of passengers. Highway buses are convenient for travel distances of up to 200 km. For distances of up to 1 000 km, high-speed rail (HSR) provides easy and rapid transit and has been developed and introduced in response to demand in these megalopolises, including for the purposes of inter-city commuting of less than 200 km. HSR uses trains with a large capacity which can reach speeds of over 200 km/h. Such trains run directly into city centres, removing the need for passengers to change services, and offer a high frequency of service, all for a relatively low price. This has proved very popular with residents in these megalopolises, as shown in Annex A.

HSR has been transporting large numbers of people quickly and frequently between cities worldwide for over 50 years. As of April 2015, HSR conveys 1 600 million people per year on service lines of 29 792 km in a total in 10 countries, utilizing 3 603 train sets. This indicates that HSR is a successful rapid transit system for people, especially in megalopolises. By installing HSR in megalopolises or on a route connecting a megalopolis and other cities outside this area, the rapid transit of people can easily be achieved and managed, resulting in short travel times that facilitate both political and economic work and promote commercial business. Using such transportation is one solution to a typical city issue in a megalopolis.

Highway bus transportation systems have also been established as highway networks have been extended. Among the benefits of such systems is the ease of planning service routes and schedules, as well as the actual start-up of such bus transportation services, since these companies do not need to prepare extensive and expensive physical facilities such as those required for HSR operations, namely railroad tracks and civil engineering structures, that are built and financed by rail companies at their own or government expense. It is also easy to change both service frequency and routes according to passenger flow. Therefore, highway buses can be an effective means of quickly conveying people for a distance of less than 200 km by optimizing the transport capacity between cities.

Another benefit of highway bus and HSR services is that they convey citizens in large numbers as a "lot." This reduces citizens' travel expenses; in fact, using personal transportation (driving personal vehicles on public roads) can cost 20 times as much as using highway buses or HSR. Lot transportation also results in much lower CO_2 emissions than in cities where only personal transportation is used.

These two transportation modes, highway buses and HSR, are examples of indispensable smart transportation for megalopolises which have specific issues regarding cost-effective, accessible and user-friendly transport for travellers.

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Smart community infrastructures — Smart transportation for rapid transit in and between large city zones and their surrounding areas

1 Scope

This document specifies a procedure to organize smart transportation that enables one-day trips by citizens between cities and in a large city zone, including its surrounding areas, and conveys a large number of people at a high frequency in a short time over distances of up to 1 000 km.

Smart transportation aims to promote political and economic work and stimulate business activity by providing citizens with a manner of travel to complete a return trip from their home or place of work to destinations outside their cities on the same day. However, this document does not designate a procedure for constructing smart transportation facilities.

NOTE "One-day trip" means travel from an origin to a destination and back to the origin on the same day. The purpose of such travel is out of the scope of this document.

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
large city zone
area that includes large cities connected or related for political or economic reasons

Note 1 to entry: A large city zone holds a single core city and its surrounding areas, while a megalopolis is still a large city zone but holds more than one core city and their surrounding areas to form a belt-like area. Typical large city zones include Paris, Tokyo, Jakarta, Bangkok and Manila.

Note 2 to entry: In a megalopolis, over half of the national or regional population is concentrated or localized where one-day trips are required therein due to business, economic and political communication and activities. Typical megalopolises include BosWash (USA), Blue Banana (Europe) and the Tokaido Megalopolis (Japan).

3.2
highway bus
transportation to convey people with buses operated on fixed service routes, on which highways are fully or partly incorporated

3.3
high-speed rail
transportation to convey people with high-capacity trains at a high frequency in a short time over long distances

Note 1 to entry: High-speed trains are generally considered to be those trains running at over 200 km/h, although the International Union of Railways defines them as trains running at over 250 km/h.

4 Concept of smart transportation for rapid transit

4.1 General

This document describes the performance required for smart transportation to overcome a city issue or how one-day trips can be successfully provided to citizens by transporting a large number of people at a high frequency in a short time for distances of up to 1 000 km between cities located inside or outside a large city zone, including a megalopolis. A megalopolis usually includes key cities such as capitals and commercial, industrial, academic, scientific or educational centres. Thus, there are usually a lot of journeys necessary within a large city zone and between a large city zone and its surrounding areas.

The anticipated smart transportation modes for this purpose are highway buses and high-speed rail (HSR). The former can transport people for distances of up to 200 km, the latter for distances of up to 1 000 km for one-day trips. Both transportation modes should be selected according to the distance and required capacity. For distances over 200 km, HSR should be selected, but either transportation mode is possible for distances of less than 200 km. The required capacity is also a criterion for the selection of a transportation mode. Highway buses have a smaller capacity than HSR. However, this capacity can be easily changed, since more buses can immediately be dispatched or cancelled depending upon the number of passengers received at any particular time. Capacity is usually fixed with HSR.

One other advantage of using highway buses and HSR for this purpose is to directly connect the city centres in different cities without forcing travellers to change to local services before entering/leaving the city centre. This is always required when travelling by airplane to/from an airport distant from the city centre. No check-in procedures are necessary for bus or train rides, especially when customers purchase paper- or e-tickets in advance, enabling passengers to arrive at a station only a few minutes prior to departure. High-frequency services or those departing at fixed times every hour allow customers to travel without timetables. Bus or train services using exclusive highways or tracks enable on-time operation that is undisturbed by other traffic. These time-reliable services promote the transportation business, resulting in financially stability. Buses and trains provide “lot transporting,” i.e. the conveying of people in the same direction or to the same destination to the same schedule with the same vehicles at a time suitable to a number of citizens. If people travel in their own vehicles to their respective schedules, it causes large energy consumption and heavy traffic congestion, resulting in high CO_2 emissions. Personal car use is uncontrollable traffic and one of the major sources of CO_2 emissions.

When introducing highway buses and HSR, the capital cost is high compared with other transportation modes, due to construction of high-standard public roads or railroad tracks. Furthermore, additional technologies need to be developed to operate such buses and trains. However, as every large city zone has already experienced, the higher the service speed offered, the more sharply and effectively the economy grows in the area, if successful. Thus, the introduction of high-speed and high-capacity transportation will foster cities and large city zones. In fact, there is no large city zone that has not introduced such transportation services. This alone shows that it is worthwhile introducing such transportation despite the high capital cost. However, it should be confirmed that the target area has a population large enough to financially support a transportation business that requires high initial capital costs when making decisions on the introduction of smart transportation.

4.2 Applicable city issues

When the issue is to enable one-day trips by citizens between cities within a large city zone, including a megalopolis, or between a large city zone and cities outwith this by a transportation service which can accommodate a large number of people at one time, this smart transportation is applicable.

5 Adoption of smart transportation for rapid transit

5.1 Objectives

As mentioned in 4.1, smart transportation to enable one-day trips by citizens in and between large city zones and their surrounding areas can be organized by determining a suitable transportation mode and then installing it while satisfying the requirements in 5.4. Transportation modes, except airplanes, applicable to smart transportation should be selected by following 5.5.

5.2 Target area

A large city zone, including a megalopolis, and surrounding areas containing cities within/between which a number of one-day trips are to be enabled.

5.3 Applicable transportation modes for smart transportation

Applicable transportation modes are shown below for smart transportation according to the transportation distance in a target large city zone:

— both buses and HSR for transportation distances of less than 200 km;

— HSR for transportation distances over 200 km.

When smart transportation is applied to transportation distances of less than 200 km, consider the conditions in 5.5.

5.4 Requirements for smart transportation

5.4.1 General

The services provided by a transportation mode selected as smart transportation shall satisfy the conditions specified in 5.4.2 to 5.4.4.

5.4.2 Customer satisfaction

5.4.2.1 Service frequency

The transportation service shall be available every hour minimum, even in off-peak periods, and every 5 min maximum during rush hours.

5.4.2.2 Transportation capacity

The possible capacity shall be over 500 persons per hour.

5.4.2.3 Main station location

Main stations shall be situated in or close to the city centre.

5.4.2.4 Connection to/from the station for smart transportation

Connection services by rail, bus, ferry, airplane, walking, bicycle, bike or car shall be provided to customers for their ease of access to smart transportation.

5.4.2.5 Service route

The route shall include as many cities as possible by avoiding excessive increases in travel time from terminal to terminal.

5.4.2.6 Roads/tracks

The roads/tracks to be used for smart transportation shall enable on-time operation of highway buses and HSR trains and have no level crossings.

5.4.2.7 Schedule speed

The schedule speed can be increased by improving acceleration.

NOTE Schedule speed is given by dividing the one-way distance between terminals by the scheduled travel time.

5.4.2.8 Increases in number of stops/stations

The number of stops/stations for smart transportation shall be increased, if needed, by consulting with municipalities on the service route, even after the services start.

5.4.2.9 Transportation information

Any transportation information helpful to customers in recognizing their departure and arrival stations and those for changes to other services shall be provided.

5.4.3 Safety

5.4.3.1 Dispatching

All service vehicles for smart transportation are dispatched and controlled at a dispatching centre through wireless communication.

5.4.3.2 Immediate stopping

The immediate stopping of vehicles in order to prevent accidents shall be ensured in the operation of smart transportation systems.

5.4.4 Efficiency of operation and services

5.4.4.1 Vehicle structures

Lighter vehicles shall be used in order to help reduce the cost of infrastructure for smart transportation.

5.4.4.2 Coach convenience

Entry and exit from vehicles shall be easy and accessible for all, including the elderly and those with small children or disabilities, so that passengers are able to enter and exit with minimal or no assistance. Vehicles shall be equipped with handgrips and non-slip floors for safety and furnished with easy communication channels in case of emergency. Vehicles may also include space devoted to bicycles or other large items.

5.4.4.3 Promotion of environmentally friendly vehicles and life-cycle performance

Transportation systems which produce low chemical emissions, vibration and noise levels shall be used. Furthermore, positive application of technologies shall be promoted to develop environmentally friendly vehicles and enhance the life-cycle performance of the transportation.

5.4.4.4 Ticket inspection

No inspection work is required onboard for reserved seats.

5.4.4.5 Energy saving

Transportation systems shall be used which can save energy by, for example, using recovered braking energy, minimizing energy consumption, optimizing operation schedules or controlling vehicle running performance.

5.5 Selection of a transportation mode for smart transportation

Select a transportation mode for smart transportation by considering the following transport conditions to solve specific city issues:

— transportation distance of target sections;

— transportation capacity required for target sections;

— transportation service frequency requested for target sections;

— fare payable by customers travelling in target sections;

— cost to facilitate transportation facilities and vehicles for smart transportation to be installed in target sections.

5.6 Installation of smart transportation

By using the transportation mode selected, a system of smart transportation shall be established in accordance with the requirements described in 5.4.

6 Maintenance of the quality of smart transportation for rapid transit

6.1 General

To maintain the performance of smart transportation for rapid transit and confirm its effectiveness, the parameters shown in 6.2 shall be periodically observed. If the effectiveness of smart transportation cannot be confirmed, modify the current smart transportation services by partly changing the transportation conditions described in 5.4, where possible and reasonable.

6.2 Parameters to be observed

To ensure that the performance of smart transportation is effectively organized, observe any changes in the following parameters:

— population in the target area where smart transportation was installed;

— traffic flows to/from the target area;

— the modal split of smart transportation in the target area;

— the required capacity of smart transportation;

— city/city zone axes of the target area;

— parameters developed based on proven measures for transit performance.

6.3 Modification of smart transportation

When identifying unwanted changes in the value of the parameters designated in 6.2, modify the conditions of smart transportation as laid out in 5.4, where possible. To correct the transportation parameters, analyse any unexpected or irregular occurrences in the area where smart transportation was installed. Modify the irregular conditions of the smart transportation system if the irregular conditions are not acceptable.

Annex A
(informative)

Examples of smart transportation that works as rapid transit services

Table A.1 shows typical examples of smart transportation between cities and in large city zones, including megalopolises, available to citizens making a one-day trip in the respective areas.

Table A.1 — Typical examples of smart transportation for rapid transit between cities or within a large city zone

	City zone (megalopolis)									
Service conditions	**New York–Philadelphia, US**	**Los Angeles–San Diego, US**	**Vienna–Brno–Prague, EU**	**Seoul–Daejeon, Republic of Korea**	**Bangkok–Pattaya, Thailand**	**BosWash, US**	**Blue Banana, EU**	**The Tokaido Megalopolis, Japan**	**Beijing–Tianjin Economy Zone, China**	**Four Metropolitan City Zone, Taiwan**
Population in the area/10^6 persons	10	13	3	12	6	52	100	67	36	14
Transportation mode	Highway bus	Highway bus	Highway bus	Highway bus	Highway bus	HSR	HSR	HSR	HSR	HSR
Service distance/km	155	194	340	153	147	735	492, between London and Paris	515	120	345
Maximum service frequency (service interval)/min	60	60	110	15	30	60	60	5	5	5
Minimum service frequency (service interval)/min	120	168	240	35	40	120	80	30	30	60
Maximum service speed/km/h	78 (schedule speed)	83 (schedule speed)	74 (schedule speed)	77 (schedule speed	49 (schedule speed)	240	300	285	240	300
Average service speed/km/h	80	90	80	80	50	110	210	220	200	230
Travel time between terminals/h	2	2,2	4,4	2	3	7	2,3	2,3	0,6	1,5

Bibliography

[1] ISO/TR 21245-1, *Railway applications — Generic standards for rail project planning process —Part 1: Stakeholders and their needs/interests*

[2] ISO/TR 21245-2, *Railway applications — Generic standards for rail project planning process — Part 2: Conditions*

[3] ISO 37154, *Smart community infrastructures — Best practice guidelines for transportation*

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