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Intelligent transport systems — Interactive centrally determined route guidance (CDRG) — Air interface message set, contents and format

*Systèmes intelligents de transport — Guidage routier déterminé
centralement interactif (CDRG) — Jeu de message d'interface d'air,
contenu et format*



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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.

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In exceptional circumstances, when a technical committee has collected data of a different kind from that which is normally published as an International Standard ("state of the art", for example), it may decide by a simple majority vote of its participating members to publish a Technical Report. A Technical Report is entirely informative in nature and does not have to be reviewed until the data it provides are considered to be no longer valid or useful.

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Introduction

The interactive CDRG system provides a driver with a recommended route to his or her destination. The recommended route is sent as a route object that is utilized to display the route on the navigation map or to produce driving direction instructions. This recommended practice, however, only describes the transferring information, such as route object, that is required for CDRG. How the transferred information is used onboard is left to the in-vehicle unit designer. Because, in some countries, interactive CDRG systems are being developed and implemented using beacon or cellular phone technologies, we recognize the necessity for standardizing message sets for interactive CDRG. By the standardized interactive CDRG message set, drivers will be able to receive CDRG service on the same in-vehicle unit regardless of which CDRG service area the in-vehicle unit has entered.

To help understand the functional and technical aspect of the interactive CDRG, implementation experiments of such a system are explained in Annex A.

Intelligent transport systems — Interactive centrally determined route guidance (CDRG) — Air interface message set, contents and format

1 Scope

This Technical Report describes the message contents and format of the air interface between the infrastructure and the in-vehicle unit in the Interactive CDRG system. The scope of standardization work will be the message set requirements for the air interface.

- a) The air interface message set for route guidance information in the interactive CDRG system in this Technical Report is applicable to both vehicles equipped with an onboard map database and those which are not equipped (i.e. those equipped with simplified graphic output and/or text message display functions).
- b) This Technical Report covers media independent systems. In this Technical Report, messages required for both cellular phone-based CDRG and beacon-based CDRG have been taken into account.
- c) The size of each message is defined by considering the “In-vehicle Navigation Systems Communication Device Message Set Requirements”.
- d) When applying this Technical Report, which is recommended practice to the implementation of any CDRG system, any values less than the defined field size values are allowed, as great importance is attached to the communication efficiency, and the order of description of messages proposed in the message set of this Technical Report might not necessarily be observed.

2 Abbreviations

CDRG	Centrally Determined Route Guidance
LDRG	Locally Determined Route Guidance
SRG	Static Route Guidance
MDRG	Multi-mode Determined Route Guidance
OD	Origin-Destination

3 Definitions of special terminology

Table 1 lists definitions of special terminology.

Table 1 — Special terminology

Term	Definition/explanation
Connecting network information	By indicating how the links and major roads ahead of the vehicle's present position are configured, connecting network information realizes Interactive CDRG even for vehicles not equipped with onboard map databases.
Downlink	The downlink refers to that portion of a communications link used for the transmission of information from the infrastructure to each in-vehicle unit.
Infrastructure	The infrastructure handles communications with each vehicle. Installed alongside the road, the infrastructure collects data from each vehicle, provides data to the vehicle and performs any related information processing.
Interactive two-way communication	Following the reception of destination and related information from the in-vehicle unit, the infrastructure provides the in-vehicle unit with information that defines the recommended route, describes route conditions, and provides an estimated travel time to the destination.
LDRG	Under LDRG, the vehicle follows a route in the routing information generated by the in-vehicle unit mainly using link travel time data received from the infrastructure.
Link	A link is defined as the roadway section between two nodes such as intersections and has directivity with respect to the flow of traffic.
Link travel time	Travel time of a specific link.
Local street	Local streets are all roads other than major roads.
Major roads	Major roads are subject to route guidance by the Interactive CDRG system. These are roads on which management personnel at the traffic control centre consider important such as national highways and other arterial roads with large amounts of traffic.
Multi-mode route guidance	Multi-mode route guidance provides route guidance under the combined operation of the Interactive CDRG, LDRG and SRG systems.
Node	The node refers to the starting point or ending point of a link in a road network. Basically, it is an intersection, a diverging point or a merging point. For convenience's sake, however, any other point may be taken as a node.
OD	The OD information includes both the departure and destination points.
Recommended route	The recommended route is a route calculated by the CDRG infrastructure and sent to the in-vehicle unit.
SRG	Under SRG, the vehicle follows a route generated by the in-vehicle unit using only fixed information such as distance and other data stored in onboard map databases.
Traffic assignment	Traffic assignment is the distribution of traffic in response to the needs of both the traffic situation and the intents of management personnel at the traffic control centre in order to realize a safe, smoothly flowing traffic environment.
Traffic control centre	The traffic control centre comprises necessary buildings, facilities and personnel to effectively execute traffic management and control.
Travel time	Travel time is the actual time required for a vehicle to pass through a specific roadway section in a route.
Uplink	The uplink refers to that portion of a communications link used for the transmission of information from each in-vehicle unit to the infrastructure.

4 The concept of interactive CDRG

4.1 Goals

4.1.1 Promoting Smooth Traffic Flow

- a) An interactive CDRG system is intended to secure a more smooth flow of traffic through improved traffic management based on the high-precision prediction of traffic flow generated from OD information collected by the system.
- b) In the future when in-vehicle units have become more widespread, the interactive CDRG system will help reduce traffic congestion through traffic assignment.

4.1.2 Securing traffic safety and improving the traffic environment

- a) By providing a recommended route based on the driver's destination and preference for travel, the interactive CDRG system assists the driver with probable routing and travel times to his or her destination. Consequently, the system relieves the driver's stress. Moreover, for drivers travelling in an unfamiliar region, interactive CDRG will prevent accidents caused by drivers who are lost or have made a sudden route change.
- b) By shortening both travel times and travel distances, the Interactive CDRG system will decrease the probability of accidents and reduce the environmental degradation caused by fuel consumption and noise pollution associated with vehicular traffic.

4.1.3 Promoting onboard unit market

This Technical Report assumes the use of an onboard navigation unit as the interactive terminal for CDRG.

- a) Standardizing the message sets brings on benefits both to users, by realizing interchangeable onboard units, and to manufacturers, by standardized production.
- b) Standardizing the message sets enables manufacturers to use interchangeable components for the applications that result in expanding the market.

4.2 Basic system functions

- a) The system includes facilities for interactive two-way communication between the vehicle and the infrastructure.
- b) Using data received from vehicles, traffic management administrators and other sources, the service provider determines a route to the vehicle's destination.
- c) This recommended route, determined by the service provider is based on the driver's and/or provider's preference for that trip. Minimizing the predicted travel time to arrive at the driver's destination may be one such preference.
- d) In the future when in-vehicle units have become more widespread, the system will determine recommended routes in such a way that its traffic assignments may alleviate traffic congestion.
- e) The system will provide service to both vehicles equipped with map databases and those which are not equipped.
- f) Portable navigation devices that could be brought into vehicles are not considered in this Technical Report.

4.3 Secondary effects

- a) Because the driver can find his or her desired routing recommended by the system, based on predicted travel times and related traffic information, he can choose a route best suited to dynamic traffic conditions. Lacking this capability for prediction, it is difficult for LDRG and SRG to choose routes best suited to dynamic traffic conditions.
- b) Because the recommended route is based on the driver's destination and preference for his trip, the amount of data provided to the in-vehicle unit is relatively small and the communication efficiency between the vehicle and the infrastructure can be increased.
- c) As a result of b), the system can provide route information for distant destinations with a minimum amount of data that does not require wide bandwidth of the media for communication.
- d) Because the infrastructure calculates recommended routes, the computational load on the in-vehicle unit can be reduced.
- e) It is unnecessary to update the in-vehicle unit's software for routing calculation.
- f) By shortening travel times, personal travel expenses can be reduced with positive economic consequences.

4.4 The possibility of multi-mode route guidance

- a) In-vehicle units with map databases can provide more effective route guidance by skilfully combining information provided by the interactive CDRG with LDRG and/or SRG functions of the in-vehicle unit.
- b) Both the LDRG and SRG can choose routes based on the local streets information included in the road network data stored in the onboard database. If the in-vehicle unit with LDRG function receives link travel time information from the infrastructure, the in-vehicle unit combines these data with the above road network data to arrive at its routing decision. However, accurate route selection based on prediction is difficult.
- c) By providing routing information based on prediction, interactive CDRG is intended to handle links on major roads on which traffic is heavy. Consequently, interactive CDRG is best suited for route guidance on middle- or long-distance routes. For short journeys of only a few kilometres, LDRG or SRG will, in most cases, be more appropriate.
- d) By combining the Interactive CDRG with the LDRG or SRG function of the in-vehicle unit, the following system can be realized. From his point of departure until arrival at a major road, a driver uses either LDRG or SRG. Guided by interactive CDRG on the major road, the driver nears his destination where once again the system switches back to either LDRG or SRG and guides him through the local streets to his final destination.
- e) With vehicles not equipped with onboard map databases, without relying on LDRG or SRG, the driver must choose his or her own route. Arriving at a major road, the driver chooses his route according to Interactive CDRG using connecting network information. Overall, the same route guidance system operation as described above will be realized.

5 Message set — Contents and format

5.1 Comments on message set

The air interface message sets for the two systems, one based on DSRC and the other on cellular phone, are listed in two columns.