RECOMMENDATION ITU-R M.1310*

TRANSPORT INFORMATION AND CONTROL SYSTEMS (TICS) – OBJECTIVES AND REQUIREMENTS

(Question ITU-R 205/8)

(1997)

Summary

This Recommendation provides the radio requirements aspects of Transport Information and Control Systems (TICS). TICS are systems utilizing the combination of computers, communications, positioning, and automation technologies to improve the safety, management, and efficiency of terrestrial transportation systems.

The ITU Radiocommunication Assembly,

considering

a) that there is a need to integrate various technologies including radiocommunications into land transportation systems;

b) that many new land transport systems use intelligence in land vehicles coupled with advanced vehicle, advanced traffic management, advanced traveller information, advanced public transportation, and advanced fleet management systems, to improve traffic management;

c) that the Transport Information and Control Systems (TICS) are being planned and implemented in various regions by administrations;

d) that international standards would facilitate worldwide applications of TICS and provide for economies of scale in bringing TICS equipment and services to the public;

e) that early international harmonization of TICS would have several benefits;

f) that worldwide compatibility of TICS may be dependent on common radio spectrum allocations;

g) that the ISO is standardizing TICS (non-radio aspects) in ISO/TC204,

recommends

that TICS intended for regional and/or worldwide use should meet the following characteristics and objectives:

1 Elements of TICS

Based on major services identified to date, the elements of TICS for which RF links are the major communication method are identified in the following sections. For rural area applications, it might be necessary to adapt these technologies to meet their requirements.

* This Recommendation should be brought to the attention of the International Organization for Standardization (ISO) and the International Electrotechnical Commission (IEC).

1.1 Advanced vehicle control systems

Advanced vehicle control systems are oriented to complementing major portions of the driving task.

Elements	RF options
Longitudinal collision avoidance: helps to prevent head-on, rear-end or backing collision between vehicles, vehicles to objects or pedestrians.	Short-range radar, LCX
Lateral collision avoidance: helps prevent collisions when vehicles leave their lane of travel.	Short-range radar, LCX
Intersection collision avoidance: helps prevent collisions at intersections.	Short-range vehicle-to-vehicle, or to road side
Vision enhancement systems: improves drivers' ability to see the roadway and objects on or along the roadway.	Forward looking infrared (short-range radar)
Pre-crash restraint deployment: anticipates an imminent collision and activates passenger safety systems before the collision occurs earlier than is currently feasible.	Short-range radar
Automated road systems	Short-range vehicle-to-vehicle, short-range radar, LCX, DSRC
Safety readiness: provides warnings about the condition of the driver, the vehicle and the roadway.	Not RF based

LCX: Leaky Coaxial Cable is for auxiliary purposes; one-way or two-way

DSRC: Dedicated short-range communication.

1.2 Advanced traffic management systems

The purpose of which is to improve traffic flow and result in a more efficient use of the road systems.

Elements	RF options
Traffic network monitoring and control: manages the movement of traffic on streets and highways.	Microwave distribution, radar
Travel demand management: supports policies and regulations designed to mitigate the environmental and social impacts of traffic congestion.	Microwave, DSRC
Incident detection and management: helps public and private organizations quickly identify incidents and implement a response to minimize their effects on traffic.	Two-way mobile-to-base, LCX
Emissions testing and mitigation: provides information for monitoring air quality and developing air quality improvement strategies.	Microwave distribution
Parking management	Broadcast, two-way mobile-to-base, DSRC, LCX

1.3 Advanced traveller information systems

Advanced travel information systems are intended to assist travellers in trip planning and on route navigation and traffic conditions.

Elements	RF options
Pre-trip travel information: provides information for selecting the best transportation mode, departure time and route.	Broadcast, two-way mobile-to-base, LCX
En-route driver information: provides driver advisory and in-vehicle signing for convenience and safety during travel.	Broadcast, two-way mobile-to-base, DSRC, LCX
En-route transit information: provides information to travellers using public transportation after the start of the trip.	Broadcast, two-way mobile-to-base, DSRC, LCX
Route guidance: provides travellers with simple instruction on how to best reach their destinations.	Broadcast, two-way mobile-to-base, DSRC, LCX
Ride matching and reservation: makes ride sharing easier and more convenient.	Two-way mobile-to-base

1.4 Advanced public transportation systems

Designed to improve the efficiency of public transportation and make it more desirable by providing real-time scheduling and rider information.

Elements	RF options
Public transportation management: automates operations, planning and management functions of public transit systems.	Two-way mobile-to-base
Personalized public transportation: offers flexibly routed transit vehicles for more convenient service to customers.	Two-way mobile-to-base

1.5 Advanced fleet management systems

Intended to improve efficiency and productivity of commercial vehicle operations.

Elements	RF options
Vehicle administration: provides electronic purchasing of credentials and automated mileage and fuel reporting and auditing.	Two-way mobile-to-base
Safety monitoring and tracking: senses the safety status of a commercial vehicle, cargo and driver.	Two-way mobile-to-base, DSRC
Fleet management	Two-way mobile-to-base
Vehicle pre-clearance: facilitates domestic and international border clearance, minimizing stops.	DSRC
Automated roadside safety inspections: facilitates roadside inspections.	DSRC
Hazardous material incident response: provides immediate description of hazardous materials to emergency responders.	Two-way mobile-to-base

1.6 Emergency management systems

Designed to improve the response times for all emergency vehicles involving transportation and non-transportation related incidents.

Elements	RF options
Emergency notification and personal security: provides immediate notification of an incident and an immediate request for assistance.	Two-way mobile-to-base, LCX
Public travel security: creates secure environment for public transportation patrons and operators.	Two-way mobile-to-base
Emergency vehicle management: reduces the time it takes emergency vehicles to respond to an incident.	Two-way mobile-to-mobile, DSRC, two-way mobile-to base

1.7 Electronic payment services

Elements	RF options
Electronic payment services: allows travellers to pay for transportation services electronically.	Two-way mobile-to-base, DSRC

2 TICS radio service objectives

2.1 Radio services

The provision of all TICS functions will be most effectively achieved through the use of the following radio services:

– *Broadcast*: point-to-multipoint one way transmission.

– *DSRC*: one way or two-way short-range communications.

– *Short-range radar*:

  – Short-range vehicle-to-vehicle: short-range vehicle-to-vehicle communications;

  – Short-range continuous communications (e.g., LCX, etc.).

– *Wide area*: mobile two-way communications using networks of terrestrial base stations (e.g., cellular) or using satellites.

2.2 Service objectives

The ranges indicated below are intended for consideration only.

2.2.1 Broadcast

– Large coverage area including underground car park tunnels and rural areas.

– Data rate: 0-32 kbit/s

– Data integrity: less than one undetected message error per 100 messages

– Transmission latency (this term needs to be defined throughout for the purposes of this Recommendation): to be determined

– Reception form: stationary/mobile and stationary.

2.2.2 DSRC

– Small coverage area

– Data rate: 64 kbit/s to 2 Mbit/s

– Data integrity: less than one undetected message error per 100 messages to less than one detected message error per one million messages (ratio of undetected message error per one million messages should be negligibly small)

– Transmission latency: to be determined.

2.2.3 Short-range radar

– Small coverage area

– Range resolution: less than 3% of the detection distance or less than 1 m

– Velocity resolution: less than 3% of the vehicle speed or less than 1 km/h.

2.2.4 Short-range vehicle-to-vehicle

– Small coverage range: tens of metres

– Data rates: tens of kbit/s to several Mbit/s

– Data integrity: very high: low probability of undetected error

– Transmission latency: to be determined.

2.2.5 Short-range continuous

– Continuous coverage along the roadway

– Data rate: several tens of kbit/s to several Mbit/s

– Data integrity: very high: low probability of undetected error

– Transmission latency: to be determined.

2.2.6 Wide area

– Nearly ubiquitous coverage

– Data rate: up to 19.2 kbit/s

– Data integrity: medium

– Transmission latency: to be determined.

3 International standardization

For safety reasons international standardization is desirable in respect to the short-range vehicle-to-vehicle communications and any short-range radar employing cooperative techniques.

From a user's perspective, international standardization is highly desirable, at least on a region-wide basis, for the convenience of users moving across the region and for broadcast and short-range vehicle-to-roadside communications.

4 Interconnection requirements

The largest capacity will probably be required for the purpose of data collection from roadside sensors. Other services include control of signals and variable message signs, distribution of data between traffic authorities, service providers and fleet managers and for distribution of data to/from broadcast and roadside communications facilities. A mix of dedicated and switched connections are anticipated. Multipoint distribution will benefit from the use of packet mode communications.

5 Use of evolving mobile telecommunication services

It is expected that the evolving mobile telecommunication would be able to provide for many of the TICS services, particularly those requiring terrestrial, two-way, wide-area communications.