PUBLIC CALL FOR TENDER
PROJECT TEAM EXPERTS

for the execution of the work called for in the proposed Specific Agreement
SA/CEN/GROW/EFTA/546/2016-06

Location Referencing Harmonization

Introduction

Following the acceptance by the European Commission of a proposal from CEN, as prepared by the CEN/TC 278 Secretariat, funding is available for establishing two teams of paid experts.

Recruiting these experts has been delegated by the CEN Secretary General to the secretariat of CEN/TC 278, held by NEN.

Tasks of the project teams

One project team is tasked with the preparation of a CEN Technical Specification (TS) on Urban-ITS – Location Referencing Harmonization and the other project team with the Managing and coordinating Standardisation Request M/546.

Contractual details

The proposed Project plan is attached. The project plan describes in detail what is expected from the project team, the work plan and milestones and the expertise required for the execution of the task(s).

The experts selected will sign an Agreement with NEN. Applicants should be forewarned that the elapsed time between completion of the deliverables and NEN being in a position to issue the payment is at least five months. This will be partly overcome by the fact that CEN and the EC have agreed on the following payment steps:

- Step 0: Pre-financing (25 % of the total budget) - following signature of the Agreement with NEN
- Step 1: Interim payment[1] - subject to the approval of the interim report by the European Commission and EFTA
- Step 2: Final payment[2] - subject to the approval of the final report by the European Commission and EFTA

Selection procedure

Applicants will be selected by a selection committee, which is composed of:

- the Chair of CEN/TC 278 Intelligent transport systems
- the Convenor of CEN/TC 278/WG 17 Urban-ITS
- the Secretary of CEN/TC 278 Intelligent transport systems
- a representative from the CEN Central Management Centre

[1] Up to 75% of the total budget, reflecting the actual number of man-days spent.
[2] Up to 100% of the total budget, reflecting the actual number of man-days spent.

Experts will be selected ensuring an equal representation of sectors, countries and skills, as well as the expected 'chemistry' within the project team. Additionally the selection will be based on the principle of best value for money, considering the day rate of the expert and the number of days the expert requires to execute the work.

The report of the selection committee on the selection of the experts will be submitted for approval to the European Commission and EFTA prior to the contracting of the experts.

Application procedure

Applications should be submitted using the attached application form (word format) by **28-02-2017**. Applications received after the deadline will not be taken into consideration.

I am looking forward to receiving your application.

Yours sincerely,

Maarten Peelen
Secretary of CEN/TC 278

SA 2016-06
Location Referencing Harmonization

Project plan

1 CONTEXT

Two documents provide the context for this proposal:

(1) Standardisation Request to the European standardisation organisations as regards Intelligent Transport Systems (ITS) in urban areas. Ref Standardisation Request M/546 (Published February 2016).
(2) Recommendations of / / 1: Project Report: Intelligent transport systems: Standards and actions necessary to enable urban infrastructure coordination to support Urban-ITS. http://media.wix.com/ugd/a7dbd0_8cc42a2831df44f6a2e040f65036579c.pdf

This project proposal is made in the context of, and is part of, the CEN response to the first document and is designed to meet PT 1701 High Level Recommendation HLRa in the. second document

A	**1701- HLRa Location Referencing Harmonisation**

The task of PT1701 was to identify gaps and overlaps in ITS standards that may be needed by Urban Administrations to assist them to implement Urban-ITS. The PT was further charged to outreach into the Urban Administration community and EC Urban-ITS related projects community to identify the scope and issues relating to its work, and subsequently, to validate its interim findings. The project team itself comprised 11 persons comprising: Urban Administrations; practitioners and advisers to Urban Administrations; professional standards developers; ITS industry; automotive industry.

As part of its work, the PT created and examined 95 use cases for ITS deployment in the Traffic Management, Multimodal Information Systems and Urban Logistics domains. In addition more than140 projects/reports studied for relevance and content. These were used to create 103 interim recommendations for standards related activities that could usefully help to expedite the speedy deployment of Urban ITS.

These recommendations were included in the interim report produced by the PT in January 2016 and were used as the core of the extensive programme of outreach activities it carried out, contacting some 116 urban authority/related organisations. A list of outreach contacts can be found in Annex P of the Final Report of PT1701.

The interim findings were made available in and INTERIM report in January 2016 In the INTERIM version, 95 Use Cases were explored/examined and 103 interim recommendations made from these analyses to the priorities identified by Urban Administrations and other actors open workshop that was held on 11/12 February 2016, and as a result of the discussions at that meeting, and based on early feedback from Urban Administrations, the content of the Interim Report was extensively

revised, including a significant consolidation of the recommendations, and the summary report and executive summary significantly rewritten to focus on the issues as identified by the Urban Administrations.

The PT1701 final report referenced above consolidates the recommendations supported by outreach feedback and provides 8 high level recommendations for support under the CID Ref Standardisation Request M/546. This has been accepted by CEN TC 278, and, more significantly, by the European Commission, and represents the key recommendations for support under the mandate Ref Standardisation Request M/546.

One of the main findings from the work of PT1701 and highlighted in its final report is that there are a number of major gaps that will weaken the ability of Urban Administrations to implement Urban-ITS efficiently, and in some aspects, gaps may prevent its introduction unless faced and provided as a matter of urgency. There are, additionally, a number of highly desirable aspects that could much better assist Urban Administrations to implement Urban-ITS, and a number of aspects of lower priority that need to be addressed at some point in time.

Key issues identified by Urban Administrations as identified barriers to implementation of Urban ITS, where Standards are needed to remove/reduce the barrier to the implementation of Urban-ITS are identified as follows:

A. Awareness of what is available
B. Location referencing
C. Vendor lock-in
D. Standards for “New Modes” and “new measures
E. Data exchange/data management
F. Immaturity of some concepts

2 OBJECTIVES AND IMPACT

2.1 Objectives

Background
The objective of this study is to identify the standards and actions necessary to enable urban infrastructure coordination to support the deployment of Urban-ITS. In particular, the study will concentrate on what is relevant to the development of a Technical Specification to meet the recommendations of PT 1701 viv: High Level Recommendation HLRa:

Location referencing harmonisation
and
Urban-its standards development management

Preparation, submission, and subsequent oversight, coordination and management of TC 278 Project Proposal responses to the Standardisation Request M/546 Mandate (CID).

2.2 Relevance

In respect of specific services, harmonising location referencing has been a recurrent issue across different domains. Indeed, in outreach feedback, the need for this work attracted more than twice as many affirmations than any other PT1701 recommendation.

While CEN/TC 278/PT 1701 provided the pre-study identifying priority work to be supported under Standardisation Request M/546, the timescales in order to achieve completion within the timespan of the CID are tight. This will require coordination of the work to ensure seamless integration and interoperability of the results, avoid any duplication of effort, as well as requiring good oversight and leadership. As the first project submission in the series of responses, this Project Proposal also provides for resource to manage all the Urban-ITS initiative responses to Standardisation Request M/546 and provide co-ordination and oversight throughout the timespan of the CID.

2.2.1 Location referencing Harmonisation

2.2.2 1701- HLRa - Project team to develop Technical Specification regarding Provision of a real time continuous location referencing data for the Urban-ITS environment. The referencing system should allow for planned and real-time data.

This recommendation 1701-HLRa, Location Referencing, received significantly more support than any other proposal in PT1701.

Location information has been a requirement since before the digital era, and most of it was founded on the Victorian principal of the “look-up table”, and physical reference books and tables, and not related to actual physical position. But while some data is based on a latitude/longitude system (and there are multiple versions of such systems, others are based on the gazetteered reference to physical objects (for example bus stops or parking bays in a car park). Because gazetteered referencing is institutionally entrenched, and migration to a geo-referencing based on physical location may be protracted, we may expect to see the use of translators for some time to come.

An ITS deployment needs to draw data (for MIS, TM or UL purposes) from different modal systems, so that control systems for the various modes can interact to provide seamless services to the urban traveller, and to provide a location and time determination system that will work in the urban canyon and provide positioning and timing information in enclosed spaces.

See also (PT1701 Final Report, Sections E.4.3; F.3.1.2).

USE CASES: GEN-0001; ULG-0001; ULG-0002; MIS-0002; MIS-0005-1; MIS-0005-2; MIS-0007; MIS-0008; TM-0001; TM-0005; TM-0006.

The requirements for standard harmonisation comprise 2 recommendations, both concerning the harmonisation across modes of existing location referencing standards. This is a major issue with almost all application standards having their own location referencing methodology which inevitably are not in line with each other or the INSPIRE based standards. Although these recommendations originate from the MIS studies, they are considered generally applicable across the whole Urban-ITS domain.

Some of the recommendations overlapped with those in the other study areas, and these have been grouped together in this report, as ‘panoptic’ recommendations, (for example location referencing), while others are very specific to the traffic management domain, (for example configuration of traffic controllers).

For efficient multimodal information is essential to have access to:

a) Real-time data referring to
   I. public transport operation;
   II. traffic and road conditions;
b) Continuous and multimodal location referencing standards in urban areas;
c) Well known and if possible unique urban access point to data;
d) and highly desirable to conduct standardised data exchanges or APIs, using an up-to-date standardised data model.

A	**1701- HLRa Location referencing Harmonisation**		
		Rc_GN01	There is a need for a pan-European project to find a consensus solution for a combination of (probably existing) standards to avoid vendor lock-in for centre<>centre and centre<>field communications.
		Rc_GN02	To develop GDF 5.1 data model covering the connection between Transmodel and GDF and the corresponding data exchange format (G.4.11)
		Rc_GN12	Standard harmonisation: To develop a standard for continuous, multimodal and real-time location referencing in urban areas taking into account all existing standards. (G.4.12)
		Rc_SO03	ESO/OEC: It is recommended that Standards be developed for New elements to include in Local Dynamic Map related to a Car Park internal description including :Available spots locations; Evolution of MAP standard to describe different paths to reach a spot; Trajectory description to reach one specific spot And transmit it towards vehicles preferably by ITS-G5 or Wifi Hotspot. This work is probably best led by the DATEX standards community. (I.2.10.3.4)
		Rc_SM09	A functional translation algorithm is needed to bring together the various location referencing schemas employed by different, modes, activities and authorities in such a way that the data associated with those references can be shared to provide Urban-ITS services. A new or existing project is proposed to handle this issue. (E.4.3.5)
		Rc_Gn11	Develop standards for systems that are capable of determining the position of vehicles and travellers in the urban environment and inside structures and time in a reliable and accurate. (E.4.3.5)
		Rc_Gn12	Standard harmonisation: To develop a standard for continuous, multimodal and real-time location referencing in urban areas taking into account all existing standards. (G.4.12)
		Rc_MI30	New standard development To define a standard for data accuracy criteria and publication referring to space and time data. (G.4.6)

This is expressed in the PT1701 Final Report as:

A	**1701- HLRa Location referencing Harmonisation** Interoperable location referencing (all domains), mostly harmonization of multiple standards and sometimes need for new standard(s); intersections topology. Necessary for data exchange for ITS services (essential for planned and real-time data processing and information dissemination, and also for in-vehicle signage). USE CASES: ULG-0001; GEN-0001; ULG-0002; MIS-0002; MIS-0005; MIS-0005-1; MIS-0005-2; MIS-0007; MIS-0008; TM-0001; TM-0005; TM-0006	**Project Team** • Location Referencing for Urban-ITS to: • Collect technical and implementation details per method • Propose a translator (Rosetta stone) between methods • Write guideline for when to use which method (PT estimate 200 man days: Team of 3 est. €150k)

2.2.3 Location referencing

2.2.4 Introduction

Location referencing refers to relating the user or client device on a map. This map can be topographical in the case of a navigation system or logical in the case of a bus or tram system.
'Geographic Information Systems' (GIS), deal with information concerning phenomena associated with location relative to the Earth (ISO 19101); the hardware, software, people, and data used to capture, manage, analyse and display geospatial information for general geospatial, surfaces, and network analysis and visualization.
The GIS software and services market, excluding GNSS and remote sensing, totalled approximately $2.5 billion US dollars in 2014 and is expected to grow at around an 11% rate to above $4 billion in 2018.
Nearly all ITS applications need some form of location determination and referencing to put the data or information into a spatial context. The biggest problem is not so much this requirement, but that our legacy systems have undertaken this in different ways.
In data terms, for most systems, we need to know values and where the data was collected. For example, a loop detector is referenced to a particular point defined generally by a description of the road, the direction, the lane and a stated distance from a known reference point like a junction. Data from a moving probe vehicle will often be defined by XY coordinates based on an agreed location referencing systems such as WGS84. However, there are issues with location determination in the "urban canyon" or in enclosed spaces such as car parks or stations.
Public transport information is often referenced to a time related layer of (referenced and identified) routes and stops, but without the need to worry about where these routes and stops are in geographical space, i.e. without the need to reference to a particular point in space, just to a bus-stop reference invented and assigned locally. Location information for public transport elements like stop points, station layouts etc. is typically handled independently and with varying levels of coherence: some countries have national standards, others have local or regional databases.
Historically, applications in the transport sector have spawned location referencing systems that have properties that suit the application itself. However, this silo approach has resulted in a significant number of incompatible location referencing systems, inevitably within the same organisation.
A typical road authority may have 10 of more such different location referencing systems for traffic control, pavement management, detectors, asset management and content dissemination etc.; none of which are compatible or easily translated from one to another because of different business rules or definitions. An example of this is 'lanes'; is a long exit lane from a motorway counted as a running lane, and where does it start and end?
The same is true for applications in the ITS 'Traffic Information' domain, which has at least 5 location referencing systems. When proponents of a standard for a new application start, their main aim is to achieve a result within timescale and budget which leads to solutions that are not dependant on any systems outside of their application area; so concepts like data-registries and location referencing have traditionally been disregarded, or not even considered in the first place!
In public transport information services, location references – where they exist – are both inconsistent with location information on the infrastructure, and may be incoherent internally as well. For example, even where a bus stop is geo-located as a point in space, this is often unmatched with the road along which the bus will be travelling. Also, there is a logical divergence on whether the "stop" is the point that passengers should stand, of the point that the vehicle will stand. While this distinction will generally be of no significance for end users of itself, it makes multimodal information – for example, planning a walk-then-bus journey – more difficult and unreliable.

More generally, in the Urban-ITS context, multiple applications are suddenly required to cooperate. So, in a multimodal environment, the disparity between location referencing systems becomes a major issue.
The only solution is to first identify the characteristics of location referencing that can be 'application independent' and then evolve (a) a conversion strategy for the short term, and (b) a migration strategy for the long term; with constant pressure on budgets, this represents a major challenge.

2.2.4.1 The layers of a location referencing system

The synthesis of this is that there are 6 "layers" to a location referencing system. A multimodal urban traveller might need to reference (represented by the arrow) all of the layers to receive MIS.
This is shown in Figure 1.

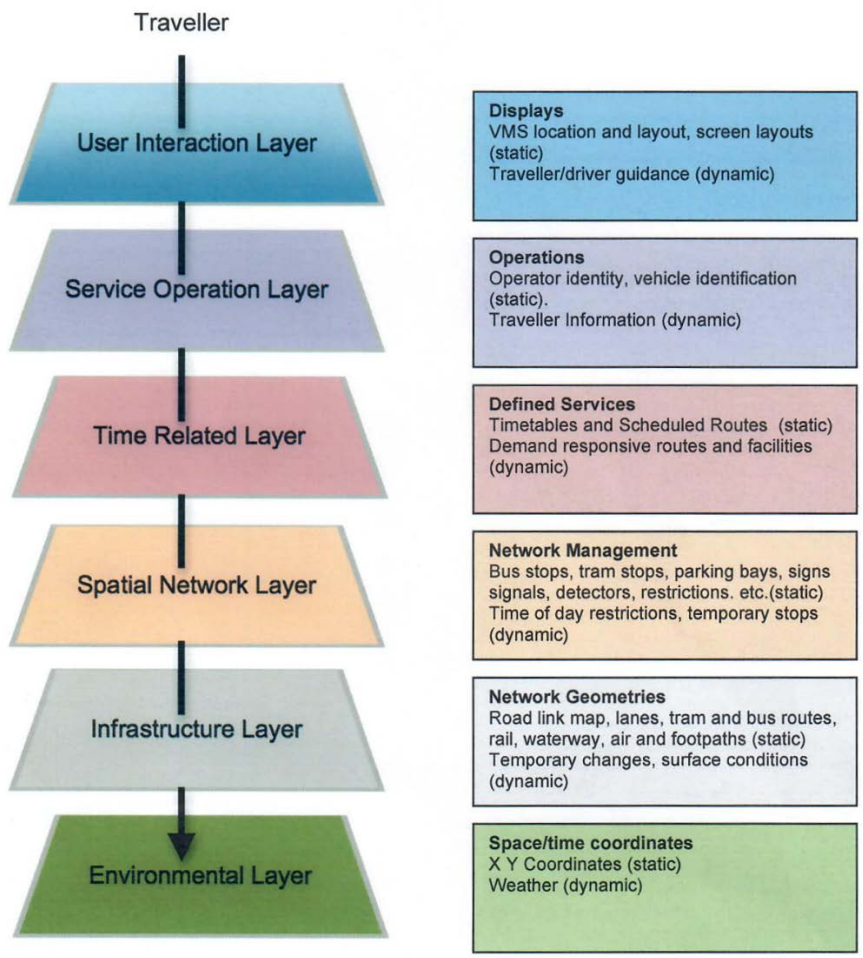


Figure 1 : The layers of an ITS ''Location Referencing" system

In order to make a truly 'Multimodal Information Service' available to the urban traveller, all these layers need to line up, so that, for example, the traveller knows where in the urban space the tram stop is, and the tram operator needs to see the routes compared with the routes of other transport modes.
Each of these layers has at least one set of standards, usually different between different transport modes. Some services need to access every layer, but some only a subset of all the layers.

The location determination method used in the majority of user devices generally relies on GNSS; however, whereas this has sufficient accuracy for most information based system, it will suffer from inaccuracy so that it will not be suitable for some C-ITS applications, or even stop working in the "urban canyon" where line of sight to a sufficient number of satellites will be significantly reduced. Additionally, there will be applications that will require location determination indoors (car parks and public transport stations) which cannot yet be satisfied by existing location determination systems.

2.2.4.2 What fits where?

Looking at the MIS value chain as an example, Table 1 shows each of the processes will access some but not all of the layers, which when the information is combined will make it impossible to combine to provide a true multimodal offering.

Table 1: An example of the correspondence of applications and layers in MIS.

	User Interaction	Service Operation	Time Related	Spatial Network	Infrastructure	Environmental
1.Planned Data Retrieval		✓	✓	✓		
2. Real-time Data Capture			✓	✓	✓	
3. Planned Data Processing		✓	✓	✓		
4. Real-time Data Processing				✓	✓	
5. Planned and real-time data combination		✓	✓	✓	✓	
6. Information Structuring	✓	✓	✓	✓	✓	✓
7. Information Dissemination	✓			✓	✓	✓

To take an example of data from road detectors entering the system; it is likely that the existing detector address will be proprietary to the UTC system; it is possible that there will be a reference to the infrastructure layer, but is unlikely to have any reference to environmental coordinates (WGS84) because the main purpose of its addressing historically has been simply to ensure that it provides data to the control algorithms for the road section.

2.2.4.3 What exists now?

2.2.4.3.1 Pre-coded location referencing (RDS-TMC)

In a pre-coded location referencing system an identifier is given to a set location. This could be a point location, a linear location, route location or an area. Generally, location references are related to each other in a contiguous fashion so that an event can be described by a primary location followed by an "extent" that describes how many locations are involved.
Pre-coded location referencing is used in RDS-TMC because of the low bandwidth of the RDS data stream. A location has to be coded into 16 bits giving 64k possible locations in any given location set. The advantage of this type of location coding is that it is simple, efficient and uniquely references a location where an event exists. The main disadvantages are that: it is limited to 64k locations (which is acceptable for inter-urban networks, but possibly limiting for urban networks); it relies on

synchronisation of editions between the originator of the message and the receiver; it is complex to update to add or remove new roads and intersections.
Pre-coded location referencing sits in the spatial network layer with direct linking to the Infrastructure and Environmental layers by way of location description and WGS84 coordinates. It is used by DATEX II as one of its location referencing methods.
Location code tables are maintained on a national level.
The standards for pre-coded referencing systems are ISO14819 – Part 3 and in ISO17572 Part 2 and when used in TPEG it is included as enhanced TMC coding and described in ISO 17572 Part 2.

2.2.4.3.2 On the Fly Location Referncing Systems (TPEG-loc)

"On-the-fly" location referencing is used where there are fewer limitations on bandwidth. The advantages are that there are no issues over synchronisation of location set editions between the originator of the message and the receiver. In an on-the-fly location referencing system an X-Y coordinate is used (in TPEG it is WGS84) to describe a point, or a pair of X-Y coordinates to describe a link. Unfortunately, a WGS84 point may not be sufficiently accurate to describe a point unambiguously. Examples of this are where a road runs parallel and close to another road or one road crosses another on an over-bridge; or in an urban sense where a canal, or tram track is between roads of the same name. This is overcome in TPEG-loc by the addition of an additional descriptor for the location (e.g. a road number and direction). In urban areas this might still not be sufficiently unambiguous due to the small differences in maps, so AGORA adds a series of descriptors, which describe the geometry of the roads surrounding the location to enable accurate map matching, rather than the end user device simply snapping to the nearest road. On-the-fly location referencing sits in the environmental layer with references to the Infrastructure layer.
Standards in the area are ISO TS 21219 parts 21, 22 and 23.
Other initiatives are underway. *Tomtom* (large vendor) is suggesting that its OPEN LR location referencing system (www.openlr.info) be used as an industry standard to be further developed by all. Open Location Referencing (LR) is an on-the-fly location referencing system and exits in the environmental layer.

2.2.4.3.3 Inspire

A major recent development has been the effect of the INSPIRE Directive in May 2007, establishing an infrastructure for spatial information in Europe to support community environmental policies, and policies or activities which may have an impact on the environment.
The INSPIRE directive (2007/2/EC) – implemented and amended under several Commission regulations) aims to create a European Union spatial data infrastructure. This will enable the sharing of environmental spatial information among public sector organisations and better facilitate public access to spatial information across Europe.
INSPIRE is based on the infrastructures for spatial information established and operated by the 28 Member States of the European Union. The Directive addresses 34 spatial data themes needed for environmental applications, with key components specified through technical implementing rules. This makes INSPIRE a unique example of a legislative "regional" approach.
To ensure that the spatial data infrastructures of the Member States are compatible and usable in a community and transboundary context, the Directive requires that common 'Implementing Rules' (IR) are adopted in a number of specific areas (metadata, data specifications, network services, data and service sharing and monitoring and reporting). These IRs are adopted as 'Commission Decisions' or 'Regulations', and are binding in their entirety. The Commission is assisted in the process of adopting such rules by a regulatory committee composed of representatives of the Member States and chaired by a representative of the Commission (revised Comitology procedure).

The INSPIRE specifications for network referencing and data definitions (Transport Networks) are out of alignment with those in common practice within the many highway administrations. INSPIRE is centred on ISO 19100 series standards. This series does have a definition of 'transport nodes'. A 'transport node' is a location that facilitates transfers between transport modes, transport networks and/or transport means. ISO 19147, Geographic information -- Transport nodes, which is limited to the transport of persons and the static getting-on and getting-off points, was published in 2015. Work on an additional standard for transport nodes for freight transport is expected.

2.2.4.3.4 ISO 1916 GML (Geography Markup Language)

GML (Geography Markup Language) is an XML dialect designed to describe and exchange geographical features, with possible business extensions through profiles and application schema. This allows the description of generic geographic data sets containing points, lines and polygons. It is also deigned to allow de definition of business specific application schemas that are specialized extensions of GML. Using application schemas, users can refer to roads, highways, and bridges instead of points, lines and polygons.
Clients and servers with interfaces that implement the OpenGIS® 'Web Feature Service Interface Standard '(see http://www.opengeospatial.org/standards/wfs) read and write GML data.
The project OPTICITIES provides a list of known, publicly accessible GML application schemas, selecting only those possibly related to domains:

- CityGML - a common information model and GML application schema for virtual 3D city / regional models. Direct link to the CityGML homepage.
- Coverages - an interoperable, encoding-neutral information model for the digital representation of spatio-temporally varying phenomena (such as sensor, image, model, and statistics data), based on the abstract model of ISO 19123
- INSPIRE application schemas, available on http://inspire.ec.europa.eu/schemas/
- LandGML - a GML implementation equivalent to LandXML
- OS MasterMap GML
- WXXM - Weather information exchange model

The standard in this area is ISO 19107:2003 Spatial schema and the OGC Simple Feature Common Architecture).

2.2.4.3.5 EN/ISO14825:2011 GDF (Geographic Data File)

GDF (Geographic Data Files) is a CEN-ISO standard designed to describe and transfer road networks and road-related data. Much more than a generic GIS standard, GDF provides a structured description of the road network and related data for in-vehicle or portable navigation systems, traffic management centres, or services linked with road management systems, including public transport systems.
Its primary use is for car navigation systems, but it can also be used in many other transport and traffic applications such as fleet management, dispatch management, traffic analysis, traffic management, and automatic vehicle location. Most recent extensions include information for pedestrian navigation, 3-D map rendering, and 'Advanced Driver Assistance Systems' (ADAS).
Data in GDF format are provided by many map vendors such as Navteq, TomTom, Mapscape BV, GeoSmart, Automotive Navigation Data, AutoNavi and NavInfo.
Despite the existence of the GDF standard, the nature of model abstractions, as well as semantic interpretations and proprietary content extensions lead to interoperability issues between GDF map

products from different vendors. In practice the GDF files are not fully interchangeable due to vendor specific extensions.
The standard in this area is EN/ISO14825:2011 Intelligent transport systems -- Geographic Data Files (GDF) -- GDF5.0

2.2.4.3.6 Transmodel

Transmodel includes a set of principles for geo-referencing, and derived standards (SIRI, NeTEx) build on this to provide a node-and-link based system where elements are related to the '*Service Operation', 'Time Related', 'Spatial Network' and 'Infrastructure' layers.* It is possible to link them with XY coordinates in the environmental layer.
(For a description of Transmodel see PT1701 Final Report D.2.3.25).

2.2.4.4 Where are the gaps in location referencing?

Two Use Cases have been constructed, one for location referencing and one for location determination:

CEN/TC 278/PT 1701 USE CASE TEMPLATE		
M	**Use Case Name**	**Urban-ITS Interoperable Location Referencing**
M	**Use Case reference /id**	**GEN-0001 v3 20151124**
M	Description	Provision of a real time continuous location referencing system for the Urban-ITS environment. The referencing system should allow for planned and real-time data.
M	Scenario	An ITS deployment needs to draw data (for MIS, TM or UL purposes) from different modal systems, possibly under the ownership and control of several different organisations. In order to be able to compare routes, vehicle positions and interchange locations/structures effectively, it needs a common location referencing system.
M	Scope	To be able to place planned and real-time data in a universal location referencing environment so that control systems for the various modes can interact to provide seamless services to the urban traveller.
M	Actors Involved	Public transport operators Traffic managers Trip planning service providers 'travel information provider's Car park operator Location referencing providers Location determination providers Freight shippers Other travel mode providers Road maintenance operators Geographic information providers
M	Stakeholders	EU and National governments Urban administrations Public transport authorities Road operators Travellers
M	MIS / TM / UL	MIS / TM / UL
M	Assumptions	That each element in the Urban-ITS chain is prepared to provide links to this universal location referencing system.

M	Identified standards (not exhaustive list)	ISO/EN 14819-3 Traffic and travel information (TTI) TTI messages via traffic message coding - part 3 location referencing for Radio Data System - Traffic Message Channel (RDS-TMC) using ALERT C . ISO/TS 21219 Intelligent transport systems - Traffic and travel information via transport protocol experts group, generation 2 (TPEG2) - part 21,22, 23. CEN/TS 16157-2 Intelligent transport systems — DATEX II data exchange specifications for traffic management and information — Part 2: Location referencing. ISO 17572-3 Intelligent transport systems (ITS) -- Location referencing for geographic databases – Parts 1,2 and 3. ISO 19147:2015 Geographic information -- Transfer Nodes. ISO/TS 1910XX Geographic information. ISO 14825 Intelligent transport systems -- Geographic Data Files (GDF) -- GDF5.0. Various Transmodel, SIRI and NeTEx – Locations. EN 12896 Transmodel v6- Part 1: Common Concepts (Location Model, Projection Model). TS16614-1; Network and Timetable Exchange — Part 1: Network Topology. CEN/ISO TS 19091, Intelligent Transport Systems - Cooperative-ITS - Using V2I and I2V Communications for Applications Related to Signalized Intersections (SPaT, MAP, SRM, SSM) . ETSI EN 302 637-1 Cooperative Awareness Message (CAM). ETSI EN 301 637 -2 Decentralised Environmental Notification Message (DENM).
M	Standardisation gaps identified	There is no shortage of standards in the location referencing arena, the problem is that many of the methodologies are not compatible. The gap here is to ensure that multiple systems can all describe locations in the urban setting in such a way that they can cooperate to provide ITS services.
	Recommended actions	Development of standards: refer to the list above. A functional translation algorithm is needed to bring together the various location referencing schemas employed by different, modes, activities and authorities in such a way that the data associated with those references can be shared to provide Urban-ITS services.
O	Other information	

CEN/TC 278/PT 1701 USE CASE TEMPLATE		
M	**Use Case Name**	**Urban-ITS Location and Time Determination**
M	**Use Case reference /id**	**GEN-0002 v3 20151124**
M	Description	Provision of a location and time determination system that will work in the urban canyon and provide positioning and timing information in enclosed spaces.
M	Scenario	ITS deployments generally need to determine the position of an ITS station to a high degree of accuracy and reliability within the urban area and within structures such as multi-storey car parks.
M	Scope	Satellite positioning systems work well in the inter-urban space where there is no shielding of satellites by trees or tall buildings. The positional accuracy is adequate for must travel applications with the exception positioning of autonomous vehicles. However, they do not work well in some urban environments where a reduced number of satellites in line of sight due to the shielding effects of tall buildings (the urban canyon). There will also be applications where positioning inside buildings such as multi-storey car parks requires location determination.
M	Actors Involved	Public transport operators Traffic managers

		Trip planning service providers 'travel information provider's Car park operators Location referencing providers Location determination providers Freight shippers Other travel mode providers Road maintenance operators Geographic information providers
M	Stakeholders	EU and National Governments Urban administrations Public transport Authorities Road Operators Travellers
M	MIS / TM / UL	MIS / TM / UL
M	Assumptions	That location determination systems are freely available.
M	Identified standards (not exhaustive list)	There are a number of standards in this area, most are for determination of the position of objects. These range for from the simple radio direction finder available since the 1950s through to systems that use a number of beacons inside buildings using tagged objects. ISO 19116 Geographic information -- Positioning services.
M	Standardisation gaps identified	Standards for systems that are capable of determining the position of vehicles and travellers in the urban environment and inside structures and time in a reliable and accurate way.
	Recommended actions	Development of standards: refer to the list above
O	Other information	

2.2.4.5 Future requirements

PT1701 Final Report Annex C.8 describes the scenarios for autonomous vehicles. In future the requirement for location referencing and determination will be of a far higher order of accuracy and reliability than for conventional Urban ITS applications. Presently a map in the Urban-ITS context only needs to provide data to an accuracy of about a metre; this is enough to describe lanes and other road features and to determine the position of stops in the public transport domain.

The maps required for an autonomous vehicle will have to be far more precise and accurate than location referencing and determination used today because it will need to continuously provide updated detailed information about the world to the car. It is likely that location determination will need to be in the 10s of mm and that objects/hazards on the route will also need to be described and to 10s of mm accuracy.

The map will change from a static asset to a dynamic asset which itself will need to be continuously updated as objects/hazards are not necessarily static. It is likely that the maps will be updated continuously in a cooperative manner from measurements taken from other vehicles.

2.2.4.6 Location referencing recommendations

Due to the nature of the silo development there are, for individual applications, no gaps, as the location referencing system has been designed to fulfil the needs of that application. The problems

come when one needs to combine the data and information from one application with that from another application, the coding and business rules will rule out a simple combination exercise. When combining applications and their associated data structures from applications that have been developed in silos, there are four options:

a) Do nothing and muddle along as before and not achieve full Urban-ITS integration;
b) Develop something new that encompasses all of the legacy applications;
c) Take an existing location referencing method and apply and adapt it across all the legacy applications; or
d) Develop a framework that can translate between different referencing systems as required.

The best practical option would be Option d) - a sort of Rosetta Stone. In a similar way to that which may be proposed for EU-ICIP, a strand could be developed that would tie in the location reference elements together within the parameters set in the INSPIRE framework (see http://inspire.ec.europa.eu/)

Rc_SM09- A functional translation algorithm is needed to bring together the various location referencing schemas employed by different, modes, activities and authorities in such a way that the data associated with those references can be shared to provide Urban-ITS services.

Rc_Gn11- Develop standards for systems that are capable of determining the position of vehicles and travellers in the urban environment and inside structures and time in a reliable and accurate.

Recommendation:

Rc_Gn12- *Standard harmonisation:* To develop a standard for continuous, multimodal and real-time location referencing in urban areas taking into account all existing standards.

2.2.4.6.1 HLR2 Outreach Feedback response

Rc_Gn01: 10% of outreach respondents supported this recommendation, one of which deemed it its highest priority.

Rc_Gn02: 5% of outreach respondents supported this recommendation.

Rc_Gn012: 42% of outreach respondents supported this recommendation, four of which deemed it their highest priority.

Rc_SM09: 3% of outreach respondents supported this recommendation.

Rc_SO03: One positive and one negative response.

Comments received:

a) Gn01: We do recognize the importance to establish a standard for centre to centre communication, but we are of the opinion that this is not a specific Urban ITS topic: the Datex II standard for the data model is already in place; a standard for “Platform independent model specifications for data exchange protocols” is under work in CEN TC 278/WG 8. This will be the basis for future standardized exchange protocols. Therefore we suggest participating to ongoing standardization activities rather than setting up a new PT specific for Urban ITS needs. We also

suggest taking a look at what has been done in the European Corridor project in this regard (e.g. the ECo-AT project in Austria).(2 identical comments from different respondents.

b) Hot topic !

c) I'm mostly interested in the topics EU-ICIP, meta-data registry, data model harmonisation and enhancement and harmonisation of location referencing methods. Actually, I intended to also mention some architectural topics, but they are all tied to FRAME and I'm not sure if this is a future-oriented approach.

d) Interoperable location referencing (all domains, mostly harmonization and sometimes need for a new standard: intersections topology). Necessary for data exchange for ITS services (essential for planned and real-time data processing and information dissemination, but also for in-vehicle signage).

e) GN12 These standards should be developed with emerging data standards for the Internet of Things in mind. We'd welcome delegations to the UK to become better informed of the emerging global HyperCAT standard, that a UK consortium of major industry partners such as Cisco and BT, have got behind. It is an open, interoperable and scalable architecture that would be ideal for this application.

f) Gn12/TM01/TM02/MI12/MI24/UL02 In all cases (TM, MI, & UL), and adapted to new modes as well.

g) GN11 GN12 That's probably an ambitious challenge. It's definitively linked to reference data model for network topology. That's particularity true of FCD data, which can hardly be re-mapped to existing referential, without the use of complex algorithms proprietary of a few actors from the geographic sector market.

h) All DATEXII recommendations are important to our organisation. So also Rc_SO02, Rc_SO03- are applicable, however, not with the same urgency as Tm01 and 02, because of the different Use Cases.

i) As a data handler and broker, seamless data exchange and location referencing are within the applicable domains the two most important issues for NDW. In the future, when we also might handle PT data, all recommendations concerning seamless data exchange and location referencing in these area's (MIS) might become very important as well. So, our here stated judgement is from a quite narrow perspective.

j) Interoperable location referencing (intersections geography and topology). Essential for planned and real-time data processing and information dissemination, but also for in-vehicle C-ITS services).

k) Similarly, location referencing is a fundamental building block.

l) Location Referencing The experience of the TN-ITS protocol in implementing the INSPIRE linear referencing should be taken into account. More countries are in the process of adopting the same exchange mechanisms between road authorities and commercial navigation system providers (see CEF project EU-ITS Platform) and TN-ITS WG1 on location referencing, as well as the INSPIRE Thematic Cluster on Transport networks. Moreover, the various recommendations on location referencing appear to overlap significantly and should perhaps be combined into a single recommendation.

m) The recommendation to develop an EU delivery vehicle real time mapping/route optimisation matrix is interesting and raises a number of questions: a) this is at the heart of commercial logistics. Why should the Commission get involved? b) what would such a 'matrix' contain? INSPIRE would be relevant; (c) there will be numerous other similar real time mapping / optimisation applications as well. (d) the difference could be in 'door-to-door' deliveries where at an urban level you need to have good information on buildings, entrances to sites, delivery points, reception locations etc. (INSPIRE would be relevant, as well as much improved data on the part of public administrations).

n) We support the findings of the report in concluding that an EU wide referencing stardust for geo-location is required. The ability to standardise spatial references down to site and even equipment level would simplify the migration of data between C-ITS and similar systems by ensuring compatible data structures. As above, this would increase the opportunities for building C-ITS systems from different manufacturer's components and Urban Administrations andsimplify competition.

2.2.4.6.2 HLR2 PT1701 conclusion

This subject obtained the highest number of positive responses, including 5 responses indicating that it was their highest priority. This recommendation attracted a high level of support from both Urban Administrations and advisors. The findings of the outreach meeting and HLR2 proposal is therefore confirmed as a priority, indeed, probably the highest priority of all of the recommendations.

However, it is to be clear that the objective is to best use, harmonise, provide translate existing LR systems, not to invent yet another.

Becomes **1701-HLRa** in final report.

2.2.5 Urban-ITS Project Management

This aspect of the project covers the coordination and cohesion of Urban-ITS standardisation by CEN/TC 278 during the span of the Standardisation Request M/546 mandate.

The project management role will provide and vet project submissions, and subsequently coordinate projects under and associated with Standardisation support projects under Standardisation Request M/546 related support, to ensure that they are complementary and do not overlap; can cross access experts between projects, and are progress chased within the TC 278 processes to ensure on-time delivery and performance to the stringent timeline requirements required for support under Standardisation Request M/546. The support will include liaising/meeting with DG MOVE as required.

This aspect of the project will provide regular management reports to WG 17; bi-annual reports to the TC 278 plenary; and biannual reports to ITS-SG/DG MOVE. At the close of the project, these progress reports and an overview progress and achievement report will be provided in the form of a Technical Report to TC 278/EC DG MOVE.

This project aspect is included in this project proposal, being the first of a series of project proposals for support under Standardisation Request M/546, in accordance with the recommendations of the PT1701 Project Team

2.3 Indicators

	Target	**Minimum**
Effectiveness		
Project progress in relation to the schedule specified in this proposal	In time	In time

Stakeholder Engagement		
The PT1701 Recommendations were developed as a result of • Phase 1: Expert study and outreach to known subject area experts/practitioners. • Phase 2: Outreach feedback to proposed recommendations, especially from Urban Administrations • Phase 3 consolidation, association and amalgamation See PT1701 Final report http://media.wix.com/ugd/a7dbd0_8cc42a2831df44f6a2e040f65036579c.pdf Outreach feedback that shaped the PT1701 final deliverable came from 116 urban authority/related outreach direct contacts	CEN/TC 278, ISO/TC 204 ISO/ TC 211 ETSI – ITS POLIS TISA DATEX II	Minimum from 3 different stakeholder groups.
The modus operandi of CEN, based upon a network of national standardisation bodies, is geared towards involving all parties concerned		
Dissemination results		
Provide project overview on CEN/TC 278 website: www.TC 278.eu	Project overview + updates	Project overview
The deliverable will be disseminated to the CEN/TC 278 members at three occasions (Working Draft, TC review and Formal Vote) and at WG level more frequently. Participation in TC 278 and at WG level is open to any interested party.	3	2

2.4 Impact

The project will assist Urban Administrations to:

- Progress harmonisation and migration paths for location referencing data, to assist Urban Administrations to implement Urban-ITS.
- The project will assist TC 278 and EC DG MOVE to coordinate and manage projects submitted under Standardisation Request M/546.

2.5 SMEs, consumer organization and environmental and societal stakeholder representation (Art.17(4) (b) of standardization regulation No 1025/2012) example– Annex III organisations (ECOS, ETUI, ANEC, SBS)

The modus operandi of CEN, based upon a network of national standardisation bodies, is geared towards involving all parties concerned, including SMEs and societal stakeholders.

The following European stakeholder organizations are member of CEN/TC 278

- ANEC, the European Consumer Voice in Standardization
- ECOS, the European Environmental Citizens Organisation for Standardisation
- SBS, Small Business Standards

As member of CEN/TC 278 they can participate in CEN/TC 278 and its Working Groups and have access to all CEN/TC 278 documents.

3 DESCRIPTION OF THE TASKS

3.1 Introduction

The tasks for this PT will be (in respect of Location Referencing Harmonisation) to:

- Collect technical and implementation details per method
- Propose a translator (Rosetta stone) between methods
- Write guideline for when to use which method
- Develop into a Technical Specification

3.2 Scope

Development of CEN Technical Specification.

Intelligent Transport Systems – Urban-ITS – Location Referencing Harmonisation

The scope of this project is not to develop yet another location referencing system standard or to combine them all in into one massive gazetteer.

Whereas the INSPIRE project proposes standards to be used in all applications (not just transport) in the future development of services; the urban authorities already live with a multitude of legacy location referencing systems, all tailored to the needs of the applications they serve. Indeed, some of these location referencing systems are provided by vendors of complete systems and so the authority is locked into the vendor's offering and hence cannot, at a realistic cost, replace the location referencing schemas.

A practical approach is thus needed to support the Urban Authorities in bringing together the data from their different applications (bus, tram, parking, UTC, etc. so that the information can be used to form a truly integrated Urban-ITS offering to their citizens.

This project will undertake a comprehensive survey of location referencing methodologies across all areas of the transport authorities representative across Europe. The results of this survey will be to produce a concise guide to all of the location referencing systems in use and will serve to give the urban authorities the confidence they need to start the process of integrating their data.

The next part of the study will be to propose methodologies to translate between different location referencing systems used within an urban authority. It is unlikely that an universal translator will be possible, but a toolkit for building systems that allow the integration of data from difference modes and disciplines within the urban environment. This toolkit will have to allow for the characteristics in each of the layers of the location stack described in section 2.1.3.2. Examples of these characteristics are point vs. linear and area referencing; actual vs. logical and route data etc.. To reemphasize, this activity will not propose yet another location referencing standard or a one size fits all approach, but practical assistance to the Urban Authority to build confidence and hence promote Urban-ITS.

The outputs will be:

- A summary of the background and existence of the multitude of location referencing systems used by Urban Administrations backed up by a database of occurrences of location

referencing schemas. (a little like the *Dummy's Guide* to xxx) (as an Annex to the TS, or perhaps a separate TR).

- A Technical Specification that will detail a toolkit for building translators/concentrators between the profiles of location referencing system used in a particular Urban Authority.

3.3 Work plan & Milestones

The work plan is as follows:

0	Signature of contract between CEN and the EC	Start (s)
1	Consultation or Public Call for tender and signed contract to start work	S+3
2	Kick-off meeting & Work plan for the Project Team	S+5
3	Draft TS (TS Location Referencing Harmonisation) for TC review	S+17
4	**End of TC review (Interim report)**	**S+19**
5	Final draft (TS Location Referencing Harmonisation) ready for Formal Vote (FV)	S+22
6	Start FV in TC 278:	S+25
7	End FV/Approval deliverables	S+29
8	Publication of TS deliverable by CMCC (CEN stage code 60.60) Urban-ITS Project Management Technical Report to TC Ballot	S+30
	Final Report	**S+32**

3.4 Deliverables

3.4.1 Interim report (S + 19 months)

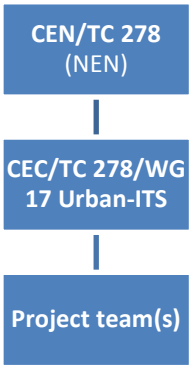
An interim report in the form of a progress report describing the work performed so far and a first draft of the deliverables. Delivered at the stage that the first working draft is available.

3.4.2 Final report (S + 32 Months)

A final report for all tasks containing the reference of the TS published (CEN stage code 60.60).

4 Execution of the different tasks

4.1 Organisation & relationship (TC, WGs, project team, NSBs, subcontracting,..).



The work plan of the Project Team will be aligned with the standardisation process in CEN. The Project Team will co-ordinate the time schedule with the timing of TC 278/WG 17 Urban-ITS and provide deliverables in due time before their meetings. The work plan of the Project Team will give room for the given commenting and voting process within TC 278.

Regular status reports will be provided to WG 17 for information and seeking assistance on issues where required. The Project Team will consider and take due account of inputs from the members of WG 17.

The Urban-ITS Project Management team will provide twice yearly reports to CEN/TC 278 plenary and ITSSG.

4.2 Subcontracting to external organizations

4.2.1 Motivation for hiring experts

The drafting of the documents requires specialized expertise which is not available to standardization managers as permanently employed by CEN and its member NEN. This is the justification for the Commission financial support.

To employ such specialized experts by a CEN member would be expensive and not economically viable considering the very specific area of specialization that is required for the execution of this contract. To engage the services of the appropriate specialist experts from the market is more cost-effective. This sub-contracting also enables the quick availability of the drafts to enter the consensus building and validation processes, which are CEN's core business.

The management and administration of the consensus building and validation process with the aim to publish the end results as a standards deliverable is the responsibility of the CEN National Standards Body, in this case NEN.

CEN has a standard methodology to select specialized experts for a so called Project Teams. Project Team experts are selected via a consultation or Public Call for tender. A balanced composition of the different stakeholders (e.g. in terms of expertise) is preferred.

For the Project Teams in relation to this Grant, experts should have specific expertise and knowledge, which will be the main criterion for their selection and which is described in detail below.

4.2.2 Expertise required

4.2.2.1 Project Size and Composition

The project comprises 2 teams:

- TEAM LR: Location Referencing Harmonisation: 4 Experts: LR1; LR2; LR3: LR4
- TEAM M: Urban-ITS Project Management: 2 Experts: M1; M2

4.2.2.2 TEAM LR: Location Referencing Harmonisation

Expert LR 1: Traveller information expert / Project Team leader	
Description	*Requirements*

The PT leader is responsible for the formal reporting to NEN, for moderating the work in the PT in order to achieve reasonable consensus inside the PT, and act as the interface to the 'parent body' CEN/ TC 278/WG 17 and liaises with other external groups. — project management (timeframe, indicators etc.); — organise and manage the project team, — organize and chair physical and e-meetings. — responsible for initiation, management, development and coordination of deliverable Meet with at least 10 UAs (in addition to those represented by other experts in the PT) Attending and liaising with external LR sources on 1-2 occasions to ensure work and deliverable is in line with their needs. Lead and guide the work to propose a translator (Rosetta stone) between methods and write a guideline for when to use which method. Plus full role as Lead expert and team member responsible for developing of Traveller Information Services aspects of the project (Interoperable location referencing (all domains), mostly harmonization of multiple standards and sometimes need for new standard(s); intersections topology. Necessary for data exchange for ITS services (essential for planned and real-time data processing and information dissemination, and also for in-vehicle signage.), Responsible for originating and leading specifications in respect of Traveller information aspects of project and co working with other PT members to develop and revise the deliverable over the duration of the project.	ISO/TC 204/WG 10; CEN/TC 278/WG4; Standardisation Team experience (preferably standardisation team leadership expertise). Good working knowledge of location referencing. Awareness of location reference (LR) sources, and familiarity with LR results and conclusions of CEN/TC 278/ PT 1701 in respect of LR. A proven track record of practical implementation and operation of services is essential (rather than specific expertise in the development of location referencing and mapping.)
Expert LR 2: TM Location Referencing Expert	
Description	*Requirements*
Lead expert in respect of Input and liaison for Traffic Management (TM) and Route Guidance (RG) aspects.	Experience and knowledge of OCA/UTMC practices; Knowledge of TC 278 Standardisation in respect of Traffic Management and location referencing. Awareness of TM LR practices and sources, and commercial GNSS LR products, and familiarity with TM results and conclusions of CEN/TC 278/PT 1701.
Expert LR 3: Public Transport Location Referencing Expert	
Description	*Requirements*
Lead expert in respect of input and liaison for Public Transport routing and information guidance aspects. The person must have an awareness and good working knowledge of Public Transport and Multimodal Information Systems (MIS) LR practices and sources, plus familiarity with PT/MIS results and conclusions of CEN/TC 278/PT 1701.	Experience and knowledge of LR aspects used by Transmodel/NeTEx/IFOPT/SIRI; Knowledge of TC 278 Standardisation in respect of Public Transport and location referencing. Awareness of PT LR practices and sources, and familiarity with PT/MIS results and conclusions of CEN/TC 278/PT 1701.
Expert LR 4: Location Referencing Expert	
Description	*Requirements*
Lead expert in respect of Urban Administration generalised use of location referencing.	Experience working for and within an Urban Administration with practical experience of

	common sense practice. Experience of use of databanks that include LR components.

The role 'Editor' is ideally carried out by one of the above mentioned experts.

Editor LR	
Description	*Requirements*
Responsible for the editing of the deliverable(s) in accordance with the CEN editing rules. The document is expected to be in the region of 150 – 250 pages.	Knowledge of CEN deliverables editing rules, structure and procedures. MS WORD & MS OFFICE Apps

4.2.2.3 TEAM M: Urban-ITS management

Expert M 1: Team manager	
Description	*Requirements*
Lead management and coordination of submissions, coordination, reporting and oversight of TC 278 projects submitted under Standardisation Request M/546.	— Strong knowledge of/familiarity with PT1701 Project report — General project management and communication skills: o Communication of a highly technical content to stakeholders o Proficiency to specify standards requirements in written form o Project management o Team working skills o Consensus building skills — 2.5 days month over 3 year span of M/546
Expert M 2: Team Administrator	
Description	*Requirements*
Administration, co-ordination, project preparation and submission and subsequent report preparation, administration and submission of TC 278 projects submitted in response to Standardisation Request M/546 and the PT1701 prestudy.	— Strong knowledge of/familiarity with PT1701 Project report — Knowledge of and experience in applying CEN's and ISO's internal regulations and working methods — 3.3 days month over 3 year span of M/546

4.2.3 Travel requirement

The travel budget will be part of the man-day tariff.

4.2.3.1 TEAM LR: Location Referencing Harmonisation

The project leader will assume key lead responsibility for liaison between the many parties involved in providing location referencing. This will involve travel to their meetings.

Most work can be undertaken by skype/gotomeeting, but a number of face to face meetings will be required (to be agreed by project leader with team).

4.2.3.2 TEAM M: Urban-ITS management

The Urban-ITS Project Management will coordinate on a weekly basis throughout the three-year span of the project. Meetings for WG 17, TC and other Urban-ITS will occur regularly and so no separate formal physical meetings are scheduled for this sub-group activity. However, the activity will require Urban-ITS Project Management to attend all TC 278 Plenary, WG 17 and ITSCG meetings; coordinate with DG MOVE/DG GROW/DG CONNECT, and potentially outreach to EC/US harmonisation groups and other outreach such as ITS Congress.