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Title **A 2.3 METHODOLOGY of „Key meanings and bilingual messages in VMS“ (Task 2.3 of WP 2 „Implementation scenarios and concepts toward self-explaining road environments“)**

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Summary Verbal representations (in the form of terms, facts, statements, indications, requests, demands etc.) can occur in combination with or in addition to or independently from traffic signs. Of a total sample of about 40 traffic signs the verbal representations were recorded in all languages of the project together with graphical information and analysed in line with ISO/TC 37 standards

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Report

A 2.3 METHODOLOGY

of

„Key meanings and bilingual messages in VMS“ (Task 2.3)

(WP 2 „Implementation scenarios and concepts toward self-explaining road environments“)

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A 2.3 METHODOLOGY

0 A2.3 in the IN-SAFETY Technical Annex

Hereunder the part of the IN-SAFETY Technical Annex referring to Task A2.3 is copied for reference. It has, however, to be taken into account that on the basis of studies and developments over the last months minor aspects of the original conception may need to be modified.

A2.3 Key meanings and bilingual messages in VMS (Leader: Infoterm)

Verbal representations (in the form of terms, facts, statements, indications, requests, demands etc.) can occur in combination with or in addition to or independently from traffic signs. If a total sample of about 40 traffic signs is selected, the number of verbal representations may amount to about 50. All verbal representations (i.e. text messages in static traffic signs and identified variable message signs – including variants in the same language) of the same meaning will be recorded in one record each in all languages of the project (i.e. all official EU working languages and the national languages of the new member states – which includes Germanic, Romance, Slavic languages and Greek with the respective character sets). In addition to the linguistic information graphical information will be recorded in all cases where applicable. If no equivalent exists in a given language, translations will be proposed – duly taking into account state-of-the-art localization methods and intercultural aspects. These data will be recorded and maintained in a state-of-the-art terminology management system (TMS) adapted for this purpose.

This system will follow the stipulations of the ISO standards (or standards in preparation; s. Appendix to Annex 2):

- ISO/PWI 12620-1*** Computer applications in terminology – Data categories – Part 1: Model for description and procedures for maintenance of data category registries for language resources
- ISO 12620-2*** Computer applications in terminology – Data categories – Part 2: Terminological data categories
- ISO 16642:2004*** Computer applications in terminology – Terminology Markup Framework (TMF)

Furthermore the results of the SALT project (Standards-based Access service to multilingual Lexicons and Terminologies, http://www.loria.fr/projets/SALT) will be taken into account.

***In the period from the initial proposal to the start of the project nearly a couple years elapsed, during which time standardization activities in ISO/TC 37 “Terminology and other language and content resources” advanced considerably and coordination activities between ISO/TC 37 on the one side and JTC 1/SC 32 “Data management and interchange“ (especially WG 2 “Metadata”) and ISO/TC 184/SC 4 “Industrial data” as well as Workshop CEN/ISSS/eCAT “Multilingual eCataloguing and eClassification in eBusiness” on the other side developed particularly with respect to data modelling methodology, which opened new horizons. Therefore, many more standards have been taken into account in this Report. (see References)

The linguistic data (in or without combination with graphical signs) will be analyzed, evaluated from linguistic and other points of view – considering also the future necessities of car navigation systems.

In this way consistency and coherence of expressions within same and between similar records will be checked, and - whenever necessary - proposals for improvement made. All these data will be put together in one table per language for usability testing. Taking into account existing usability testing methods and procedures as well as databases of subjects for testing usability in the automotive industry and the pertinent technical testing institutions of the countries of the project, interview partners (sampled according to gender, age groups, professions etc.) will be provided with (preferably multiple choice MS EXCEL-based) questionnaires and interviewed by telephone (whenever necessary).

The results of the interviews will be gathered, evaluated and interpreted. In certain cases clear proposals will be made to regulating authorities for harmonization or legal implementation (where applicable).

Also, due to the restricted space on VMS the presentation of information in two or more languages is problematic. Furthermore VMSes are most often applied on Highways on which travellers pass the signs with high speed, which limits the amount of words perceivable per sign. On the other hand VMSes offer the opportunity of displaying verbal information in different languages. Recent research on the acceptance of VMS displaying bilingual messages in a sequential way done by the Finnish National Road Administration (Finnra) indicates that further research on the display of bi- respectively multilingual messages should be undertaken.

Within this activity it will be examined on the basis of existing research or investigations whether the serial (by turns) or parallel display of bilingual messages on VMS yields better comprehension. Questionnaires for relevant government departments, organisations, producers and managers in the EU member states will be drafted. Relevant research results will be collected from various countries (e.g. Ireland, Spain, Finland, United Kingdom). Nationally used bilingual traffic signs and bilingual Variable Message Signs VMS and the relevant national regulations will be also reviewed.

The work will result in proposals of guidelines for the parallel and serial display of bilingual text messages, which will be evaluated by CDV and KTI.

This Methodology refers to the first part of Task A2.3.
Task A2.3 strongly depends upon the input from Task A2.2.

1 Theoretical foundation and basic concepts

This chapter tries to show that semantic data modelling (both in the meaning of human communication semantics and formal semantics of computer science) can be driven to a more generic data model, which allows to cover any kind of structured content – including the messages on and meanings of traffic signs – at the level of lexical semantics to be processed in a harmonized way. This generic data model would seamlessly interface with data models in product data management (e.g. for traffic signs regarded as physical products, which have to be technically described, produced, traded, etc.) and other areas of content management.

1.1 Terms related to science theory and methodology	IN-SAFETY relevance
meaning (definition:) set of thoughts that people take ***symbols*** to have NOTE 1: Meanings can do many things, such as: • provoke a certain *idea*, or • denote a certain *real-world entity*. NOTE 2: Meanings can be presented through various different mediums (vehicles of communication): • *linguistic means* (i.e. verbally expressed) and • *non-linguistic means* (i.e. non-verbally expressed) perception/thinking ←→ communication ←→ representation of meaning by signs/symbols • relate to different "systems" in the human brain • many fields of studies – from humanities and life sciences to technology and brain research – are studying the phenomena related to perception, thinking and communication via "representations".	In IN-SAFETY several fields of science have to converge and arrive at joint solutions to problems arising from different ***presentations of meaning***: - on large panels - on smallest screens - by voice or other acoustic means - by haptic means - via multimedia means communicating meaning to the driver (or to the car acting on behalf of the driver)
semiotics; semiology (definition:) the study of ***signs***, both individually and grouped in sign systems, and includes the study of how ***meaning*** is transmitted (***communicated***) and ***understood*** NOTE 1: Semioticians classify signs and sign systems in relation to the way they are transmitted=*communicated* (see ***modality***): *verbal (linguistic)* and *non-verbal (non-linguistic)* NOTE 2: The process of carrying meaning depends on the use of (pragmatic) *codes* that may be the individual noises or letters that humans use to form words, the body movements they make to show attitude or emotion, or even something as general as the clothes people wear. NOTE 3: Semiotics is commonly sub-divided into the mutually overlapping fields of *syntax*, *semantics* and *pragmatics*, whereby these fields are characterised by the relations between signs, the meaning of signs and the users of signs in a given situation.	***Meaning*** is transmitted by ***signs*** through ***communication*** and must be ***understood*** (otherwise meaning becomes meaningless) ➔the driver (or the car acting on behalf of the driver) must ***understand*** the ***meaning*** of the ***signs*** ➔there are "constraints" on top of the signs: s. ***pragmatics***
[interhuman] **communication** (definition:) process of exchanging information, usually via a common system of symbols [by transferring *meaning*/information/data from a *source*	In ***traffic telematics*** both kinds of communication:

(addresser) to a *receiver* (addressee) *as efficiently and effectively as possible*] NOTE 1: ***Communication studies*** is the academic discipline focused on communication forms, processes and meanings, including speech, interpersonal and organizational communication NOTE 2: There is a necessary overlap between semiotics and communication; both disciplines also recognise that the technical process cannot be separated from the fact that the receiver must *decode the data*, i.e. be able to distinguish the *data as salient* and *make meaning* out of it. NOTE 3: ***Telecommunication*** refers to communication over (long?) distances. It covers all forms of distance and/or conversion of the original communications, including radio, telegraphy, television, telephony, data communication and computer networking. In practice, *something of the message may be lost in the process*.	***interhuman communication*** and ***technical telecommunication*** enter into a close relationship
pragmatics (sub-field of linguistics) (definition:) generally the study of natural language ***understanding***, and specifically the study of how context influences the ***interpretation of meanings*** NOTE 1: ***Context*** here must be interpreted as situation as it may include any imaginable extra-linguistic factor, including [cultural], social, environmental, and psychological factors. NOTE 2: in the narrower meaning of textual environment of syntactic entities in written text (e.g. in text linguistics) context is also called ***co-text***	In traffic telematics the situation of the driver consists of (a) the ***driver's cultural context*** and (b) the ***traffic context*** (e.g. in a foreign country); the driver is also faced with the ***co-text in or between traffic signs*** appearing as variations, which have to be taken into account in the data models and meta-models developed for EU-wide VMS data modelling
semantics (linguistics) (definition:) the study of the ways in which words, phrases, and sentences can have ***meaning*** NOTE 1: Semantics usually divides words into their sense and reference. NOTE 2: ***Formal semantics*** is also a sub-field of computer science. *Both fields have a common origin in the studies of Alfred Tarski, Richard Montague, Alonzo Church and others.*	In the context of IN-SAFETY the ***linguistic concept of semantics has to be extended*** to comprise also non-verbal representations on traffic signs in general and on VMS in particular
formal semantics (computer science) (definition:) the field concerned with the rigorous mathematical study of the meaning of programming languages and models of computation NOTE 1: The formal semantics of a language is given by a mathematical model to represent the possible computations described by the language. NOTE 2: ***Formal semantics*** is also a sub-field of linguistics.	In the context of IN-SAFETY the semantics approaches of computer science and linguistics have to be made inter-operable, since meaning

	is communicated through technology to the driver (or to the car acting on behalf of the driver), which has an impact on human reactions (or triggers car reactions) having an impact on human life
syntax (linguistics) (definition:) the study of the rules, or "patterned relations" that govern the way the words in a sentence come together NOTE 1: It concerns how different words are combined into clauses, which, in turn, are combined into sentences. NOTE 2: Most formal theories of syntax offer explanations of the systematic relationships between *syntactic form* and *semantic meaning*.	In the context of IN-SAFETY the ***linguistic concept of syntax has to be extended*** to comprise also non-verbal representations on traffic signs in general and on VMS in particular
syntax (computer science) (definition:) (especially in the subfield of programming languages) the set of allowed reserved words and their parameters and the correct word order in the expression NOTE 1: This application of the word can apply to natural languages as well, e.g. through Latin's inflectional case endings. NOTE 2: In computer languages, syntax can be extremely rigid, as in the case of most assembler languages, or less rigid, as in languages that make use of "keyword" parameters that can be stated in any order.	In the context of IN-SAFETY the syntax approaches of computer science and linguistics have to be made inter-operable, since meaning is communicated by technology to the driver (or to the car acting on behalf of the driver), which has an impact on human reactions (or triggers car reactions) having an impact on human life
Theoretical linguistics can be subdivided into: • Phonetics • Phonology • Morphology	In IN-SAFETY linguistic phonetics and phonology are of high relevance to ***in-vehicle spoken representation*** of verbal messages In IN-SAFETY ***morphology has to be extended*** to comprise also non-verbal representations on traffic signs in general and in VMS messages

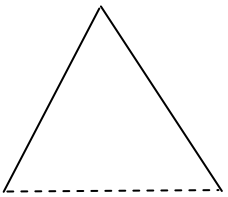
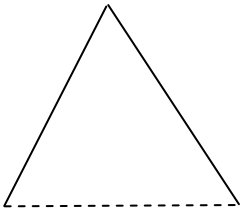
• Syntax
• Semantics
  o Lexical semantics
  o Structural semantics
  o Prototype semantics
• Stylistics
  o Prescription
• Pragmatics
	in particular
	In IN-SAFETY the ***linguistic concepts of syntax and semantics have to be***
	(a) extended to comprise also non-verbal representations on traffic signs in general and on VMS in particular and
	(b) made interoperable first of all at the level of content entities (=lexical semantics)
	In IN-SAFETY the linguistic concept of stylistics ***has to be extended*** to comprise also non-verbal representations on traffic signs in general and on VMS in particular (and to be confined to the level of content entities (=lexical semantics)
	In IN-SFETY ***pragmatic variations*** have to be taken into account in the data models and meta-models developed for EU-wide VMS data modelling

1.2 Terms related to the representation of meaning	**IN-SAFETY relevance**
sign (in general) (definition:) "…something that stands for something else, to someone in some capacity" (Marcel Danesi and Paul Perron: Analyzing Cultures) and which may be understood as a ***discrete unit of meaning***, whether ***denotative*** or ***connotative*** NOTE 1: A sign is usually standing for anything other than a sound. NOTE 2: Signs also include *images*, *gestures*, *scents*, *tastes*, *textures*, *sounds* — essentially all of the ways in which *information can be processed into a codified form* and *communicated as a message* by any	The majority of ***traffic signs*** and some VMS are ***complex signs***, comprising also different kinds of ***symbols*** (such as letter symbols, symbol for bus, car, horse, etc.); signs and symbols

sentient, reasoning mind to another by *verbal* and *non-verbal means*.	belong to the ***code*** (system) of traffic signs.
symbol (definition:) ***conventional representation*** of a ***concept*** or quantity in the form of a conventional written or printed ***sign*** (specifically, a ***glyph***) or by expressing sound NOTE 1: Thus mathematical symbols such as π and + represent quantities and operations, currency symbols represent monetary units, chemical symbols represent elements, and so forth. NOTE 2: In more psychological and philosophical terms, all concepts are symbolic in nature and representations for these concepts are simply *token artefacts* that are allegorical to (but do not directly codify) a symbolic meaning EXAMPLES: • a ***material object*** whose *shape* or *origin* is related, by nature or convention, to the thing it represents (e.g. the scepter is a traditional symbol of royal power) • a more or less conventional ***image*** (i.e. an *icon*), or a detail of an image, or even a *pattern* or *colour* (e.g. the colour red is often used as a symbol for socialist movements) • symbols for sounds are usually called *graphemes*, *letters*, *logograms*, *diacritics*, etc.	***symbols*** (such as letter symbols, symbol for bus, car, horse, etc.); signs and symbols belong to the ***code*** (system) occur as part of or additions to traffic signs and VMS.
code (semiotics) (definition:) ***set of conventions*** currently in use to ***communicate meaning*** through signs, which only acquire ***meaning*** and ***value*** when they are interpreted in relation to each other NOTE 1: Since the relationship between the *signifier* and the *signified* is arbitrary, interpreting signs requires familiarity with the *sets of conventions* or *codes* currently in use to communicate meaning (s. Saussure) NOTE 2: Codes are *rule-driven systems* which suggest the choice of signifiers and their *collocation* to transmit the intended meanings in the most effective way. To that extent, codes represent a broad interpretative framework used by both *addressers* and their *addressees* to encode and decode the messages. NOTE 3: Since signs may have many levels of meaning from the *denotational* to the *connotational*, the addresser's strategy is to select and combine the signs in ways that limit the range of possible meanings likely to be generated when the message is interpreted. This will be achieved by including also metalingual contextual clues (s. ***pragmatics***).	In IN-SAFETY the traffic signs and additional signs and information are a highly "coded" set of symbols, of which a large part is also highly stable due to legalization or other kinds of authoritative stipulation. In spite of the ***high degree of codification***, there is a lot of ***variation*** at the designation / representation level.
modality (definition:) way in which the ***information*** is to be ***encoded*** for presentation to humans, i.e. to the type of ***sign*** and to the ***status of reality*** ascribed to or claimed by a sign, text or genre NOTE: Modality is more closely associated with the semiotics of Charles Peirce (1839-1914) than Saussure (1857-1913) because *meaning* is	In IN-SAFETY modality has to be extended also towards haptic and other kinds of ***non-verbal*** and ***non-visual*** symbols.

conceived as an effect of a set of signs. In the Peircian model, a reference is made to an *object* when the sign-carrier (a *representamen*) is interpreted recursively by another sign (becoming its *interpretant*), a conception of meaning that does in fact imply a classification of sign types. NOTE 2: Semioticians classify signs and sign systems in relation to the way they are transmitted (i.e. ***modality***). This process of carrying meaning depends on the use of *codes* that may be the individual noises or letters that humans use to form words, the body movements they make to show attitude or emotion, or even something as general as the clothes they wear.	In traffic telematics in principle any ***modality*** can thus occur in the communication between driver and car (and – to some degree – traffic signs); the traffic telematic system as the medium extends to in-vehicle information.

1.3 Terms related to models and data modelling	**IN-SAFETY relevance**
modelling (definition:) process of ***generating a model*** (which is a conceptual and/or abstract representation of some phenomenon) NOTE: A model is always a simplification, justified on the grounds that it allows the production of acceptably accurate solutions to questions, problems, requirements or needs.	In IN-SAFETY we need both: - a semiotic model from the point of view of content entities (s. semiotic triangle) - a model for formal semantics from the software point of view (s. data modelling) which must fit together, i.e. be interoperable.
data modelling (in information system design) (definition:) analysis and design of the information in the system, concentrating on the logical entities and the logical dependencies between these entities. NOTE 1: Data modelling is an abstraction activity in that the details of the values of individual data observations are ignored in favour of the structure, relationships, names and formats of the data of interest, although a list of valid values is frequently recorded. NOTE 2: The data model should not only define the data structure, but also what the data actually means (semantics). While a common term for this activity is "data analysis" the activity actually has more in common with the ideas and methods of synthesis (putting things together) than it does in the original meaning of the term analysis (taking things apart). This is because the activity strives to bring the data structures of interest together in a cohesive, inseparable, whole by eliminating unnecessary data redundancies and relating data structures by relationships. NOTE 3: The process of developing the data model involves analyzing the kinds of data (***data categories*** or data elements) that will generally fit into the information system, and the relationships between different data elements within that system. Then the modeller must come up with representations of data models that guide the software development process.	

In the early phases of a software development project, emphasis will be on the design of a ***conceptual data model***. This can be detailed into a logical data model sometimes called a functional data model. In later stages, this model may be translated into a ***physical data model***.	
semiotic model (definition:) the relation between "object", "concept" and "designation" at the level of lexical semantics NOTE 1: If one wants to accommodate ***definitions*** and other kinds of descriptions of the concept in the model, designation has to extended towards ***concept representation*** (s. Annex 1) NOTE 2: The semiotic model (i.e. the concept model at the level of lexical semantics) is frequently presented in the form of the ***semiotic triangle***.	
semiotic triangle (explanation:) As a concept model originating from Aristotle, the semiotic triangle reveals the primary sign relations (between object and concept on the one hand and concept and concept representation on the other hand – also called direct relations) and the secondary sign relation (between object and concept representation – also called indirect relation). (Wikipedia „semiotisches Dreieck" 2005-12-08) In the field of terminology the following model is widely used: concept  designation object Because of the difficulty to accommodate "definition" in this model, the left bottom corner recently is also called concept representation, which covers both: ***symbolic representations*** and ***descriptive representations*** of concepts (s. Annex 1) resulting in: concept  representation object Of course the semiotic triangle is inevitably an extremely simplified (re)presentation of different matters – and therefore it was – sometimes vehemently – criticized. But it is still used today for different things, like:	In a more "dynamic" model, all of them: object, concept and representations are "permitted" a certain degree of "autonomy", which takes the fact into account that things of the outer and inner world are in constant change: - objects change - concepts evolve - definitions change (in accordance with concept change) - designations evolve In IN-SAFETY ***representations*** are: - displayed messages of traffic signs, VMS, additional panels, etc. - morphologic elements of traffic signs or additional panels - official names of traffic signs, VMS, additional panels, morphological elements, etc. - "popular" names of

- at the object corner (bottom right): • Class /object/ (in classification) • Data element object (in the metadata approach) • /thesaurus object/ (in thesaurus theory) - at the concept top corner: • Class /concept/ (in classification) • Data element concept (in the metadata approach) • thesaurus concept (in thesaurus theory) - at the representation corner (bottom left): • Class /name/ (in classification) • Data element name (in the metadata approach) • Descriptor (in thesaurus theory) and seems to work satisfactorily in data modelling.	the above - official rules or explanations of the above - expectations to the driver for a desired behaviour in verbal or other form (e.g. in in-vehicle information / communication)
object (definition:) (in terminology science) anything perceivable or conceivable (ISO 1087-1:2000 3.1.1) NOTE: Objects may be material (e.g. an engine, a sheet of paper, a diamond), immaterial (e.g. conversion ratio, a project plan) or imagined (e.g. a unicorn).	In IN-SAFETY ***objects*** (also called ***subjects*** e.g. in ISO 7239) are simple or complex situations (referring e.g. to traffic, environment, weather, geographical or other information, etc.)
concept (definition:) (in terminology science) unit of knowledge created by a unique combination of ***characteristics*** (3.2.4) (ISO 1087-1:2000 3.2.1) NOTE: Concepts are not necessarily bound to particular languages. They are, however, influenced by the social or cultural background which often leads to different categorizations.	In IN-SAFETY ***concepts*** (called ***referents*** e.g. in ISO 7239) are expected driver's behaviour due to traffic or other situations
designation; designator (definition:) (in terminology science) representation of a ***concept*** (3.2.1) by a sign which denotes it (ISO 1087-1:2000 3.4.1) NOTE: In ***terminology work*** (3.6.1) three types of designations are distinguished: symbols, ***appellations*** (3.4.2) and ***terms*** (3.4.3).	
term (definition:) verbal ***designation*** (3.4.1) of a ***general concept*** (3.2.3) in a specific ***subject field*** (3.1.2) (ISO 1087-1:2000 3.4.3) NOTE: A term may contain symbols and can have variants, e.g. different forms of spelling.	
Variants of the seminotic triangle*: Other re-interpretations rename the three corners of the semiotic triangle according to different theories of perception / thinking of objects and their mental representation represented by symbols:* *On the top of triangle appear for instance:* • *Referent* • *Interpretant (Peirce)* • *Reference (Ogden-Richards)*	

• *Sinn (Frege)* • *Intension (Carnap)* • *Designatum (Morris, 1938)* • *Significatum (Morris, 1946)* • *Connotation, Connotatum (Mill)* • *mentales Bild (Saussure, Peirce)* • *Inhalt (Hjelmslev)* • *Bewusstseinszustand (Buyssens)* • *Begriff (Saussure, Wüster)* *At the left bottom corner one can find:* • *Signifikant* • *Sign (Peirce)* • *Symbol (Ogden-Richards)* • *zeichenhaftes Vehikel (Morris)* • *Ausdruck (Hjelmslev)* • *Representamen (Peirce)* • *Sem (Buyssens)* • *Benennung/term (Wüster)* *At the right bottom corner one can find:* • *Signifikat* • *Gegenstand (Frege, Peirce, Wüster)* • *Denotatum (Morris)* • *Denotation (Russell)* • *Extension (Carnap)*	
*All corners of the semiotic triangle are of a certain **autonomy**, i.e. they are subject to change/development. This change/development is NOT synchronized:* • ***object autonomy** refers to the change/development of the (material or abstract) objects around us,* • ***concept autonomy** refers to the change/development in the perception or classifying/categorizing of the objects by us,* • ***representation autonomy** refers to the changes/development of meaning, any representation of a concept may take.* *This autonomy translates into a data modelling "autonomy".*	If IN-SAFETY takes traffic signs as physical products, which have to be designed, produced, traded etc. the idea of object autonomy would allow a seamless inter-facing of the semantic model with product data modelling.
term autonomy (data modelling) (definition:) data modelling principle allowing each term representing the concept to be documented with all necessary data categories NOTE 1: To be more explicit, the main term, any synonym, any abbreviated form of the term and any orthographic variant must be allowed to carry additional data categories such as grammatical gender, part of speech, geographical usage, context example, source reference, product code etc. Terminology data bases with term autonomy don't have data categories like synonym, variant or abbreviation; they repeat blocks of term-related data categories for each of the terms representing the same concept. NOTE 2: For traffic sign databases, we propose to replace the ***term section*** by a ***representation section***. Therefore we should rename term autonomy to ***representation autonomy***.	

representation autonomy (data modelling in traffic sign databases) (definition:) data modelling principle allowing each representation of the concept to be documented with all necessary data categories NOTE: concept representations in traffic sign databases can be verbal (written or spoken), alphanumeric, pictogrammatic, graphical, haptic, acoustic, etc. or any combination thereof.	

1.4 Terms related to distributed data management	IN-SAFETY relevance
data management (definition:) management of databases comprising all the disciplines related to managing data as a valuable resource	IN-SAFETY in its recommendations has to think about ***centralised or decentralised / distributed data management*** within a country and across several countries
distributed database; DDB (definition:) database that is under the control of a central ***database management system*** in which ***storage devices*** are not all attached to a common CPU NOTE 1: A DDB may be stored in multiple computers located in the same physical location, or may be dispersed over a network of interconnected computers. Collections of data (e.g. in a database) can be distributed across multiple physical locations. NOTE 2: Each partition/fragment of a DDB may be replicated (i.e. redundant fallovers, RAID like). Besides distributed database ***replication*** and ***fragmentation***, there are many other distributed database design technologies, such as local autonomy, synchronous and asynchronous DDB technologies. These technologies' implementation can and does definitely depend on the needs of the business and the sensitivity/confidentiality of the data to be stored in the database.	
federated database; virtual database (definition:) the fully-integrated, logical composite of all constituent databases in a ***federated database system*** NOTE: Ideally, a federated database system abstracts the noncontiguous, virtual nature of the federated database from ***users*** and ***clients***.	
federated database system (definition:) a type of ***meta-database management system*** which transparently integrates ***multiple autonomous database systems*** into a single federated database NOTE 1: The constituent databases are interconnected via computer network, and may be geographically decentralized. Since the constituent database systems remain autonomous, a federated database system is a contrastable alternative to the (sometimes daunting) task of merging together several disparate databases. NOTE 2: Through data abstraction, federated database systems can provide a uniform front-end user interface, enabling users to store and retrieve data in multiple databases with a single query – even if the constituent databases are heterogeneous. To this end, a federated database system must be able to deconstruct the query into subqueries for submission to the relevant constituent database management systems (DBMS), after which the system must composite the result sets of the subqueries.	IN-SAFETY clearly distinguishes between the ***system aspect*** (referring to database and database system as well as its management) and the ***content aspect*** of networked databases where ***repositories*** are the electronic store (database) of structured information in the form of ***registers***, while the places, where registers are kept and maintained according to operational

NOTE 3: Because various database management systems employ different query languages, federated database systems can apply wrappers to the subqueries to translate them into the appropriate query languages.	and organizational rules are called ***registries***.
repositories (of data collections) (definition:) electronic store (database) of structured information in the form of ***registers***, NOTE: The places, where registers are kept and maintained according to operational and organizational rules are called ***registries***.	Complying with standards IN-SAFETY distinguishes between: - ***repositories*** - ***registers*** and - ***registries***

1.5 Terms related to traffic signs and messages	**IN-SAFETY relevance**
traffic sign; road sign (definition:) signage at the side of or above roads to impart information to road users NOTE 1: Since language differences can create barriers to understanding, international signs using symbols in place of words have been developed in Europe and adopted in most countries and areas of the world. NOTE 2: The traffic signs in the Vienna Convention first of all refer to fixed and static ("traditional") traffic sign boards. NOTE 3: Due to new technologies traffic signs can also be shown on movable or variable traffic sign boards.	In IN-SAFETY - ***sign*** is used for traffic signs, - ***symbol*** is used for message elements on traffic signs or additional panels, - which can be a ***traffic sign message element*** or ***additional panel message element***
traffic sign board (definition:) the "hardware" on which the traffic sign message is displayed with or without additional panels NOTE: Depending on whether the traffic sign board is fixed or moved, or whether the message is static or variable, one can distinguish between: - fixed traffic sign boards: traffic sign board is installed in a fixed position - movable traffic sign boards: traffic sign board can be moved (e.g. mounted on a trailer) - static message sign boards: the message displayed on the traffic sign board cannot be changed, unless the traffic sign board is exchanged - variable message sign boards: traffic sign boards with a ***variable message sign display***.	
variable message sign; VMS (definition:) a sign for the purpose of displaying one of a number of messages that may be changed or switched on or off as required (EN 12966-1 – item 3.19)	
variable message sign display (definition:) optical display of varying messages on a variable message sign board NOTE: VMS displays can further be subdivided (acc. to present VMS technology) into those, which are - able to display (a maximum number of) predefined pictograms with or without additional texts - (limited) freely programmable (variable and/or animated) pictograms	IN-SAFETY clearly distinguishes between - ***VMS technology*** - ***VMS sign board*** - ***VMS display*** - ***VMS message***

with or without additional texts (with constraints due to matrix displays with low resolution) - (fully) freely programmable VMS message displays (with little constraints due to high-resolution).	
traffic sign message; message (definition 1:) a configuration consisting of symbols and/or text (EN 12966-1 – item 3.14) (definition 2:) message on a traffic sign board geared to the driver requiring a certain behavior depending on the situation (according to the Vienna Convention and ISO 7239) NOTE: In compliance with ISO 7239 “Development and principles for application of public information symbols” it makes sense to differentiate components of signs resp. sign boards (and additinonal panels) as follows: - pictograms - texts - background (of pictogram or text) - enclosure (of pictogram or text), such as circular, triangualar, diamond, square, etc.	IN-SAFETY distinguishes between: - ***traffic sign components*** and ***additional panel components*** on the one side and - ***traffic sign message elements*** and ***additional panel message elements*** on the other side
message element (of a traffic sign or additional panel) (definition:) ***symbol*** or other information used for message elements on traffic signs or additional panels, which can be a ***traffic sign component*** or ***additional panel component***, that can stand by itself or needs to be combined or supplemented with another symbol or additional information NOTE: Whereas traffic sign components and additional panel components, such as enclosure and background, belong to the basic traffic sign system features and need not be outspelled to the driver, message elements may need to be verbalized/outspelled in the communication to the driver.	

2 VMS in multilingual traffic environments in Europe

In the course of time a considerably complex traffic system for automotive vehicles has emerged, which is fairly demanding with respect to drivers' perception and reaction. Over the last decades traffic signs showed no tendency to be reduced – on the contrary, traffic development necessitates an increase of traffic signs and systems on the road (here focusing on highways) as well as technical devices within the car. This certainly has an impact on drivers' driving and traffic behaviour.

While drivers have become accustomed to the increase of traffic signs over the years, an overload of information (over-masking) probably is not improving driving and traffic behaviour. On the one hand a traffic sign system has evolved over the decades, which is – to quite some extent – harmonized at international level (first of all by the Vienna Convention). On the other hand there is still quite a bit of variation in traffic signs – and an evolution of new technologies. VMS (variable message signs, incl. also traditional and new verbal messages) can – in many cases – replace "traditional" fixed and static traffic sign boards. Actually all traffic signs could be replaced somewhen by VMS in the future (on the basis of traffic telematic systems based on "ubiquitous networks").

In this connection it is useful to clearly distinguish in IN-SAFETY between:
- ***VMS technology*** – whenever the technology is referred to;
- ***VMS boards*** – if it concerns the "hardware" on which the messages is displayed;
- ***VMS displays*** – if the technical method of displaying the message is involved;
- ***VMS messages*** – if the displayed message is referred to.

One of the major skills of a driver is to recognize/perceive and understand traffic signs. Especially in the form of VMS boards the system of traffic signs has become under pressure from technology. They do not only replace some traditional traffic signs, but also present new features, which add to the strain on the concentration of the driver. Therefore, there is

- the **danger**: that everything becomes more complicated;
- the **chance**: that the traffic sign system could be simplified with a well designed VMS system (managed on the basis of an appropriate content management through a traffic telematics system).

The respective content management will have to extend into the in-vehicle communication system.

This outline of the future development shows that several subject fields and application practices have to join forces in order to find common – and hopefully optimal – solutions.

In this part of the A 2.3 methodology the investigations and proposed solutions cover:
- verbal messages (as major message elements of a traffic sign or additional panel) being:
  - a verbal component of a traffic sign or additional panel;
  - verbalized traffic sign or additional panel;
  - verbalized non-verbal element of a traffic sign or additional panel;
- a data model for covering all variations in:
  - traffic signs, especially such on VMS displays,

- (pictogrammatic or textual) information on additional panels (s. Vienna Convention examples H1 to H9),
- verbal messages (in all their guises).

In this connection it must be mentioned that the layout of VMS displays often provides space below the pictogram for adding additional information accommodating, what is traditionally shown on additional panels.

Excluded from the investigation are

- the use of lights (traffic lights, flashing lights*, car lights, etc.)
- the use of "arrows", which obviously needs harmonization (within traffic systems as well as between traffic systems and other environments, such as train stations, airports, etc.)
- most of the potential uses of geographical names.

Concerning arrows, the elaboration of an application-oriented arrow methodology in coordination with other environments, where arrows are used (airports, hospitals, train stations, etc.) would be useful.

**New types and/or functions of flashing lights on VMS displays to arouse the driver's attention or to indicate that the VMS board is in function, while not displaying any message, may have to be considered in IN-SAFETY.*

The methodology outlined here comprises – in addition to the ***theoretical foundation and basic concepts*** systematically compiled in Chapter 1

- a Categorization, classification and typology of road/traffic signs and messages is outlined in Chapter 4;
- the development of "Europeanisms" as quasi-pictograms replacing traffic signs or being used as element of traffic signs or additional panels is proposed in Chapter 4 (incl. also a transliteration approach to non-Latin alphabets);
- an approach to extend VMS towards in-vehicle information and communication is suggested in Chapter 5;
- the IN-SAFETY data model for verbal messages is conceived I Chapter 6;
- a proposal for a systematic distributed database management scheme is outlined in Chapter 7;
- standardization issues are addressed in Chapter 8;
- several Annexes provide additional information;

and conclusions as well as recommendations are drafted at several places in the text of this report.

Although there can be no doubt that the system of traffic signs is indeed systemic in principle, there are few investigations as concerns the semantics and syntax of road signs. Ballardin e.a. (2005) suggests that more verbal messages in combination with pictogrammatic elements could be systematized into a system of variable verbal or mixed verbal-pictogrammatic additional panels to traffic signs.

For the sake of consistency in this report:
- ***sign*** is used for traffic signs,
- ***symbol*** is used for (semiotic-morphologic) elements on traffic signs or additional panels.

A ***symbol*** is a ***message element*** of a traffic sign or additional panel which
- can stand by itself or
- need to be combined or supplemented with another symbol or additional information.

3 Categorization, classification and typology of traffic signs and messages

3.1 History

The earliest road signs gave directions; for example, the Romans erected stone columns throughout their empire giving the distance to Rome. In the Middle Ages multi-directional signs at intersections became common, giving directions to cities and towns.

Traffic signs became more important with the development of automobiles. The basic patterns of most traffic signs were set at the 1908 International Road Congress in Rome.

3.2 Position

Most countries place traffic signs, at the side of roads to impart information to road users. Increasingly they are placed also 'over-head' above roads, such as on motorways and highways. Since language differences can create barriers to understanding, international signs using symbols in place of words have been developed in Europe and adopted in most countries of the world. Shape, size, colours and sign elements have been harmonized to quite an extent on international level.

3.3 Categorization and classification

Annexe 1 of the Vienna Convention on Road Signs and Signals of November 8, 1968 defines eight categories of signs (according to Annex 1, Sections A~H):

A. Danger warning signs (Section A), such as

A.1 General Caution
A.2 Obstacles
A.3 Things Near or Crossing the Roadway
A.4 Road works or construction
A.5 Bends and Turns
A.6 Tunnels
A.7 Bridges
A.8 Traffic Lights
A.9 Warning Signs for Regulatory Signs
A.10 Level Crossings and Intersections
A.11 Lane Starts/ends
A.12 No Passing Zone
A.13 Pedestrians
A.14 Schools
A.15 Fire stations
A.16 Oncoming Traffic
A.17 Railway Crossings

A.18 Falling Rocks
A.19 The Unexpected
A.20 Road conditions
A.21 Side Wind
A.22 Slow Down
A.23 Merge To Stay With Through Traffic

B. Regulatory signs: these signs are intended to inform road-users of special obligations, restrictions or prohibitions with which they must comply; they are subdivided into:

(i) ***Priority signs (Section B)***: these signs indicate the order in which vehicles should pass intersection points, such as:

B.1 "GIVE WAY" sign
B.2 "STOP" sign
B.3 "PRIORITY ROAD" sign
B.4 "END OF PRIORITY" sign
B.5 Sign indicating priority for oncoming traffic
B.6 Sign indicating priority over oncoming traffic

(ii) ***Prohibitory or restrictive signs (Section C)***, such as

C.1 Prohibition and restriction of entry
C.2 Prohibition of turning
C.3 Prohibition of U-turns
C.4 Prohibition of overtaking
C.5 Speed limit
C.6 Prohibition of the use of audible warning devices
C.7 Prohibition of passing without stopping
C.8 End of prohibition or restriction
C.9 Prohibition or restriction of standing and parking

(iii) ***Mandatory signs (Section D),*** such as:

D.1 Direction to be followed
D.2 Pass this side
D.3 Compulsory roundabout
D.4 Compulsory cycle track
D.5 Compulsory footpath
D.6 Compulsory track for riders on horseback
D.7 Compulsory minimum speed
D.8 End of compulsory minimum speed
D.9 Snow chains compulsory
D.10 Compulsory direction for vehicles carrying dangerous goods
D.11 Remarks concerning the combination of signs

(iv) ***Special regulation signs (Section E),*** such as:

E.1 Signs indicating a regulation or danger warning
E.2 Signs indicating lanes reserved for buses
E.3 "ONE-WAY" sign
E.4 Preselection sign
E.5 Signs notifying an entry to or an exit from a motorway
E.6 Signs notifying an entry to or exit from a road on which the traffic rules are the same as on a motorway
E.7 Signs indicating the beginning and the end of a built-up area
E.8 Signs having zonal validity
E.9 Signs notifying the entry to or exit from a tunnel where special rules apply
E.10 "PEDESTRIAN CROSSING" sign
E.11 "HOSPITAL" sign
E.12 "PARKING" sign
E.13 Signs notifying a bus or tramway stop

C. Informative signs: these signs are intended to guide road-users while they are travelling or to provide them with other information which may be useful; they are subdivided into:

(i) ***Information, facilities or service signs (Section F),*** such as:

F.1 "FIRST-AID STATION" symbol

and miscellaneous symbols, such as:

F.2 "BREAKDOWN SERVICE"
F.3 "TELEPHONE"
F.4 "FILLING STATION"
F.5 "HOTEL or MOTEL"
F.6 "RESTAURANT"
F.7 "REFRESHMENTS OR CAFETERIA"
F.8 "PICNIC SITE"
F.9 "STARTING-POINT FOR WALKS"
F.10 "CAMPING SITE"
F.11 "CARAVAN SITE"
F.12 "CAMPING AND CARAVAN SITE"
F.13 "YOUTH HOSTEL"

(ii) ***Direction, position or indication signs (Section G),*** such as:

- Advance direction signs;
- Direction signs;
- Road identification signs;
- Place identification signs;
- Confirmatory signs;
- Indication signs;

(iii) ***Additional panels (Section H),*** such as panels:

- showing the distance from the sign to the beginning of the dangerous section of road or of the zone to which the regulation applies
- showing the length of the dangerous section of road or of the zone to which the regulation applies
- being placed under the signs while the information to be given on the additional panels may be inscribed on the lower part of the sign
- concerning parking prohibitions or restrictions
- being restricted to particular road users
- exempting a certain category of road users from restricting regulatory signs
- indicating parking space reserved for handicapped persons
- indicating that the section of road ahead is slippery because of ice or snow.

However, individual countries (or even regions/provinces/states) may categorize road signs in different ways, such as:

Germany:

- Sinnbilder der StVO
- Gefahrenzeichen 100-199
- Vorschriftzeichen 200-299, which comprise priority signs, prohibitory signs, mandatory signs and special regulation signs
- Richtzeichen ohne Verkehrslenkungstafeln 300-499
- Verkehrslenkungstafeln 500-599
- Verkehrseinrichtungen 600-699
- Zusatzzeichen 1000-

United States of America

- Regulatory signs
  - Warning signs
  - Guide signs
- Route marker signs
  - Expressway signs
  - Freeway signs
- Informational signs
  - Recreational and cultural interest signs
- Emergency management signs
  - Temporary traffic control (construction or work zone) signs
  - School signs
  - Railroad and light rail signs
  - Bicycle signs

3.4 Variable sign message elements

Composition of road/traffic signs and their verbal and non-verbal messages:
Pictograms (DE Sinnbilder der StVO) have been identified as

- pictogrammatic-"morphologic" elements of traffic signs
- additional panels to traffic signs
- combinable with other (verbal or graphic) additional panels

(no traffic sign catalogue IDs {identification number according to the German VzKat} are assigned to these pictograms in Germany)

Additional panels (DE Zusatzzeichen) can consist of:

- alphanumeric symbols
- graphic symbols (e.g. arrows {many meanings, many combinations possible}, etc.)
- pictogrammatic symbols (e.g. "truck")
- combinations thereof and with traffic signs

There are ***traffic signs containing integrated***

- pictograms or graphic symbols (as semiotic-'morphologic' elements)
- alphanumeric information
- combinations thereof

and others

- being ***supplemented by additional panels***, which contain
  - pictogrammatic symbols or
  - graphic symbols or
  - alphanumeric information or
  - a combination thereof

3.5 Verbal messages (incl. variable verbal messages)

Textual (i.e. alphanumeric, namely verbal or quasi-verbal) information being the central part of a traffic sign or being integrated in regular traffic signs or in their additional panels are:

- Emergency, Police, WC, … (+ TEL symbol) + distance indication…
- (Names:) London, Paris, etc.
- EXIT, STOP, give way 50 ys, etc.
- One-way, …-zone, beginning/end of …, etc.
- Slippery road: if raining, if freezing, if dirty, etc.
- (Time indications:) on Sundays and holidays, from 20h to 06h, etc.
- H (= bus stop in DE), U12 (temporary or permanent re-routing)
- (Distances:) 100m (in 100m; from here 100m… – e.g. railway crossing)
- (Other measurements:)
    - 5,5t (gross weight), 8t (axle weight), etc.
    - 2m (width), 3.8m (height), 10m (length, distance, …)
- (Speed:) 80 (= 80km/h) + time (period) indication
- (Degrees:) 10% (gradient road, dangerous hill), 0° (temperature), etc.

which may or may not be combined with graphical symbols.

According to Mr. Bald a semantic & syntactic categorization/typology of verbal messages in or in combination with traffic signs does not yet exist:

> *"Klassifizierung/Typologisierung von 'verbal messages im Straßenverkehr' sind mir im Moment nicht bekannt, allenfalls aus dem RDS-TMC-System, bei dem es für Störungsmeldungen codierte Messages gibt. Aus den StVOen der Länder und den zugrundeliegenden internationalen Verträgen könnte man allenfalls eine Systematik herleiten, die auf Warnungen / Gebote&Verbote / Hinweise aufbaut. Es muss da etwas geben: ich kann mich erinnern, vor ca. 20 Jahren einmal eine Info bekommen zu haben, dass auf Zusatzschildern z.B. die positive Aussage in allen Sprachen grundsätzlich unter dem Symbol stehen soll (z.B. unter dem Symbol eines Fahrrades die Worte 'frei', 'libre' usw.), die negative Aussage dagegen über dem Symbol ('nur', 'only' usw.). Dadurch solle der der Landessprache nicht mächtige Autofahrer gefühlsmäßig alleine über den optischen Kanal das richtige 'fühlen'."*
>
> [I do not know at this moment of any classification/typologisation of 'verbal messages in traffic'; maybe they exist in the RDS-TMC system, in which there are coded messages for failure messages. … I remember that on additional panels positive statements (e.g. … admitted) are always placed under the respective symbol, however negative statements (e.g. only for …) are always placed under the respective symbol. …]

There are at most only some steps towards a systematisation. A recent article (Ballardin 2005) indicates that there may indeed be further potential for harmonizing and systematizing messages on additional panels by a combination of existing symbols (some of which could be taken from the signing of airports or train stations, etc.). However, this requires a thorough investigation of the syntax of the messages to be conveyed – for which they provide an approach.

3.6 Designations (and different kinds or levels of naming)

The traffic signs (comprising integrated "morphologic" elements or not) and their additional panels (comprising integrated "morphologic" elements or not) can have

- simple designations such as: curve, warning, STOP, etc.
  (which are more or less self-explanatory)
- simple designations, such as ***gradient road***, which, however, more often than not may mean something like "Steep downgrade – You should shift to a lower gear. The degree of the slope is shown")
- 'difficult' legal designations (used in law) vs. popular names (used for instance in driving schools)

and may need a new short/concise and easy to understand name and/or explanation in real traffic situations – and especially in in-vehicle communication.

In this connection verbal can mean:

- written verbal,
- spoken verbal,

which in actual use could be literally different, for 'noise' (in the meaning of visual interferences) in written communication may be different from 'noise' (in the meaning of acoustic interferences) in spoken communication. In traffic telematics both have to be considered as 'equivalent/synonym' from the semantic point-of-view, even if their 'linguistic outer form' could be quite different. This has a strong impact on data modelling and information design.

Any non-verbal traffic sign (or traffic sign containing non-verbal information in addition to verbal information; or containing a non-verbal information supplemented by verbal information…) can be represented by:

- a (sometimes 'difficult') legal designation (often with additional explanation, which may be different for written display than for the spoken form);
- a (easy to understand) popular name (possibly with additional explanation, which may be different for written display than for the spoken form);

(potentially) in any language or language combination. The legal designation in one language may be perceived as 'difficult' by people of that language community, but quite simple and easy to understand in another language by people of that community. Popular names may exist in some languages, but not in others.

3.7 Optimization of verbal messages

As a side-effect of these investigations, verbal messages on static sign boards and VMS displays could be optimized with regard to

- harmonization,
- comprehension,
- multilinguality,

taking into account

- cultural aspects,
- localization methods,
- road equipment standards and national regulations,

- future necessities of car navigation systems.

Some of the criteria for terminological optimisation are:

- Transparency (morphological / semantic motivation)
  - *de: unbeschrankter Bahnübergang / grüne Welle*
- Consistency
  - *consistent use of terms in all types of verbal messages*
- Appropriateness
  - *familiar to the reader (localization)*
  - *don't cause confusion or insecurity*
  - *have no negative connotations (neutral, politically correct)*
- Linguistic economy
  - *de: Ultrakurzwellenüberreichweitenfernsehrichtfunkverbindung*
- Derivability
  - *medicinal plant vs. herb → herbal, herbalist, ...*
- Linguistic correctness
  - *de: aktualisieren vs. updaten, geupdated, upgedatet, ...*
- Preference for native language
  - *de: Startseite vs. Homepage*

3.8 Conclusions:

- CONCLUSION 1: This complex situation requires a terminological approach to data modelling (s. data model)
- CONCLUSION 2: This approach should be based on pertinent standards and standardisation activities (s. Annex 2)
- CONCLUSION 3: The aspect of verbal messages (including variable verbal messages) on highways and high-speed motorways provide sufficient prototypical data for carrying out Task A2.3

It is suggested

- to take the international conventions as starting point,
  - to take samples from there
  - to be supplemented by samples from
    - national legal and other kinds of regulatory provisions
    - reality (if necessary/useful).
- to analyze prototypical samples of verbal messages (including variable verbal messages) in coordination with the investigation of the respective graphic and other non-verbal signs and signals by the partners of WP 2.

In this connection the degree of harmonization of traffic/road signs and signals used on highways, high-speed motorways etc. can be considered as highest. Therefore, and because

- security is at stake especially when driving at high speed (or too slowly on high-speed motorways);
- highways have been and will be increasingly used for transit (in the form of heavy traffic, tourists etc.);

- tourism between European countries will increase (incl. foreigners from abroad hiring cars, etc.);

it is suggested to ***focus on verbal messages in/at traffic signs and VMS on high-speed motorways***.

4 Official variations in traffic signs and languages in Europe

4.1 The language situation: legal/official languages in the EU/EEA

The official languages (and language variants) of IN-SAFETY:

- 22 EU (European Union) official languages (incl. Irish Gaelic, and Luxembourgish)
- 24 EEA (European Economic Area – i.e. the EU and EFTA) official languages (incl. in addition Icelandic and Norwegian, but not Schwyzerdütsch)
- 35 official language situations (in combination with road/traffic sign variants) = ***locales*** (incl. 4 variants each of German and French, 2 variants each of English, Italian, Dutch, Swedish and Greek)
- not included: official regional languages, such as Catalan, etc.

Not all variants are relevant in reality – but /some/ could be or become.

The following table can give an impression of the linguistic variation of languages used in different countries or regions (not even including regional languages with an official status):

(language symbols according to ISO 639-1 and country symbols according to ISO 3166)

• csCS	• enGB	• frLU	• lvLV	• slSI
• daDK	• enIE	• gaIE	• mtMT	• svSE
• deDE	• esSP	• huHU	• nlNL	• svFI
• deAT	• etEE	• isIS*	• nlBE	• …
• deCH	• fiFI	• itIT	• noNO*	
• deLU	• frFR	• itCH	• plPL	
• elGR	• frBE	• lbLU	• ptPT	
• elCY	• frCH	• ltLT	• skSK	• laVA*

**Iceland, Norway and Switzerland belonging also to the EEA are included (but no differentiation into Norwegian Nynorsk and Bokmål has been made, as experts say that Norwegian road/traffic signs only use a 'neutral' Norwegian form); Latin has been included for the sake of completeness.*

This table does NOT comprise major language communities, some of which enjoy official status at regional level (such as Catalan). Nor does this table comprise something like "international English", which is increasingly used as *lingua franca* in international communication. International English develops certain conventions, which *neutralize* the national peculiarities of British, American, Australian etc. English.

4.2 Bilingual traffic signs

In many countries or regions (especially border regions) of the world bilingual traffic signs are in use. Bilingual signs are for instance used in Wales, where Welsh highway authorities choose whether they are "English-priority" or "Welsh-priority" and the

language having priority in the highway authority's area appears first on signs. Most of south Wales is English-priority while north Wales is Welsh-priority. Bilingual signs were permitted by special authorization after 1965 and in 1972 the Bowen committee recommended that they should be provided systematically throughout Wales. In the Scottish Highlands, road signs often are found with the Scottish Gaelic given (in green) as well as the English (in black). This seems to be part of the Gaelic language revival encouraged by many, including the Bòrd na Gàidhlig. In Hong Kong traditional Chinese characters are still used traffic signs (although the mainland uses simplified Chinese characters). Most, if not all, of Hong Kong's traffic signs are bilingual, as English and Chinese are considered official languages. English often appears on top of text in traditional Chinese.

Bilingual signing in Wales and elsewhere has caused traffic engineers to inquire into the safety ramifications of providing sign legend in multiple languages. As a result some countries have opted to limit bilingual signing to dual-name signs near places of cultural importance (e.g. New Zealand), or to use it only in narrowly circumscribed areas such as near borders or in designated language zones (e.g. the NAFTA countries).

Maybe A2.3 should concentrate on the safety relevant traffic signs and messages. In this connection it should be investigated, whether bilingual VMS such as:

- two signs of same content in two languages are placed one after the other with a certain distance;
- two signs of same content in two languages are placed side by side (or near to each other);
- the message in two languages is displayed on one VMS board split in left and right halves; *(special case: traffic signs with bilingual verbal message element, such as ZONE…)*
- the message in two languages is displayed on one VMS board split in top and down halves; *(special case: traffic signs with bilingual verbal message element, such as DOUANE…)*
- the message in two languages is displayed on one VMS board, every message element in two languages one below the other;
- the language of the message is displayed on one and the same VMS board for a certain number of seconds, after which it is switched to another (or third) language;

will not become obsolete due to increased use of ***co-operative in-vehicle systems***. Reduction of information definitely reduces the danger of over-masking. Bilinguality could be taken care of by personalization features of such systems.

If one analyses the reasons for bilingual traffic signs and messages, ther are

- language policy reasons
- historical reasons
- reasons of traffic signage change at boarders, to which the (first of all local and regional) driver must become accustomed.

Geographical names are a complete different problem set and should be excluded from the investigation.

If personalization features of co-operative in-vehicle systems would more or less fully comply with political, historical as well as other reasons for bilingual signage, preference should be given to in-vehicle representation of the message in personalized form. This would also apply in the case that future VMS message displays become (fully) freely programmable.

4.3 Variations of traffic signs and verbal messages – Locales

In the light of present and foreseeable VMS technology development

- any pictogrammatic traffic sign or information on an additional panel, or any graphical symbol or any combination thereof could be represented also in verbal or verbalized form,
- any written verbal form could also be represented (one-to-one or modified) in spoken verbal form;
- some information could be expressed even in haptic form to the driver, which could also be verbalized;
- further information will be made "language independent" (i.e. universal either through new pictograms or graphical representations, or through international or pan-European universal expressions).

Therefore, any information for the driver – in principle, maybe not necessarily in practice – could be communicated

- ***multilingually*** (comprising also language variants),
- ***multimodally*** (comprising also modes beyond written and spoken),
- ***multimedia*** (going beyond a combination of visual, audio and video presentations),

and there is no end to human technical creativity.

This necessitates a highly sophisticated – not necessarily complicated! – data model, which probably can also accommodate requirements stemming from personalisation, accessibility (for people with special needs). This data model would relieve technical devices from constraints and make technical communication very flexible on the one hand, and may even support multi-channel output via many different types of devices on the other hand.

However, every kind of representation – whether written or spoken verbal representation, graphical/pictogrammatic or multimedia presentation etc. – has its own inherent constraints (first of all in terms of human perception), which have to be taken into account in the data model.

Every road/traffic sign can be expressed by words (written or spoken or other kind of representation). There are minor differences in road/traffic signs as well as in their verbal and non-verbal representations – even between countries / regions of the same language community. Therefore, the introduction of "***locales***" for these differences below the country or language community level suggests itself (e.g. deDE Gefälle vs. deAT

gefährliches Gefälle). Locales again may have synonyms in the respective region of use, but they themselves cannot be simply regarded as synonymic variants for the whole language community spreading across national borders. Different language proficiency levels ("register" in socio-linguistics) can also be covered by locales.

Textual information and/or explanations usually have a 'legal' prescribed form, which may have to be adapted to a more user-friendly form for the driver and sometimes also according to driving situation (e.g. noise, etc.) in order to be unequivocally understood; this may be different for different languages. Thus it could well be that, if the meaning of the road/traffic signs/messages have to be conveyed to the driver in-vehicle, the legal/official name and/or explanation most probably is not the best understandable. This is only partly due to the "register" (in the sense of the socio-linguistic proficiency level) of the speaker. It may also vary from language community to language community. This aspect needs further investigation.

Ideally English should be used as meta-language of the data model (and for systems based on the data model) – i.e. as the language of description of data types, data model and system components and features as well as for comparison purposes. Possibly the English used as meta-language will be a variant of international English. British English for the UK, however, is and will remain the special language for British traffic signs and traffic-related human communication.

CONCLUSION**:** Every European country has or can have road/traffic sign variants. Languages used by the country's majority in one country can be used as official minority languages in one or more other countries. A ***locale***, therefore, is a particular road/traffic sign variant or information on an additional panel or a particular combination of these with one or more verbal messages in official language.

4.4 Transliteration approach

Given the fact that Greek is written in Greek characters and other countries using a non-Latin script will join the EU, some thought must be given on how to use transcription of words in these languages/scripts into Latin. For this purpose the confusing variation in simplified transcription schemes, target language oriented transcriptions (e.g. Russian in Latin letters for French readers), common transliterations (e.g. in newspapers) vs. standardized ones, must definitely be reduced.

4.4.1 General

There is a whole "conversion" methodology in librarianship (standardized by ISO/TC 46), which is used also in other quarters of science and applications. ***Conversion*** comprises:

- ***transliteration*** (more or less letter-by-letter),
- ***transcription*** (of non-phonemic scripts into a phonemic writing system),
- ***Romanization*** (of certain non-Latin scripts into Latin letters).

Conversion may have different levels:

- (transliteration:) 1st level transliteration (for automatic bi-directional transliteration) as standardized by ISO/TC 46;
- (transcription:) 2nd level transliteration (for automatic transliteration of non-Latin text into Latin letters according to target language dependent rules);
- (conversion:) 3rd level transliteration (for transliteration into a highly user-friendly spelling according to the user's language).

Conversion in future in-vehicle information/communication systems will have to be closely linked to speech technology in a "dynamic" way:

- information will be presented "phonetically" (i.e. by "computer voice") to the driver,
- driver's spoken text will be recognized by the in-vehicle information system and processed "semantically".

At this stage most probably "only" place names will be transliterated on VMS (and/or in in-vehicle information systems, although in the future anything could be transliterated in in-vehicle presentation: names of restaurants, streets, dishes, ... - up to archaic characters for archeological information, for which there are additional requirements).

We certainly need a generic "European" transliteration approach valid for all present EU languages (i.e. one transliteration scheme for Greek geared towards all other languages), which will also be viable – at least in principle – for future EU member states with non-Latin written languages.

4.4.2 Greek transliteration

The Convention on Road Signs and Signals (Vienna, 8 November 1968) stipulates under "Informative Signs" Art. 14: "2. The inscription of words on informative signs (ii) of Art. 5, para. 1 (c), in countries not using the Latin alphabet shall be both in the national language and in the form of a transliteration into the Latin alphabet reproducing as closely as possible the pronunciation in the national language. 3. In countries not using the Latin alphabet, the words in Latin characters may be entered either on the same sign as the words in the national language or on a repeat sign. 4. A sign shall not bear inscriptions in more than two languages." This stipulation should in essence also be appliccable to the transliteration of verbal messages in Greek on traffic signs in Greece.

Most probably the UN/ELOT 743 transliteration will be most appropriate, but some minor problems need to be solved (referring among others to the ALA-LC Romanization Tables: http://www.loc.gov/catdir/cpso/roman.html):

- problem 1: trema on "I" (in ai, ei, oi), which ALA-LC does not use
- problem 2: accents and supplementary diacritics:
  - macron below characters → should be avoided?
  - some accent aigue on a (ái), é (in éi), ó (in ói), which ALA-LC does not use...
- problem 3: the ay/av/au combination, ey/ev/eu combination, the iy/iv/eu combination, the oy/ou combination,

(so that in the future the car driver can request pronunciation whether from the Greek original spelling or from the transliteration, and can hear a correct pronunciation!)

For present day VMS displays the most simple/simplified transliteration will have to be used, which may mean deprecation of some sophisticated – however disambiguating – features (such as diacritics on Greek letters and on Latin letters for Greek in transliterated form).

If in the background of any Greek words used in traffic telematic systems

- the Greek original is the governing rule (also for pronunciation, which may require an extensive word-list in the background)
- whatever transliteration would be fine (but should not deviate too much from "standard" ones)
- slightly differing presentations on VMS and in-vehicle should not be a major problem.

Extended "multi-channel" output (i.e. not only visual, but also audio and even multimedia) has not yet been fully recognized as a non-trivial question...

4.5 "Europeanisms"

The Convention on Road Signs and Signals (Vienna, 8 November 1968) stipulates under "Other markings" on p.61: "41. Word markings on the carriageway may be used for the purpose of regulating traffic or warning or guiding road users. The words used should preferably be either place names, highway numbers or words which are easily understandable internationally (e.g. "Stop", "Bus", "Taxi"). This stipulation could also be used on VMS in adapted form, since quite a number of verbal messages or verbal message elements are written with the same or very similar spelling and have the same meaning in all or most European countries. If such "Europeanisms" are widely agreed upon, they could become candidates for further internationalization.

From the point of view of human perception, these Europeanisms are perceived rather as icons than as verbal messages.

If a harmonization at European level would be feasible, this would reduce the stress of

- the European driver when crossing a EU member state border (because he need not learn additional conventions),
- the non-European drivers, who are increasing in number and more often than not using a car to drive in several European countries.

So far the following candidates for becoming Europeanisms have been suggested:

BUS	large, motorized, wheeled vehicle for carrying numerous persons in addition to the driver	
CONTROL	control point / check point	
FAIR	trade fair	
FOG		
FULL	e.g. for car park full	
METRO	Public underground / subway / metro	
OK	All right	
[tick]	All right /OK	
RADAR	Radar control	

SOS	Help in emergencies available	
SMOG	Polluted air	
TOLL	Toll fee has to be paid	
TAXI	Taxis available / taxi stand	
TEL	Telephone available	
TRAM	Street car / tram available	
via	Reach place x "via" place y	
WC	Public toilet available	
h	hour	
m	meter	
km	kilometre	
t	ton	

5 In-vehicle information/communication

The following conclusion/recommendation of the COST 30 committee (COST 30 Electronic Traffic Aids on Major Roads http://www.cordis.lu/cost-transport/src/cost-30.htm) on the subject of electronic traffic aids on major roads is definitely not justified any longer:

> *„**Need for communication with drivers***: The most suitable method for communicating with drivers is via external visual signals, in a system that can rapidly detect traffic incidents and/or bad weather. There is little justification for systems based on vehicle-borne equipment. *Radio broadcasting of messages is the only means of communicating long range information to drivers on most of the road network, but is not fast enough to prevent accidents (except for a few involving bad weather).“*

5.1 Technology supporting road safety

According to the IN-SAFETY Glossary (BAST 2005) the ***road safety measures*** and ***road safety systems*** have been categorised according to their technical solution in (s.:

- Autonomous in-vehicle systems
- Co-operative Systems
- Traffic management systems
- Road design measures

This categorisation has been chosen because it will be important for a scenario analyses that aims at comparing different technical solution supporting the same function. Further more, each of the categories addresses a different group of stakeholders which will be an important item when discussing implementation priorities.
These systems do or can interoperate in various ways.

- ***Autonomous in-vehicle systems*** are all systems that do not need any data communication with off-vehicle devices (other vehicles or infrastructure). They work with information from in-vehicle sensors only.
  This does not mean that these systems do not consider infrastructure, like a lane keeping assistant that keep track of lane markings that are part of the infrastructure. But there will be no data exchange.

- ***Co-operative in-vehicle systems*** are systems that exchange data between in-vehicle- and off-vehicle devices. They can be divided in
  - vehicle communicate with other vehicle(s) and vice versa: V←→V
  - vehicle communicate with infrastructure devices and vice versa: V←→I
- ***Traffic management systems*** usually act on the collective of drivers. They use technical infrastructure sign posted at the roadside, broadcast or internet/mobile devices.
- ***Road design measures*** are all that create or change road infrastructure elements.

Data communication with off-vehicle devices and between all four types of systems is certainly bound to increase. This data communication concerns technical data for the vehicle and for the systems operation, and data for communication to the driver in various ways. Same meanings can be conveyed in different forms of linguistic, non-linguistic (or mixed) form.

5.2 Information conveyed to the driver through traffic signs

In ***traffic telematics*** the following types of content items/units with respect to traffic signage may occur (e.g. in the form of in-vehicle information/communication) in addition to the system of traffic signs:

- ***Verbal messages***
  - written
  - spoken
- ***Non-verbal messages***
  - multimedia
    - visual (non-verbal)
    - audio (non-verbal)
    - audio-visual
    - fully multimedia
  - other (such as haptic)

Any of these

- can can come from traffic sign boards for static or variable messages;
- can potentially be combined with each other;
- can potentially be converted into each other;

for the sake of

- localization (i.e. adaptation to different language and culture);
- personalization;
- adaptation to the requirements of people with special needs (e.g. handicapped people);

and can – if the data model is adequate –

- be un-restrictedly re-usable for other purposes;
- maintained and updated in federated distributed repositories/registries.

5.3 Repeatability of data catagories

According to terminological data modelling data categories for representing the same meaning can be repeatable by language (if data are or can be in more than one language) and repeatable within language (if there are synonyms etc.). There may be further kinds of repeatabilities with content items/units (at the level of lexical semantics) under a mContent perspective. (for details see chapter 6)

Therefore, the "traditional" repeatabilities in the field of terminology, namely

- repeatability by language,
- repeatability within language,

have to be supplemented by further repeatabilities, such as repeatabilities by

- different cultures (within a country/language community, between countries, etc.);
- modality (e.g. from written to spoken and vice versa – in principle all non-verbal representations can be considered as different modes);
- special need (e.g. for people with special needs, which can also be considered as a particular kind of personalization);
- application (incl. the personalization from the point-of-view of the industry in addition to the personalization from the point-of-view of the user).

This clearly reveals that internationalization, localization and personalization are not contradictory to each other, but complementary.
The requirements for people with special needs can be seen in this framework as one kind of personalization.

These verbal and non-verbal messages can be considered formally as content items/units at the level of conceptual thinking, comprising however a sub-level above such as

- micro-propositions in the form of
  - commands,
  - admonitions,
  - recommendations,
  - etc.;
- terminological phraseology (also collocations from the formal-linguistic point-of-view);
- linguistic collocations;

or a sublevel below such as morphological units

- in terminology or linguistic entities;
- in graphical signs;
- in other kinds of representations.

5.4 Types of content items/units and their recombinability

The content items/units dealt with here can be

- language resources, such as
  - spoken or written words, collocations,
  - word or term elements,
  - small "chunks of text" such as the above-mentioned commands, admonitions, recommendations, etc.
- other content resources, such as

- visual (non-verbal),
- audio (non-verbal),
- audio-visual,
- fully multimedia,
- other (such as haptic)

content items/units, with their sub-units and more complex units. They are all ***representations of meaning*** (in the broadest sense).

In given situations, e.g. at a construction site on the highway, they can be combined and condensed into something like:

- 50 m ahead lower speed to 50 km/h and change to the left lane for 3 kilometres,

which in a city could become

- 20 m ahead lower speed to 20 km/h and change to the left lane for 200 metres.

In this connection the instructio "turn right" may require quite a different set of (re-) actions from the driver in cities as compared to highways.

With respect to multilingual information given instructions, which may be perfect in English (such as "turn right now"), may be inadequate in other language, because they would be too long or – for instance, if pronounced – too similar to another expression. Variation does not only occur at the linguistic level. Some graphic road and traffic signs vary from country to country, so that there may be situations where the question arises:

- shall a hearing-impaired Finnish person driving on a highway in Italy in a given situation receive the traffic sign displayed in the windshield in the Finnish form s/he is accustomed to or in the Italian form as used on the road in Italy? …

As a consequence any given representation for an information or instruction may

- in a different situation;
- for a different person;
- at different times of the day, of the year, …;
- in a different location;
- for a different culture;
- etc.

become inadequate and has to be replaced by a more appropriate representation. Needless to say that there can be a choice of two or more appropriate representations.

For all of the so far mentioned aspects the basic requirement:

- to avoid over-masking – i.e. information over-flow for the driver (which may be individually different from driver to driver)

is valid and has to be taken into account.

5.5 Impact on data modelling

These factors and aspects could require an approach, by which ***all kinds of representations*** are treated with the ***same basic data model,*** in which any given representation requires

- attributes and/or characteristics and/or properties and/or conditions,

or even

- sets of such attributes and/or characteristics and/or properties and/or conditions,

which may have relations among each other. The hypothesis formulated here is that, if such a basic data model can be conceived, the total record structure for all kinds representations of a given meaning comprises a set of basically the same or highly similar smaller data structures (=micro data models), which makes the whole record structure "simple" (=reduced complexity by means of a higher granularity at the level of attributes and/or characteristics and/or properties and/or conditions, etc.

However, there may be relations between (sets of) attributes and/or characteristics and/or properties and/or conditions etc. belonging to different representations within the same record. In addition meta-information items/units, such as

- thesaurus entries,
- classification entries,
- keywords,

which are also representing "concepts" (and may be multilingual, multimodal etc.), will have to be used – at least in the total information system of distributed federated repositories, from which the individual representations are taken from in order to be used in a given situation in a targeted location. The availability of such individual (centrally deployed) content items/units under special circumstances (such as in a tunnel, in case of regional black-out, etc.) will also have to be considered in future technical development.

The above-mentioned repositories/registries do not only refer to the content items/units themselves, but also to

- the semantic and syntactic specifications of individual metadata;
- micro data models;
- conversion routines (e.g. for replacing types of representations by others);
- meta models;
- combinatory relations between content items/units and their attributes and/or characteristics and/or properties and/or conditions, etc.

There will certainly not be ONE monolithic methodology for coping with this complexity, but probably a ***harmonized mix of methodologies*** will emerge.

Generally speaking, under the perspective of ***ubiquitous and pervasive computing***, technology should gradually disappear behind content and the user-friendly presentation of content. 'Soft' aspects, like culture and emotion, increasingly influence trust, and need to be considered in information design. This development also necessitates ***multi-channel*** approaches without media-breaks in traffic telematics. Furthermore, at political level the issue of ***accessibility*** (incl. the requirements of people with special needs) is gaining more attention at national (e.g. "common-look-and-feel" [CLF] in Canada) and international levels (e.g. "Information for All Programme" [IFAP] of UNESCO).

Tim Berners Lee's conception of the ***Semantic Web***, therefore, needs some extensions from the point of view of future mContent (mobile content – i.e. digital content retrieved or provided through mobile devices). In order to be efficient and effective, this generalized ***s***emantic ***w***eb must provide ***rules and procedures as well as organizational frameworks*** to

guarantee or at least support ***different kinds of interoperability***, such as technical, operational and semantic interoperability:

- throughout the enterprise/organization,
- between enterprises/organizations,
- within and between industry consortia,
- within and between industry branches,
- among different e…s (i.e. eLearning, eBusiness, eHealth, eGovernment, etc.),
- between different language communities,

which requires many new (incl. new types of) methodology standards and especially open standards as developed by the official standards bodies. Some of the above statements also apply to traffic telematics systems used locally, regionally, nationally in EU member countries.

5.6 Methodology standards

In this connection some ***fundamental methodology standards*** valid for all application fields (viz. eLearning, eBusiness, and other e…s) need to be developed, which will pave the way for semantic interoperability under the requirements of

- multilinguality;
- cultural diversity;
- multimodality (incl. speech-to-written and written-to-speech conversion);
- accessibility (incl. the requirements of people with special needs);
- multi-channel presentations.

All of them comprise to a larger or lesser degree 'soft' aspects, which have to be considered at the earliest stage of software design long before implementation. In this early stage of software design, special care must be taken that the data models used for structuring the content items/units correspond to those used for the technical type of presentation. Only this ensures the ***utmost re-usability of content items/units*** as well as ***utmost internationalisability, localisability and personalisability for any purpose*** in any potential situation in space and time. This requirement only follows the basic "rules" of comprehensive and consequent content management, namely

- single sourcing,
- resource sharing.

In this connection it must be clarified that ***semantic interoperability*** can/must be further sub-divided into

- lexical-syntactic interoperability,
- conceptual interoperability (incl. terminology, language resources, classification, ontologies, etc.),
- pragmatic interoperability (comprising also the aspects of cultural diversity, etc.).

Beside, on the basis of the above-mentioned fundamental methodology standards ***basic methodology standards***, which are specific to certain broad application fields, will ensure semantic interoperability within the same application area.

Major mobile telephone companies (telcos) and MT (mobile telephony) service providers have recognized that the further development of business via MCC (mobile computing and

mobile communication extending towards e-business, m-commerce etc.) is based on three pillars:

- content,
- technology,
- business models.

For content related businesses there are three key success factors, namely appropriate solutions for:

- efficient use of language (incl. human language technologies /HLTs/ and also multilinguality...);
- existence of standards (especially methodology standards referring to multilinguality, metadata, data modelling and XML application...);
- transfers (of content first of all, but also concerning broadband access, micro-payment systems etc.).

This may also have a bearing on the traffic telematics aspects dealt with in the IN-SAFETY project.

6 Datamodel for IN-SAFETY verbal messages

6.1 Typology of traffic sign message elements

Pictograms (DE: Sinnbilder) can be:

- pictogrammatic-"morphologic" elements of traffic signs
- graphic symbols
- additional panels to traffic symbols

Some are combinable with other (verbal or graphic) additional information.

Additional panels **(DE: Zusatzzeichen) can contain:**

- pictograms
- alphanumeric information
- graphic symbols (e.g. arrows, etc.)
- combinations thereof

There are ***traffic signs containing*** integrated

- pictograms or graphic symbols (as semiotic-'morphologic' elements)
- alphanumeric information
- combinations thereof

and others being ***supplemented by additional panels***, which contain

- pictogrammatic symbols or
- graphic symbols or
- alphanumeric information or
- a combination thereof.

Alphanumeric information (= verbal or quasi-verbal) being the central part of a traffic sign or being integrated in regular traffic signs or in their additional signs:

- Emergency, Police, WC, … (+ TEL symbol) + distance indication…
- (Names:) London, Paris, etc.

- EXIT, STOP, give way 50 ys, etc.
- One-way, …zone, beginning/end of …, etc.
- Slippery road: if raining, if freezing, if dirty, etc.
- (Time indications:) on Sundays and holidays, from 20h to 06h, etc.
- H (= bus stop in DE), U12 (temporary or permanent re-routing)
- (Distances:) 100m (in 100m; from here 100m… – e.g. railway crossing)
- (Other measurements:)
    - 5,5t (gross weight), 8t (axle weight), etc.
    - 2m (width), 3.8m (height), 10m (length, distance, …)
- (Speed:) 80 (= 80km/h) + time (period) indication
- (Degrees:) 10% (gradient road, dangerous hill), 0° (temperature), etc.

The traffic signs (comprising integrated "morphologic" elements or not) and their additional panels (comprising integrated "morphologic" elements or not) can have:

- simple designations such as: curve, warning, STOP, etc.
  (which are more or less self-explanatory);
- simple designations, such as gradient road, which, however, more often than not may mean something like "Steep downgrade – You should shift to a lower gear. The degree of the slope is shown");
- 'difficult' legal designations (used in law) vs. popular names (used for instance in driving schools);

and may need a new short/concise and easy to understand name and/or explanation in real traffic situations.

6.2 Verbal messages

In real application the written form of a verbal message could be literally different from the spoken form. But in traffic telematics both have to be considered as 'equivalent/synonym', even if their 'linguistic outer form' may be quite different.

Any non-verbal traffic sign or additional panel (or traffic sign/additional panel containing both verbal and non-verbal information) can be represented by

- ***a (sometimes 'difficult' to understand) legal designation***
  (often with additional explanation, which may be different for written display than for the spoken form);
- ***a (easy to understand) popular name*** (possibly with additional explanation, which may be different for written display than for the spoken form);
- ***(potentially) in any language or language combination.***

The legal designation in one language may be perceived as 'difficult' by people, but quite simple and easy to understand in the language of another language community. Popular names may exist in some languages, but not in others.

Although the degree of harmonization of traffic/road signs and signals used on highways, high-speed motorways etc. can be considered as quite high there still exists considerable variation even among those highly harmonized traffic/road signs. Furthermore there may be (temporary or permanent) local conditions beyond planning/imagination, such as

- individual topographic conditions: slopes, curves, etc.;
- special micro-climatic conditions ;
- other special conditions (e.g. on, under and around bridges; before, in and behind tunnels, etc.);

which have also to be reflected on traffic signs (including variable messages), which also applies to verbal messages. This does not yet include some national exceptions and new requirements emerging from developments in the direction of dynamic traffic signs.

Because

- security is at stake especially when driving at high speed (or too slowly on high-speed motorways)
- highways have been and will be increasingly used for transit (in the form of heavy traffic, tourists etc.)
- tourism between European countries will increase (incl. foreigners from abroad hiring cars, etc.)

the investigation on verbal messages is focusing on those occurring on highways.

6.3 New VMS

According to the "White Book for VMS application" (VAMOS 1991) a large number of VMS systems are coming into use throughout Europe. Their use for communicating with drivers is not new, but it has been much more common in recent years. The first applications were born to cope with local problems. Nevertheless, new technical possibilities offered may also lead to a less effective and indiscriminate use of VMS at national level and European level.

Thanks to these new technical possibilities, the use of (monolingual as well as multilingual) verbal messages may proliferate. The Convention on Road Signs and Signals (Vienna, 8 November 1968) stipulates under "Informative Signs" Art. 14 "4. A sign shall not bear inscriptions in more than two languages." This stipulation should also be applied to any multilingual messages on traffic signs. Also under "Informative Signs" the Convention stipulates in Art. 15 "Advance direction signs": "Advance direction signs shall be placed at such distance from the intersection as will make them most effective both by day and by night, having regard to road and traffic conditions, including the normal speed of vehicles and the distance at which the sign is visible; this distance need not exceed about 50 meters (55 yards) in built-up areas but shall be not less than 500 meters (550 yards) on motorways and other roads carrying fast traffic. The signs may be repeated. An additional panel placed below the sign may show the distance between the sign and the intersection; this distance may also be shown on the lower part of the sign itself. This has also to be considered for all kinds of verbal messages appearing on VMS.

In some European states there are no specific standards for VMS signs, and the regulations for fixed signs apply. In states where specific regulations for VMS signs do exist, they may differ from those that are in force in another state. Consequently different symbols are sometimes used on VMSs to carry the same meaning. There are currently no general European standards for controlling the appearance of VMS signs. Some of the pictograms currently in use on VMS closely resemble those in use on fixed signs. Others

use versions which are perhaps more suited to the technologies being used for their display. The COST 30 committee (COST 30 Electronic Traffic Aids on Major Roads http://www.cordis.lu/cost-transport/src/cost-30.htm) made recommendations to the European Conference of Ministers of Transport that for some pictograms and symbols a reversal of contrast should be permitted as this would better suit certain VMS technologies (e.g. light emitting lamp and fibre optic matrix signs). The recommendation was that these should be incorporated in the European Protocol on Road Traffic, Signs and Signals so that, for example, speed limit signs could still retain their legal status while not conforming to the existing colour and contrast requirements for fixed signs.

The Convention on Road Signs and Signals (version 2004-08-07) stipulates under Art. 8, p. 9:

> "1. In order to facilitate international understanding of signs, the system of signs and signals prescribed in this Convention is based on the use of shapes, and colours characteristic of each class of sign and, wherever possible, on the use of graphic symbols rather than inscriptions. Where Contracting Parties consider it necessary to modify the symbols prescribed, the modifications made shall not alter their essential characteristics.
>
> 1. bis. In cases where variable message signs are used, the inscriptions and symbols reproduced on them must also conform to the system of signs and signals prescribed in this Convention. When, however, the technical requirements of a given type of system of signs and signals so warrant, particularly so as to ensure satisfactory legibility, and provided that no error of interpretation is possible, the prescribed dark-coloured signs or symbols may appear in a light colour, light-coloured backgrounds then being replaced by dark backgrounds. The red colour of the symbol of a sign and its border shall not be changed.
>
> …..
>
> 3. Nothing in this Convention shall prohibit the addition, in order to facilitate the interpretation of signs, of an inscription in a rectangular panel below the sign or in a rectangular panel containing the sign; such an inscription may also be placed on the sign itself, if this does not make the sign more difficult to understand for drivers who cannot understand the inscription.
>
> 4. Where the competent authorities consider it advisable to make the meaning of a sign or symbol more explicit or to limit the application of a sign to certain periods, this can be done by inscriptions on the sign as provided in Annex 1 to this Convention or on an additional panel. If regulatory signs are to be restricted to certain road-users or if certain road-users are to be exempt from the regulation, this is done through additional panels according to Annex 1, section H, paragraph 4 (panels H, 5a; H, 5b; and H, 6).
>
> 5. The ***inscriptions*** referred to in paragraphs 3 and 4 of this Article shall be in the ***national language*** or in one or more of the national languages, and also, if the Contracting Party concerned considers it advisable, in ***other languages***, in particular official languages of the United Nations.

In this connection it may be highly commendable to constrain some of the technical possibilities of new VMS display technology (e.g. to be able to display millions of

coulours, to put any verbal information, video clip or whatsoever non-traffic related information on VMS), which otherwise could have a disturbing effect on the VMS data models – not to mention the confusing/distracting effect for the driver.

A wide variety of display technologies are currently in use. The following is not intended to be an exhaustive list, but serves to illustrate this variety:

- Roller blinds
- Rotating planks
- Rotating prisms
- Magnetic flip discs
- Lamp matrices
- Fibre optic matrices (macro and micro dot)
- Light emitting diodes
- Liquid crystal displays

In the long run freely programmable VMS display boards will become less expensive and more and more appropriate, due to their high versatility in use.

Although it is advisable to avoid text messages where possible (especially in high-speed driving situations), there is – according to the White Book – a clear trend to combine text messages with pictograms and thus exploit more fully the flexibility offered by the display capabilities of VMS signs. If properly used, text messages provided via VMS can increase driver comfort. But it may increase communication barriers to the ever increasing number of foreign drivers on European highways.

The White Book itself states that the flexibility of the textual interface can give rise to new problems, that hitherto have been addressed in different ways. In the appendix a repertoire of text messages is presented as a contribution to the standardisation process underway in the European Road Transport Environment. The repertoire was produced by the VAMOS consortium after a careful analysis of the currently most commonly used text messages, followed by discussions with VMS manufacturers and road network operators and a compatibility analysis of a similar repertoire prepared for RDS-TMC messages. Given the fact that increasingly all European highways will face requirements for multiple bilingual information more or less everywhere, we suggest

- to replace as many as possible verbal messages by pictograms or
- to replace them by pan-European verbal “icons” (which are perceived equivalent to pictograms, such as STOP, TAXI…) or
- to use combinations thereof

thus making the information to the driver ***language-independent***. Increasingly information functions of the VMS displays could be transferred to the in-vehicle information/communication systems (where there are more possibilities for personalization, including localization of verbal messages).

6.4 Terminology database (TDB and terminological data modelling approach

For maintaining the terminological data as well as language resources

- the application of a terminology management system;

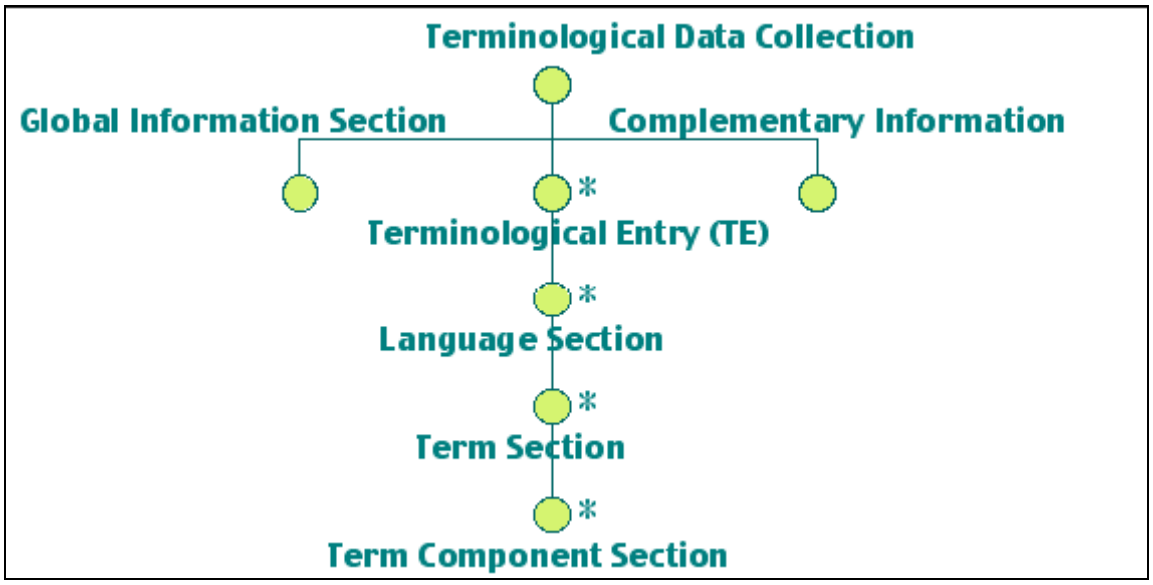
- taking into account relevant standards on
  - terminology,
  - data modelling;
- taking into account existing research results on terminology data processing;

is a sine qua non.

There exists a lot of experience in the field of data modelling for the design and implementation of terminological databases or for terminology interchange formats. This experience is published – among others – in international standards such as:

- ISO 12200:1999 Computer applications in Terminology – Machine-readable Terminology Interchange Format (MARTIF) – Negotiated Interchange
- ISO 12620:1999 Computer applications in Terminology – Data Categories
- ISO 16642:2004 Computer applications in terminology - Terminological markup framework (TMF)

While ISO 12620 lists and describes more than 200 data categories useful for terminological applications, ISO 12200 and ISO 16642 define a general terminological meta model that should be the basis for all terminological data collections (terminological data bases as well as terminology interchange formats).



(The terminological meta model as defined in ISO 16642:2004)

The ***Terminological Data Collection*** is the top level container for all information contained in a terminology management system, in a terminology data base or in a terminology data file (e.g. for data interchange). Generally it is composed by other containers.

The ***Global Information Section*** contains general information that applies to all elements represented in a terminological data collection. Usually it contains, for example, the title

of the (XML) file, the institution or individual originating the file, address information, copyright information, update information, etc.

The ***Complementary Information*** usually contains, for example, textual bibliographical or administrative information residing in or external to the terminological data collection, static or dynamic graphic images, video, audio, or virtually any other kind of binary data. It might also include references to other terminological resources or contextual links to related text corpora or to ontologies. These items are often designated as shared resources because they are available to all points in a terminological data collection and are not repeated for different entries.

The ***Terminological Entry*** is a container for all information that pertains to a single terminological concept; therefore this container should be repeatable for each concept entry being part of the terminological data collection. It usually contains, for example, the terms assigned to a concept, descriptive information pertinent to a concept, and administrative information concerning the concept. It can contain one or more language sections depending on whether the terminological data collection is monolingual, bilingual, or multilingual.

The ***Language Section*** contains all the terminological information (of a given concept entry) that are used in a given language. Usually it contains, for example, definitions, contexts, etc. associated with that language or the terms in that language. The language section must be repeated for every language treated in the relevant concept entry.

The ***Term Section*** contains information about the term, and the term itself. If more than one term represents the concept in a given language, the term section must be repeated. Usually the term section contains a single term used to designate the concept, as well as any other information (e.g., grammatical information, contexts, etc), associated with that term.

The ***Term Component Section*** contains information about elements of the term, e.g. morphemic elements, words, or contiguous strings from which a polynomial term is formed. In some languages, such as German or English, it is frequently unnecessary to distinguish information about the individual components making up a polynomial term. In other languages, such as French or Spanish, it is important to be able to include information such as gender for the individual words used in constructing a multiword term because this information is necessary when using the term in texts.

6.5 Proposal for an In-Safety meta model

The terminological meta model can be used as a basis for a traffic sign meta model needed in the framework of the In-Safety Project. The following major reflections have to be taken into account:

- Replace ***Language Section*** by ***Locale Section:***
  In multilingual terminology management, terms are handled by language, e.g. the German term, the English term etc. If there are geographical variations or restrictions

in the use of terms, e.g. English: *windshield (US)* vs. *windscreen (UK)*, several term sections for each term are created and the term is attributed by a country code.
Traffic sign applications must be modelled differently, since national variations of traffic signs are based on national regulations and conventions. Therefore the Language Section of the terminological meta model is replaced by a Locale Section. The concept of locale is taken from software localization (LISA) where it defines a geographic region with its specific language, character code, writing direction, unit of measurement, display of dates etc. A locale is e.g. the French speaking part of Switzerland.

- Replace ***Term Section*** by ***Representation Section***
  In terminology management, concepts are mainly represented by terms. Although there are sometimes illustrations or other graphics that have to be managed by a terminology database, these items are handled as language-independent data category and stored directly at the concept level.
  Traffic sign representations and verbal messages have to be maintained in a written or spoken form; other multimodal representations are also conceivable (e.g. haptic). And graphical representations of traffic signs may differ from locale to locale. Therefore the Term Section of the terminological meta model is replaced by the more general Representation Section.

- Don't make use of an explicit Term Component Section
  In terminology management applications, there is a need – mainly for Romance languages multi-word terms – to maintain information on parts of the term.
  For traffic sign databases, information on parts of the sign itself, parts of textual information in the traffic sign, or parts of verbal messages should be handled differently. The reason is that on the one hand a detailed and structured linguistic descriptions of parts of textual messages is not as important as for terminology, and on the other hand morphologic elements of traffic signs and textual messages could be better described and retrieved as autonomous entries (with a different entry type).

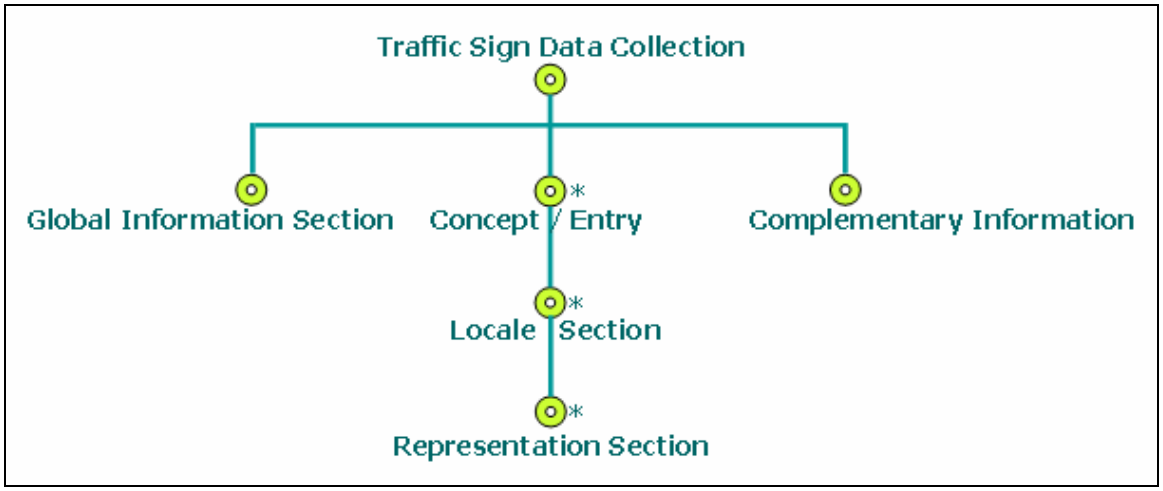
Besides these reflections concerning the adaptation of the terminological meta model for a traffic sign meta model, two other main terminological modelling principles have to tested for its suitability.

- ***Concept Orientation***
  Any terminology management application should support the principle of concept orientation. As the concept is the main organization principle for terminology collections, all information belonging to one concept has to be maintained in one terminological entry, and information belonging to another concept has to be stored in another separate entry. Above all, homonyms or polysems should be managed in two or more separate entries, e.g. terminological information for the polysemic term "mouse" has to be stored in two concept entries, one for the mouse as a small animal, and one for the mouse as a pointing device for computers. The principle of concept orientation is in contrast to the principle of word or term orientation, dictionaries or other lexicographical applications are following.

Also traffic sign data bases have to support the principle of concept orientation, since all information belonging to one specific traffic sign will be stored in one conceptual entry. Traffic signs have to have a much lower degree of ambiguity than words or terms of natural languages; otherwise (the almost context-free) communication on the road will not function, and accidents and misunderstandings will happen. Therefore "homonymic" traffic signs will only occur very rarely.

- ***Term Autonomy / Representation Autonomy***
  In most terminology management application the principle of term autonomy is implemented. Term autonomy stands for a data modelling principle allowing each term representing the concept to be documented with all necessary data categories. To be more explicit, the main term, any synonym, any abbreviated form of the term, and any orthographic variant must be allowed to carry additional data categories such as grammatical gender, part of speech, geographical usage, context example, source reference, product code etc. Terminology databases with term autonomy don't have data categories like synonym, variant or abbreviation; they repeat blocks of term-related data categories for each of the terms representing the same concept. For traffic sign data bases, we have proposed to replace the term section by a representation section (see above). Therefore we should rename term autonomy to ***representation autonomy***.
  For the design of traffic sign databases, representation autonomy means that all representations of a traffic sign (graphic, verbal, haptic etc.) within one locale should be repeatable and documentable by additional data categories such as source or status.

On the basis of these considerations, IN-SAFETY specific "structured content" (at the level of lexical semantics) requires the following adaptation of the present terminology data model:



(The traffic sign meta model for In-Safety)

The ***Traffic Sign Data Collection*** is the top level container for all information contained in a traffic sign data base or in a traffic sign data file (e.g. for data interchange). Generally it is composed by other containers.

The ***Global Information Section*** contains general information that applies to all elements represented in a traffic sign data collection. Usually it contains, for example, the title of the (XML) file, the institution or individual originating the file, address information, copyright information, update information, etc.

The ***Complementary Information*** usually contains, for example, textual bibliographical or administrative information residing in or external to the traffic sign data collection, static or dynamic graphic images, video, audio, or virtually any other kind of binary data. It might also include references to other traffic sign resources. These items are often designated as shared resources because they are available to all points in a traffic sign data collection and are not repeated for different entries.

The ***Concept Entry*** is a container for all information that pertains to a single traffic sign concept; therefore this container should be repeatable for each concept entry being part of the data collection. It usually contains, for example, the graphic sign assigned to a concept, descriptive information like a sign classification, and administrative information concerning the concept. It can contain one or more locale sections depending on whether the data collection covers one or more national traffic sign regulations.

The ***Locale Section*** contains all the traffic sign information (of a given concept entry) that are used in a given country or geographical region (locale). Usually it contains, for example, sign names, explanations or driver instructions, etc. associated with that locale. The locale section must be repeated for every national or geographic region treated in the relevant concept entry.

The ***Representation Section*** contains information about the representation of the traffic sign. If more than one representation is possible in a given locale, the representation section must be repeated. Usually the representation section contains a single representation of the traffic sign, as well as any other information (e.g., status, source, etc), associated with that representation.

6.6 Proposal for an In-Safety set of data categories

The following table lists a proposed set of data categories for the documentation of traffic signs on the basis of the traffic sign meta model.

DatCat Name	Type/Values	Description	Level
ConceptEntry	Structural element	Groups all data belonging to one traffic sign (MultiTerm: Entry level)	Struct
EntryType	Picklist	Indicates the type of the entry	Entry
	traffic sign	Picklist value of EntryType	
	traffic sign element	Picklist value of EntryType	
SignClass	Picklist	Indicates the type of the traffic sign	Entry

		(according to Vienna Convention)	
	danger warning sign	Picklist value of SignClass (acc. to VC Annex 1, Section A)	
	priority sign	Picklist value of SignClass (acc. to VC Annex 1, Section B)	
	prohibitory or restrictive sign	Picklist value of SignClass (acc. to VC Annex 1, Section C)	
	mandatory sign	Picklist value of SignClass (acc. to VC Annex 1, Section D)	
	special regulation sign	Picklist value of SignClass (acc. to VC Annex 1, Section E)	
	information, facilities or service sign	Picklist value of SignClass (acc. to VC Annex 1, Section F)	
	Direction, position or indication sign	Picklist value of SignClass (acc. to VC Annex 1, Section G)	
	additional panel	Picklist value of SignClass (acc. to VC Annex 1, Section H)	
InternationalName	Text	International name of the traffic sign	Entry
LocaleSection	Structural element	Groups all data belonging to one locale (country + language) (e.g.: ATde) (MultiTerm: Index level)	Struct
LocalClass	Picklist or text	Indicates the type of the traffic sign (according to the national/local Convention) (local picklist values or free text)	Locale
SignName	Text	Local name of the traffic sign (in national language) (MultiTerm: term level)	Locale
NameElements	Text	Morphologic elements of the local name of the traffic sign	Repres
GraphSign	Multimedia	Local graphical representation of the traffic sign	Locale
SignElements	Text	"Morphologic" elements of the local graphical representation of the traffic sign (hyperlinked to traffic sign element entries)	Repres
Explanation	Text	Verbal description of the meaning of the traffic sign (in national language)	Locale
IntExplanation	Text	English translation of the explanation	Locale
DriverInstruction	Text	Verbal information for the driver (in national language)	Locale
RequiredAction	Text	Action required of the driver (in national language)	Locale
Source	Text	(legal) reference to the source, where the SignName, GraphSign, Explanation, or IntExplanation is defined	Repres
Status	Picklist	Status of the SignName, GraphSign Explanation, or IntExplanation	Repres
	legal	Picklist value of Status	
	official	Picklist value of Status	
	regional	Picklist value of Status	

	local	Picklist value of Status	
	deprecated	Picklist value of Status	
	out of use	Picklist value of Status	
	commonly used	Picklist value of Status	

The position of the data categories within the meta model and the hierarchical structure of a traffic sign entry is described by the following list.

ConceptEntry
- EntryType
- SignClass
- InternationalName

- LocaleSection *
  - LocalClass
  - GraphicSign *
    - Status
    - Source
    - SignElements
  - SignName *
    - Status
    - Source
    - NameElements
  - Explanation *
    - Status
    - Source
  - IntExplanation *
    - Status
    - Source
  - RequiredAction *
  - DriverInformation *

* *repeatable data category (or group of data categories)*

The data categories implemented as closed data categories with a defined set of possible values (picklist) are:

- EntryType: traffic sign, traffic sign element
- SignClass: danger warning sign, priority sign, prohibitory sign, mandatory sign, informative sign, road marking, additional panel
- Status: legal, official, regional, local, out of use, deprecated, commonly used

6.7 IN-SAFETY data model and ontologies

There are many different types of ontologies as knowledge ordering tools/methods, which basically can be subdivided into those, that are strongly content-oriented (in the form of knowledge-enriched terminologies), and those, that are strongly formal relations-oriented

(focusing on relations between entities, whatever these may be). Because of its high degree of granularity the data model outlined above allows for seamless further extension into:

- modestly knowledge-enriched terminologies (as for instance needed in the description of traffic sign boards for production purposes);
- heavily knowledge-enriched terminologies (as may become necessary for transnational traffic management systems).

It should also be possible to easily produce (semi-)automatically different kinds of "formal ontologies", topic maps and the like on the basis of this data model.

7 Design for a Cluster of Repositories for IN-SAFETY Messages (CRIM)

*Messages (here understood as **locales**) can be graphic-pictogrammatic VMS or verbal messages or combinations hereof.*

7.1 Definitions

***register**:* (acc. to ISO 11179 referring to repositories) an official list in which items are recorded for reference (list of elementary data in which the meaning – i.e. the semantics – of these data is defined)

***registry**:* a place where registers are kept *and maintained according to operational and organizational rules*

repository: electronic store of structured information (such as EDIFACT messages, X12 messages, XML messages)

global semantic interoperability: semantic interoperability, which is "global" from the geographical point of view as well as from a systematical point of view.

"Structured content", such as traffic sign information, couzld be stored and maintained in databases (repositories). Because of the linguistic variation, distributed databases are recommendable. For the sake of global ***semantic interoperability***, a ***federated database system*** seems to be the most appropriate.

7.2 Framework of rules for CRIM

The conceptual framework of rules for CRIM should be conceived following the principles of comprehensive content management:

- single source;
- resource sharing;
- based on metadata methodology (and XML-based);
- metadata, micro-datamodels and meta models repository/ies;
- solution to legal and economic (e.g. business model) aspects;
- workflow management of distributed (i.e. web-based) cooperative content creation and maintenance:
    - top-down aspects, such as
        - general organization,
        - general operation,
        - change rules (incl. real-time decision-making...);

  - bottom-up aspects
    - creation of content items/units,
    - maintenance of content items/units,
    - proposal/submission system;
- workflow hierarchy according to language or other aspects (secondary /=e.g en, de, it, …/ repositories receive data from primary /=1st instance data creation/ repositories).

This would support, if not guarantee ***global semantic interoperability.***

7.3 Structure of CRIM

ONE lead repository for all INSAFETY messages (+ attributes and all related data), or – more likely – a set of lead repositories according to major types of content (all modelled according to metadata methodology).

This one lead repository or these few lead repositories will also contain or be linked to

- content descriptions for every individual message item;
- additional necessary or useful information (in structured form);
- spoken/pronounced messages (computer-generated);
- non-verbal representations of message:
  - visual,
  - audio (other than spoken/pronounced),
  - audio-visual,
  - multimedia,
  - haptic,
  - etc.

Secondary repositories according to types of content (not necessarily in same combination as at lead repository level, but all modelled according to metadata methodology):

- for different language versions:
  - +additional necessary or useful information (in structured form),
  - +spoken/pronounced messages (computer-generated);
- for deviating (or locally defined) non-verbal representations of message:
  - visual,
  - audio (other than spoken/pronounced),
  - audio-visual,
  - multimedia,
  - other (such as haptic).

Tertiary repositories for recurring elements in primary and secondary repositories (all modelled according to metadata methodology), such as:

- names (by language/country):
  - proper names:
    - geographical names,
    - names of institutions,

        - names of persons,
        - names of languages,
        - names of currencies + converter (e.g. for indicated fines);
    - other names:
        - non-proprietary names,
        - generic names (e.g. “archaeological site”);
- legal provisions (by country [or its sub-divisions] + EU + international);
- properties:
    - measurements (and conversion routines: e.g. metric into non-metric) and their values,
    - numerical values ,
    - others.

8 Standardization and certification

Whenever aspects of traffic signage and traffic system control are concerned, laws and other regulations as well as technical rules (including standards) can become the basis of certifications schemes.

Certification is when a third party gives written assurance that a product, service, system, process or material conforms to specific requirements (preferably based on formal standards). Today industry – especially the IT industry – prefers to follow “***standards conformity and interoperability assessment***” replacing commonly used “certification” (in the sense of the proliferation of self-proclaimed certification schemes). (s. Annex 2 for details)

In connection with the IN-SAFETY results there may be primary and secondary certification aspects, provided they lead to national or European standards:

Primary ***standards conformity and interoperability assessment*** (certification) aspects:

- quality certification (especially QMS [quality management system] certification)
- quality of data repositories (as well as data modelling methods and technical implementation of formats, transactions, etc.)
- quality of /traffic/ system design and implementation
    - project management of system development
    - data models and metamodels
    - user-friendliness of information design etc.
    - system integration capability
    - content management approach
        - data updating and maintenance (incl. workflows)
        - localization management
- multilinguality capability of
    - user interfaces
    - data and data models
    - technical documentation, manuals, etc.

  - localization capability
    - between “national” languages
    - between “local” cultures
- interoperability referring to
  - integration capability (concerning technical, organizational and syntactic interoperability)
  - semantic interoperability
- other primary standards conformity and interoperability assessment aspects

In this connection standards conformity and interoperability assessment can refer to

- products and services
- processes and procedures/practices/methods/operation
- personnel employed in the above-mentioned aspects and applications (personnel certification)
- external services (experts, consultants, trainers, etc.)
- combinations of the above.

Secondary ***standards conformity and interoperability assessment*** (certification) aspects:

- training
  - training content and content presentation
  - trainers
  - trainees (incl. trained managers)
- consultancy services
- web services
- combinations of the above.

9 Recommendations

- A2.3 should concentrate on the safety relevant traffic signs and messages; in this connection it should be considered, whether bilingual VMS such as:
  - two signs of same content in two languages are placed one after the other in a certain distance;
  - two signs of same content in two languages are placed side by side (or near to each other);
  - the message in two languages is displayed on one VMS board split in left and right halves; *(special case: traffic signs with bilingual verbal message element, such as ZONE…)*
  - the message in two languages is displayed on one VMS board split in top and down halves; *(special case: traffic signs with bilingual verbal message element, such as DOUANE…)*
  - the message in two languages is displayed on one VMS board, every message element in two languages one below the other;

will not become obsolete due to increased use of ***co-operative in-vehicle systems***.

- Whenever possible IN-SAFETY should consider competing or complementary conventions in road maps (also displayed by in-vehicle navigation systems), signage in airports and train stations, etc.
- If personalization features of co-operative in-vehicle systems would become more or less fully compliant with political, historical as well as other reasons for bilingual signage, preference should be given to in-vehicle representation of the message in personalized form. This would also apply in the case that future VMS message displays become (fully) freely programmable.
- Whenever possible IN-SAFETY should give preference to standardized displays of hours, date, measurements etc.
    - The European Union has a directive as a result of which non-SI markings will be banned after 2009 December 31 on any goods imported into the European Union. This will probably also apply to traffic signage. *For data management concerning non-SI data there are standardized conversion rules and the respective standards-compliant converters.*
    - The international standard for the notation of date and time of the day is ISO 8601:2004 "Data elements and interchange formats – Information interchange – Representation of dates and times" (adopted as European Standard EN 28601) is now a valid standard in all EU countries and all conflicting national standards have been changed accordingly.
- UNICODE should become the base standard for the representation of verbal messages in written form – at least in the centralized server or cluster of federated servers for VMS message signs. *In individual displays to the driver (due to technology or other constraints) the message may have to be "deprecated" in one way or other. But deprecation of the written form of verbal messages should not start from the central servers.*
- In any case such central servers would need a multilingual data model from the outset (e.g. in Germany with versions in Polish for VMS at the boarder to Poland, in Czech at the boarder to the Czech Republic, in French at the boarders to France&Belgium-Wallonia&Luxembourg, in Dutch at the boarders to The Netherlands&Belgium-Flanders, in Danish at the boarder to Denmark, etc.).
- The multiple bilingual requirements for signage in nearly every country in Europe should not be limited to European languages, but should also take into accounts the needs of foreign drivers from farther countries (e.g. Finnish truck drivers in France) or countries outside of Europe (e.g. Japanese tourists with their personalizable navigation systems).
- The complex linguistic situation of traffic signage requires a terminological approach to data modelling, which is based on pertinent standards and standardization activities (s. Annex 2), and which is unlimited multilingual due to its language-independent approach.
- The systematic terminological approach in consultation with IIID may lead to proposals to harmonize certain multilingual verbal messages, or to reduce them to pan-European symbols, or to replace them by non-linguistic symbols.
- The approach to consider a cluster of federated repositories for a systematic (but possibly distributed) administration of future VMS messages is recommended.

This requires also a (possibly one) central server for the metadata of all VMS message elements.

- Given the fact that increasingly all European highways will face requirements for multiple bilingual information more or less everywhere, we suggest
  - to replace as many as possible verbal messages on VMS displays by pictograms, or
  - to replace them by pan-European verbal "icons" (which are perceived equivalent to pictograms, such as STOP, TAXI…), or
  - to use combinations thereof,

  thus making the information to the driver as much as possible ***language-independent***. Increasingly information functions of the VMS displays could be transferred to the in-vehicle information/communication systems (where there are more possibilities for personalization, including localization of verbal messages).
- As the technical features of new VMS display boards do have an impact on data models for VMS messages (i.e. content, which is THE cost factor over the years!), they should be constrained in a systematic way also reflecting requirements stemming from content representation (such as colour, length of verbal messages, UNICODE character coding, etc.)

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Pertinent standards:

EN 12767:2000 Passive safety of support structures for road equipment — Requirements and test methods. CEN, Brussels, 2000

EN 12899-1:2001 Fixed, vertical road traffic signs — Part1 : Fixed signs. CEN, Brussels, 2001

EN 12966-1:2005 Road vertical signs – Variable message traffic signs – Part 1: Product standard. CEN, Brussels, 2005

EN 12966-2:2005 Road vertical signs – Variable message traffic signs – Part 2: Initial type testing. CEN, Brussels, 2005

EN 12966-3:2005 Road vertical signs – Variable message traffic signs – Part 3: Factory production control. CEN, Brussels, 2005

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CEN/ISSS/CWA 13699:1999 Model for metadata for multimedia information. Brussels: CEN, 1999

CEN/ISSS/CWA 13873:2000 Information Technology – Multilingual European subsets in ISO/IEC 10646-1. Brussels: CEN, 2000

CEN/ISSS/CWA 13874:2000 Dublin Core metadata element set. Brussels: CEN, 2000

CEN/ISSS/CWA 13988:2000 Guidance information for the use of the Dublin Core in Europe. Brussels: CEN, 2000

CEN/ISSS/CWA 13989:2000 Description of structure and maintenance of the web based Observatory of European work on metadata. Brussels: CEN, 2000

CEN/ISSS/CWA 14094:2001 European culturally specific ICT requirements. Brussels: CEN, 2001

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ISO 31:1992 Quantities and units. Geneva: International Organization for Standardization, 1992

ISO 843:1997. Information and documentation – Conversion of Greek characters into Latin characters. Geneva: International Organization for Standardization, 1997

ISO 7001:1990 Public information symbols. Geneva: International Organization for Standardization, 1990

ISO/TR 7239:1984 Development and principles for application of public information symbols. Geneva: International Organization for Standardization, 1984

ISO 9186:2001 Graphical symbols – Test methods for judged comprehensibility and for comprehension. Geneva: International Organization for Standardization, 2001

ISO 639-1:2002 Codes for the representation of names of languages – Part 1: Alpha-2 code. Geneva: International Organization for Standardization, 2002

ISO 639-2:1998 Codes for the representation of names of languages – Part 2: Alpha-3 code. Geneva: International Organization for Standardization, 1998

ISO 1951:1997 Lexicographical symbols and typographical conventions for use in terminography. Geneva: International Organization for Standardization, 1997

ISO 8601:2004 Data elements and interchange formats – Information interchange – Representation of dates and times. Geneva: International Organization for Standardization, 2004

ISO 10241:1992 International terminology standards – Preparation and layout. Geneva: International Organization for Standardization, 1992 (under revision)

ISO/PWI TR 12618 Computational aids in terminology – Design, implementation and use of terminology management systems. (under preparation)

ISO 12620:1999 Computer applications in terminology – Data categories. Geneva: International Organization for Standardization, 1999 (under revision to become ISO 12620-2 Computer applications in terminology – Data categories– Part 2: Terminological data categories)

ISO/CD 12620-3 Terminology and other language resources – Specification of data categories and management of a data category registry for language resources. (under preparation)

ISO/PWI 12620-1: Computer applications in terminology – Data categories – Part 1: Model for description and procedures for maintenance of data category registries for language resources (under preparation)

ISO 16642:2003 Computer applications in terminology – Terminological markup framework (TMF). Geneva: International Organization for Standardization, 2003

ISO/IEC 11179-1:2004 Information technology – Metadata registries (MDR) – Part 1: Framework. Geneva: International Organization for Standardization, 2004

ISO/IEC 11179-2:2005 Information technology – Metadata registries (MDR) – Part 2: Classification. Geneva: International Organization for Standardization, 2005

ISO/IEC 11179-3:2003 Information technology – Metadata registries (MDR) – Part 3: Registry metamodel and basic attributes. Geneva: International Organization for Standardization, 2003

ISO/IEC 11179-4:2004 Information technology – Metadata registries (MDR) – Part 4: Formulation of data definitions. Geneva: International Organization for Standardization, 2004

ISO/IEC 11179-5:2005 Information technology – Metadata registries (MDR) – Part 5: Naming and identification principles. Geneva: International Organization for Standardization, 2005

ISO/IEC 11179-6:2005 Information technology – Metadata registries (MDR) – Part 6: Registration. Geneva: International Organization for Standardization, 2005

ISO/DIS 15836 The Dublin Core metadata element set. (under preparation)

ISO/IEC 6523-1:1998 Information technology – Structure for the identification of organizations and organization parts – Part 1: Identification of organization identification schemes. Geneva: ISO, 1998 (ISO/IEC 6523-1:1998)

ISO/IEC 6523-2:1998 Information technology – Structure for the identification of organizations and organization parts – Part 1: Registration of organization identification schemes. Geneva: ISO, 1998

ANNEX 1

Representation of knowledge at concept level

In the field of terminology over the years a certain clarification concerning concept representations was achieved *(as shown by the concept system "concept representations" below, which is in line with the findings of epistemology):*

1 designation (i.e. short symbolic representation)

1.1 linguistic designation
- term (mono-word terms, multi-word terms [incl. also terms looking like phrasemes])
- abbreviation (incl. initialisms, acronyms, clippings etc.)
- alphanumeric symbol

1.2 non-linguistic designation
- graphical symbol
- other (incl. bar code, etc.)

2 descriptive representation (which can be (1) intensional or extensional and (2) logic, partitive or other)

2.1 linguistic descriptive representation (determination, explanation and other)
- determination* (strict, concise and precise, viz. fully 'systemic' - i.e. no missing elements, no redundancies)
  - logic determination
    - definition (i.e. a logic and intensional determination)
    - logic and extensional determination
  - partitive determination (which can be partitive and intensional, or partitive and extensional)
  - other kind of determination (which can be intensional or extensional)
- explanation (comprising redundancies and/or missing elements, but still referring to the concept system in question)
  - logic explanation (which again can be logic and intensional, or logic and extensional)
  - partitive explanation (which also can be partitive and intensional, or partitive and extensional)
  - other kind of explanation (intensional or extensional)
- other kind of linguistic descriptive representation (e.g. defining context etc.)

2.2 non-linguistic {descriptive} representation (which can also be (1) 'intensional' or 'extensional', and (2) strictly 'systemic' or less 'systemic' similar to determination and explanation)
- graphical {descriptive} representation
- other kind of {descriptive} non-linguistic representation

2.3 hybrid forms of (descriptive) representation

(***'determination'** according to Webster:* in logic, the act of defining a notion [=concept] by adding differentia [=characteristics], and thus rendering it more definite. This corresponds also to similar use in physics <*determination* of nitrogen in the atmosphere> and in natural history <*determination* [=classification] determining the species of minerals, plants etc. to which they belong>)

ANNEX 2

DRAFT

Standardization, best practices and certification

Closely related: standardization, unification and harmonization (together with an array of derived activities)

1 Definitions:

standardization: activity of establishing, with regard to actual or potential problems, provisions for common and repeated use, aimed at the achievement of the optimum degree of order in a given context [ISO Guide 2, 1991]; these provisions take the form of documented agreements containing technical specifications or other precise criteria to be used consistently as rules, guidelines, or definitions of characteristics, to ensure that materials, products, processes and services are fit for their purpose (see ISO Website)

unification: similar to standardization, but carried out – most often, but not always – by highly recognised or respected organizations outside of the framework of formal standardization

harmonization: the process by which differences between standards or regulations issued by different authorities are made compatible or at least ***interoperable***

standards: documented agreements containing technical specifications or other precise criteria to be used consistently as rules, guidelines, or definitions of characteristics, to ensure that materials, products, processes and services are fit for their purpose.
NOTE: International Standards thus contribute to making life simpler, and to increasing the reliability and effectiveness of the goods and services we use. (according to the ISO Website last modified explanation 2002-07-17)

certification: (sometimes used synonymously with registration) process whereby a third party gives written assurance that a product, service, system, process or material conforms to specific requirements (preferably based on formal standards)
NOTE 1: Today industry prefers to follow "***standards conformity and interoperability assessment***" replacing "certification" (in the sense of a proliferation of self-proclaimed certification schemes).
NOTE 2. "***Accreditation***" is the procedure by which an authoritative body gives formal recognition that a body or person is competent to carry out specific tasks. In the ISO 9000 or ISO 14000 context, an accreditation body will accredit – approve – a conformity assessment body as competent to carry out certification in specific business sectors.

2 Standards developing organizations (SDOs) and other rules setting organizations

In a narrow sense, standardization is carried out in the form of ***formal standardization***, which comprises activities carried out by official standards bodies, such as ISO (International Organization for Standardization), IEC (International Electrotechnical Commission), ITU (International Telecommunication Union) at international level; CEN (European Committee for Standardization), CENELEC (European Committee for Electrotechnical Standardization), ETSI (European Telecommunication Standards Institute) at European level; and corresponding standards bodies at national level. The national standards bodies in Europe are as a rule member of one of the international standards bodies as well as of one of the European standards bodies. These formal bodies at international, European and national level in Europe usually have a formal definition of membership and voting procedures. The work usually leads to formal documents (i.e. primarily, but not only standards) that are maintained over time. These documents may acquire a legal status, when endorsed by legislation or administration.

Unification is carried out for instance by the International Union of Pure and Applied Chemistry (IUPAC), which unifies the names of chemical substances, and even the naming rules to be applied in this process. ***Harmonization*** is for instance carried out by organizations of the UN System, if it is not on the basis of a legally binding intergovernmental treaty or international convention. Unification as well as harmonization can take place at international (e.g. by intergovernmental organizations), regional or national levels.

The PWC report (Pricewaterhouse Coopers: 2001) differentiates into

- ***formal standardization*** (as explained above);
- ***semi-formal*** or ***informal standardization***, e.g. by the Internet Engineering Task Force (IETF), the World Wide Web Consortium (W3C), the UNICODE consortium etc.; this also applies to IUPAC and similar non-governmental organizations (NGOs). In the past this kind of widely 'recognized' unification was often called quasi-standardization or – if enforced by big companies or consortia – ***de-facto standard*** or ***industry standard***.
- ***guidelines for best practices*** which can range from all kinds of design guidelines to vendor guidelines;
- ***government regulations*** (***technical regulations*** in ISO terminology) which can have different degrees of legal binding; this refers also to certain types of regulations issued by intergovernmental organizations which are endowed with the respective mandate for this purpose.

Organizations that formally standardize, and often organizations that semi-formally or informally standardize (if they are recognized authorities) are also called ***standards developing organizations*** (SDOs). There are also other legal rules setting organizations at European and international level, such as WHO, ICAO, etc. (for certain aspects, if for instance based on international treaties or conventions).

3 State-of-the-art of multilingual / pan European information systems

The PWC Report (Pricewaterhouse Coopers: 2001) identifies a big need for internationalization – i.e. for the sake of making enterprises fit for multilinguality and cultural diversity (MCD) – with respect to

- protocol and mark-up language
- input/output aspects, such as
  - character sets
  - cultural conventions
  - matching, indexing, ordering and sorting
  - converting content
- linguistic aspects, such as
  - language identification (even going beyond ISO 639 Codes for the names of languages)
  - HLTs and exchange formats
  - multilingual dictionaries
  - language independent semantics
- content and design aspects
- commercial and legal aspects

Big industry at least recognized that there definitely is a need for increased multilinguality in more or less all these aspects, and that a lack of awareness hindered a speedier implementation of MCD aspects in ICTs and its manifold applications. So information – especially on best practices – and standardization/harmonization were recommended as the most prominent remedy factors for this situation which is highly detrimental for Europe's development towards e-Europe.

4 Fundamental methodology standards concerning information and documentation as well as information and language processing in general

The fundamental methodology standards concerning information activities must be observed in any case in order to achieve a high degree of re-usability of data and interoperability of data structures in the IN-SAFETY framework – not to forget long life-cycle considerations, facilitated maintenance and upgrading, etc. Such standards are developed first of all in the Technical Committees:

- ISO/TC 37: ISO Technical Committee 37 "Terminology and other language resources"
- ISO/TC 46: ISO Technical Committee 46 "Information and documentation"
- ISO/IEC-JTC 1: ISO/IEC Joint Technical Committee 1 "Information technology"

of the international standards organizations:

- ISO: International Organization for Standardization
- IEC: International Electrotechnical Commission
- ITU: International Telecommunication Union

which have developed standards of high relevance to the information society – beyond eBusiness (see references). ISO/TC 37 is reflecting to introduce some of the results of the EU Project TDCnet before long into international standardization. In this connection CEN/TC 304 "Information and communication technologies – European localization requirements" need to be mentioned, too. CEN pioneered in collecting 'cultural elements', which are necessary for a systematic approach to localization. Clews/Hjulstad (2000) point out that MCD issues have a bearing on all aspects of e-Europe (incl. eResearch, eSecurity, eWorking, eGovernment, eLearning, eHealth, eAccessibility, eCommerce, eContent, eTransport, etc. – see Clews/Hjulstad: 2000: CWA 14094). The authors have listed pages of information on MCD related standards in their report: "European Culturally Specific ICT Requirements".

At this point it should be mentioned that one of the greatest barriers to information interchange are script related character set problems. Since 1992 the Unicode Consortium, together with ISO/IEC JTC 1/SC 2/WG 2 "Character sets" have been jointly responsible for developing the UCS (Universal Multiple-Octet Coded Character Set standard according to ISO/IEC 10646-1:2000 and ISO/IEC 10646-2:2001 in its ISO/IEC form) and Unicode version 3.2 in its Unicode form. As far as character code values (of all scripts used in official languages of the world) are concerned, the two standards are identical. However, The Unicode Standard (TUS) also standardizes other aspects besides character codes, such as universal transformation formats, ordering rules, directionality, etc. For a truly pan-European information system the implementation of Unicode (i.e. the 16-bit character coding) is the minimum requirement. Although TUS also contains most internationally standardized 8-bit character sets, their parallel implementation would lead to all kinds of tricky technical problems in processing, communication, display etc. ISO/IEC JTC 1/SC 2/WG 2 is already working on the 4-Byte character coding tables for many languages/scripts. Ultimately only these 32-bit coded character sets will provide a solution to all problems related to the processing of scripts.

Many kinds of information are available not only in multilingual form, but also in coded form. These codes are used and shared by most information providers. A number of International Standards – especially with respect to coding of certain information – developed by ISO technical committees require, with a view to their updating or implementation, a competent body which has the requisite infrastructure for ensuring the effective use of these international agreements. These bodies are designated by ISO to serve as maintenance agencies or registration authorities. The data, which they maintain are either of direct concern to the INSAFETY consortium or of primary importance to the handling of INSAFETY messages. In ISO alone 6 maintenance agencies and about 200 registration authorities exist.

5 Metadata related technical and methodology standards

The metadata repositories emerging from the above-mentioned standardization efforts clearly reflect the needs of the *multilingual* information society. It can be said that many international *methodology* standards are still lacking as well as many metadata registries for the respective types of data categories (metadata) as well as for the reference data (i.e.

the respective content items) based on these metadata. In the phase of formulating system requirements as well as content requirements for pan-European networks:

- Technical standards as prepared in a number of technical committees at international level
- Widely applied de-facto standards (e.g. OASIS and other SDOs – standards developing organizations)
- Metadata registers, repositories and registries, should whenever possible, be based on:
  - International standards, such as
    - ISO/IEC 11179 Series "Information technology – Metadata registries (MDR)",
    - ISO/IEC 20944 Series "Information technology – Metadata registry – Interoperability and bindings",
    - ISO/DIS 15836 "The Dublin Core metadata element set", etc.
  - other high-level harmonizing activities related to metadata repositories, such as UN/CEFACT, OASIS, etc.

- Activities of pertinent authorities, industry associations and consortia, etc. as well as Results of past and ongoing pertinent projects should be analysed with respect to:
- Technical and methodology standards of relevance to INSAFETY messages,
- IN-SAFETY related metadata,
- Multilingual aspects of IN-SAFETY related information and ICTs.

There are many standards formulating methods directly concerning IN-SAFETY messages related metadata as well as metadata repositories and registries, such as the above-mentioned:

- ISO/IEC 11179 Series "Information technology – Metadata registries (MDR)",
- ISO/IEC 20944 Series "Information technology – Metadata registry – Interoperability and bindings",
- ISO/DIS 15836 "The Dublin Core metadata element set", etc.

But new needs for such standards are emerging faster, than the respective TCs can comply with. That is why metadata schemas and registries are mushrooming worldwide.

The metadata approach today is state-of-the-art for linking, combining and evaluating information on the web. But as the users increasingly become demanding, such pan-European networks have to ensure a good quality of the contents rendered to the user. The origin of information must be well identified (and its quality validated), otherwise it will not be possible to ensure trust in the reliability of the content. The metadata approach and the use of XML (or its derivatives), while duly taking the requirements of multilinguality and cultural diversity into account, are key prerequisites to fulfil the quality requirements expected by users.

6 Certification

Certification (sometimes used synonymously with "registration") is when a third party gives written assurance that a product, service, system, process or material conforms to specific requirements (preferably based on formal standards). The most well known examples of certification are the certification of quality management systems and environmental management systems as conforming, respectively, to ISO 9000 and ISO 14000 standards. The terms "certification" and "registration" are employed in a broader conformity assessment context than ISO 9000 and ISO 14000 alone and their standardized definitions show that they are not synonymous (except for in the ISO 9000 and ISO 14000 context, where "certification" and "registration" are used interchangeably and they both mean the same thing). Today industry – especially the IT industry – prefers to follow "***standards conformity and interoperability assessment***" replacing commonly used "certification" (in the sense of a proliferation of self-proclaimed certification schemes).

*("**Accreditation**" is a term which in the ISO 9000 or ISO 14000 context is sometimes wrongly used as a synonym for "certification" or "registration". In fact "accreditation" is the procedure by which an authoritative body gives formal recognition that a body or person is competent to carry out specific tasks. In the ISO 9000 or ISO 14000 context, an accreditation body will accredit – approve – a conformity assessment body as competent to carry out certification in specific business sectors.)*

There are primary and secondary certification aspects in connection with the IN-SAFETY results, provided they lead to national or European standards:

Primary ***standards conformity and interoperability assessment*** (certification) aspects:

- quality certification (especially QMS [quality management system] certification)
- quality of data repositories (as well as data modelling methods and technical implementation of formats, transactions, etc.)
- quality of /traffic/ system design and implementation
    - project management of system development
    - data models and metamodels
    - user-friendliness of information design etc.
    - system integration capability
    - content management approach
        - data updating and maintenance (incl. workflows)
        - localization management
- multilinguality capability of
    - user interfaces
    - data and data models
    - technical documentation, manuals, etc.
    - localization capability
        - between "national" languages
        - between "local" cultures
- interoperability referring to

  - integration capability (concerning technical, organizational and syntactic interoperability)
  - semantic interoperability
- other primary standards conformity and interoperability assessment aspects

In this connection standards conformity and interoperability assessment can refer to

- products and services
- processes and procedures/practices/methods/operation
- personnel employed in the above-mentioned aspects and applications (personnel certification)
- external services (experts, consultants, trainers, etc.)
- combinations of the above.

Secondary ***standards conformity and interoperability assessment*** (certification) aspects:

- training
  - training content and content presentation
  - trainers
  - trainees (incl. trained managers)
- consultancy services
- web services
- combinations of the above.

Appendix

ISO/TC 37 AG N 139

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ISO/TC 37 titles / scopes / standards / work items

Titles, scopes, standards and work items	Cooperation
ISO/TC 37 Title: **Terminology and other language and content resources** Titre: **Terminologie, ressources langagières et de contenu linguistiques** Scope: **Standardization of principles, methods and applications relating to terminology and other language and content resources in the contexts of multilingual communication and cultural diversity** Domaine d'activités: **Normalisation des principes, méthodes et applications relatives à la terminologie, autres ressources et contenu linguistiques dans les contextes de la communication multilingue et de la diversité culturelle**	➢ ISO/TC 46 ➢ ISO/TC 184/SC 4 ➢ ISO/IEC-JTC 1/SC 32 ➢ other
ISO/TC 37/SC 1 Title: **Principles and methods** Titre: **Principes et méthodes** Scope: **Standardization of principles and methods related to terminology, language resources, terminology policies and to knowledge organization in the mono- and multilingual context of the information society** Domaine d'activités: **Normalisation des principes et des méthodes relatives à la terminologie, aux ressources langagières, aux politiques terminologiques et à l'organisation de connaissances, dans les contextes unilingue et multilingue de la société de l'information**	
Standards under direct responsibility of SC 1: ISO 704:2000 Terminology work – Principles and methods ISO 860:1996 Terminology work – Harmonization of concepts and terms ISO 1087-1:2000 Terminology work – Vocabulary – Part 1: Theory and application	
Standards under preparation: ISO/CD 704.2 Terminology work – Principles and methods ISO/CD 860.2 Terminology work – Harmonization of concepts and terms ISO/PWI 1087-1 Terminology work – Vocabulary – Part 1: Theory and application	

ISO/DTS 22134 Practical guide for socioterminology ISO/NP 24156 Guidelines for applying concept modelling in terminology work	
Proposed projects: Conceptual modelling	
ISO/TC 37/SC 2 Title: **Terminographical and lexicographical working methods** Titre: **Méthodes de travail terminographiques et lexicographiques** Scope: **Standardization of terminographical and lexicographical working methods, procedures, coding systems, workflows, and cultural diversity management, as well as related certification schemes** Domaine d'activités: **Normalisation des méthodes de travail terminographiques et lexicographiques, procédures, systèmes de codage, processus de travail et gestion de la diversité culturelle ainsi que les démarches de certification associées**	
Standards under direct responsibility of SC 2: ISO 639-1:2002 Codes for the representation of names of languages – Part 1: Alpha-2 code ISO 639-2:1998 Codes for the representation of names of languages – Part 2: Alpha-3 code ISO 1951:1997 Lexicographical symbols and typographical conventions for use in terminography ISO 10241:1992 International terminology standards – Preparation and layout ISO 12199:2000 Alphabetical ordering of multilingual terminological and lexicographical data represented in the Latin alphabet ISO 12615:2004 Bibliographic references and source identifiers for terminology ISO 12616:2002 Translation-oriented terminography ISO 15188:2001 Project management guidelines for terminology standardization	
Standards under preparation: ISO/DIS 639-3 Codes for the representation of names of languages – Part 3: Alpha-3 code for comprehensive coverage of languages ISO/WD 639-4 Codes for the representation of names of languages – Part 4: Implementation guidelines and general principles for language coding ISO/CD 639-5 Codes for the representation of names of languages – Part 5: Alpha-3 code for language families and groups ISO/WD 639-6 Codes for the representation of names of languages – Part 6: Extension coding for language variation	

ISO/FDIS 1951 Presentation/representation of entries in dictionaries ISO/CD 10241-1 Terminological entries in standards – Part 1: General requirements ISO/PWI TR 22128 Quality assurance guidelines for terminology products ISO/PWI 22130 Additional language coding ISO/NP 23185 Assessment and benchmarking of terminological holdings	
ISO/TC 37/SC 3 Title: **Systems to manage terminology, knowledge and content** Titre + Domaine d'activités: not yet available Scope: **Standardization of specifications and modelling principles for systems to manage terminology, knowledge and content with respect to semantic interoperability**	
Standards under direct responsibility of SC 3: ISO 1087-2:2000 Terminology work – Vocabulary – Part 2: Computer applications ISO 12200:1999 Computer applications in terminology – Machine-readable terminology interchange format (MARTIF) – Negotiated interchange ISO 12620:1999 Computer applications in terminology – Data categories ISO 16642:2003 Computer applications in terminology – Terminological markup framework	
Standards under preparation: ISO/PWI TR 12618 Computational aids in terminology – Design, implementation and use of terminology management systems ISO/CD 12620-1 Computer applications in terminology – Data categories – Part 1: Model for description and procedures for maintenance of data category registries for language resources ISO/CD 12620-2 Computer applications in terminology – Data categories – Part 2: Terminological data categories ISO/PWI 22274 Basic principles and requirements for multilingual product classification	
ISO/TC 37/SC 4 Title: **Language resource management** Scope: **Standardization of specifications for computer-assisted language resource management**	
Standards under direct responsibility of SC 4: no standards yet	
Standards under preparation (systematic formulation of titles): ISO/WD 21829 Language resource management – Terminology (TLM) ISO/DIS 24610-1 Language resource management – Feature structures – Part 1: Feature structure representation (FSR) ISO/NWIP (in preparation) 24610-2 Language resource management – Feature structures – Part 2: Feature systems declaration (FSD)	

ISO/WD 24611 Language resource management – Morphosyntactic annotation framework (MAF) ISO/WD 24612 Language resource management – Linguistic annotation framework (LAF) ISO/WD 24613 Language resource management – Lexical Markup Framework (LMF) ISO/AWI 24614-1 Language resource management – Word Segmentation of Written Texts for Mono-lingual and Multi-lingual Information Processing – Part 1: General principles and methods ISO/AWI 24614-2 Language resource management – Word Segmentation of Written Texts for Mono-lingual and Multi-lingual Information Processing – Part 2: Word segmentation for Chinese, Japanese and Korean ISO/NWIP 24615 Language resource management – Syntactic Annotation Framework (SynAF)	
Planned projects: TDG 1 Language resource management – Metadata Convenor: Peter Wittenburg (peter.wittenburg@mpi.nl) TDG 2 Language resource management – Morphosyntax Convenor: Gil Francopoulo (gil.francopoulo@wanadoo.fr) TDG 3 Language resource management – Semantic Content Representation Convenor: Koiti Hasida (hasida.k@aist.go.jp) Assisted by: Harry Bunt (harry.bunt@uvt.nl) Activity 1 Discourse Relations: Koiti Hasida Activity 2 Dialogue Acts: Harry Bunt Activity 3: Referential Structures and Links: Laurent Romary Activity 4: Logico-semantic Relations: Scott Farrar Activity 5: Temporal Entities and Relations: Kiyong Lee Activity 6: Semantic Roles and Argument Structures: Thierry Declerck	

ANNEX 3

International Conventions

The harmonization of traffic/road signs and signals at European level is largely based on international conventions: especially the "***Convention on road signs and signals"*** (Vienna, 8 November 1968).

Most pertinent road/traffic related conventions and protocols:

1. Convention on Road Traffic. Geneva, 19 September 1949.
19. Convention on Road Traffic. Vienna, 8 November 1968.
20. Convention on road signs and signals. Vienna, 8 November 1968. (amended version:) http://www.unece.org/trans/conventn/signalse.pdf Amendment 1 (entered into force on 30 November 1995) http://www.unece.org/trans/conventn/ECE-TRANS-92r1e.pdf
23. European Agreement supplementing the Convention on road traffic opened for signature at Vienna on 8 November 1968. Geneva, 1 May 1971.
24. European Agreement supplementing the Convention on road signs and signals opened for signature at Vienna on 8 November 1968. Geneva, 1 May 1971.
25. Protocol on Road Markings, additional to the European Agreement supplementing the Convention on Road Signs and Signals opened for signature at Vienna on 8 November 1968. Geneva, 1 March 1973.

UN series of road and traffic related conventions and protocols concerning road traffic:

1. Convention on Road Traffic. Geneva, 19 September 1949.
2. Protocol concerning countries or territories at present occupied. Geneva, 19 September 1949.
3. Protocol on Road Signs and Signals. Geneva, 19 September 1949.
4. European Agreement supplementing the 1949 Convention on road traffic and the 1949 Protocol on road signs and signals. Geneva, 16 September 1950.

5. European Agreement on the application of article 3 of annex 7 of the 1949 Convention on Road Traffic Concerning the Dimensions and Weights of Vehicles Permitted to Travel on Certain Roads of the Contracting Parties. Geneva, 16 September 1950.

6. European Agreement on the application of article 23 of the 1949 Convention on road traffic, concerning the dimensions and weights of vehicles permitted to travel on certain roads of the Contracting Parties. Geneva, 16 September 1950.

7. Declaration on the construction of main international traffic arteries. Geneva, 16 September 1950.
8. General Agreement on Economic Regulations for International Road transport.
8. a). Additional Protocol.
8. b). Protocol of Signature. Geneva, 17 March 1954.
8. c). Protocol relating to the adoption of Annex C.1 to the Set of Rules annexed to the General Agreement on Economic Regulations for International Road transport. Geneva, 1 July 1954.

9. Agreement on Signs for Road Works, amending the European Agreement of 16 September 1950 supplementing the 1949 Convention on Road Traffic and the 1949 Protocol on Road Signs and Signals. Geneva, 16 December 1955

10. Convention on the Taxation of Road Vehicles for Private Use in International Traffic. Geneva, 18 May 1956
11. Convention on the Contract for the International Carriage of Goods by Road (CMR). Geneva, 19 May 1956
11. a). Protocol to the Convention on the Contract for the International Carriage of Goods by Road (CMR). Geneva, 5 July 1978

12. Convention on the Taxation of Road Vehicles engaged in International Goods Transport. Geneva, 14 December 1956
13. Convention on the Taxation of Road Vehicles Engaged in International Passenger Transport. Geneva, 14 December 1956
14. European Agreement concerning the International Carriage of Dangerous Goods by Road (ADR). Geneva, 30 September 1957

14. a). Protocol amending article 14 (3) of the above-mentioned Agreement. Concluded at New York on 21 August 1975. New York, 21 August 1975

14. b). Protocol amending article 1 (a), article 14 (1) and article 14 (3) of the European Agreement of 30 September 1957 concerning the International Carriage of Dangerous Goods by Road (ADR). Geneva, 28 October 1993

15. European Agreement on Road Markings. Geneva, 13 December 1957
16. Agreement concerning the adoption of uniform conditions of approval and reciprocal recognition of approvals for motor vehicle equipment and parts. Geneva, 20 March 1958 & Regulations annexed to the Agreement of 20 March 1958 concerning the adoption of uniform technical prescriptions for wheeled vehicles, equipment and parts which can be fitted and/ or be used on wheeled vehicles and the conditions for reciprocal recognition of approvals granted on the basis of these prescriptions.

17. Agreement on Special Equipment for the Transport of Perishable Foodstuffs and on the Use of such Equipment for the International Transport of some of those Foodstuffs. Geneva, 15 January 1962.

18. European Agreement concerning the Work of Crews of Vehicles Engaged in International Road Transport (AETR). Geneva, 19 January 1962.

19. Convention on Road Traffic. Vienna, 8 November 1968.
20. Convention on road signs and signals. Vienna, 8 November 1968.
21. European Agreement concerning the Work of Crews of Vehicles Engaged in International Road Transport (AETR). Geneva, I July 1970.

22. Agreement on the International Carriage of Perishable Foodstuffs and on the Special Equipment to be used for such Carriage (ATP)1. Geneva, I September 1970.

23. European Agreement supplementing the Convention on road traffic opened for signature at Vienna on 8 November 1968. Geneva, 1 May 1971.

24. European Agreement supplementing the Convention on road signs and signals opened for signature at Vienna on 8 November 1968. Geneva, 1 May 1971.

25. Protocol on Road Markings, additional to the European Agreement supplementing the Convention on Road Signs and Signals opened for signature at Vienna on 8 November 1968. Geneva, 1 March 1973.

26. Convention on the contract for the international carriage of passengers and luggage by road (CVR). Geneva, 1 March 1973.

26. A). Protocol to the Convention on the contract for the international carriage of passengers and luggage by road (CVR). Geneva, 5 July 1978.

27. Agreement on minimum requirements for the issue and validity of driving permits (APC). Geneva, 1 April 1975.
28. European Agreement on main international traffic arteries (AGR). Geneva, 15 November 1975.
29. Intergovernmental Agreement on the Establishment of an Inter-African Motor Vehicle Third Party Liability Insurance Card. New York, 1 October 1978.

30. Convention on Civil Liability for Damage caused during Carriage of Dangerous Goods by Road, Rail and Inland Navigation Vessels (CRTD) 1.Geneva, 10 October 1989.

31. Agreement concerning the Adoption of Uniform Conditions for Periodical Technical Inspections of Wheeled Vehicles and the Reciprocal Recognition of such Inspections. Vienna, 13 November 1997.

32. Agreement concerning the Establishing of Global Technical Regulations for Wheeled Vehicles, Equipment and Parts which can be fitted and/or be used on Wheeled Vehicles. Geneva, 25 June 1998.

Appendix

This website (still worked on) yields a good overview – with links – to regulations concerning traffic signs and signals at international and national levels:
http://homepages.cwi.nl/~dik/english/traffic/:

Base information

Traffic signs and signals are displayed here supported by quite a few GIF images (the signals are animated).

- The conventional international traffic signs as used in many countries.
- Traffic signals.

Note: work is still very much in progress!

Online sources

International treaties are from the Swiss law site which is very complete, but it is only in French, German and Italian. Their PFD is not very good, and their HTML does not cover the actual signs at all, but still the most complete site to be found.

International

1926	French | German | Italian The first convention where something was done about the differences in traffic signs across the nations. No actual signs are given.
1931	French | German | Italian This convention was actually about traffic signs. The documents above, alas, do not include the actual signs, but I think they can be ascertained from the text.
1949	In 1949 there has been a convention in Geneva that covered (amongst others) international traffic signs. As far as I have been able to ascertain this just prolonged and perhaps extended the 1931 convention.
1968	French | German | Italian The Vienna convention on (amongst others) traffic signs. This convention is shown complete, including the actual signs, but this is the version after the amendments of 1993.
1971	French | German | Italian Additional European rules about traffic signs.
1973	French | German | Italian Additional European rules about road markings.
1993	No source yet In 1993 the Vienna convention was amended, I am still researching whether there were fundamental changes.

Western Europe

Andorra	Presumably uses Spanish type signs.
Austria	German, unofficial | German, unofficial These are sites of manufacturers of traffic signs, they contain slightly different pieces of information.
Belgium	Dutch | French The complete law, well done, I am missing the German version. Otherwise it is official; done by the Belgian police.
Danmark	Danish, unofficial This is the site of a manufacturer of traffic signs.
Finland	English | Finnish The English version does not give you the road marks. I do not know the actual status of this site, but it appears to be fairly official.
France	French, unofficial | French, unofficial | French, unofficial A reasonable collection of French traffic signs, the first from a person, the second from a company (a bit more complete, but apparently Windows oriented), the third apparently shows old fashioned traffic signs, but is fairly complete.
Germany	German

	The complete law, well done. By what I understand this site maintains the online versions of German law.
Greece	Greek This gives the law, the second link on this page will give a page with links to pages with traffic signs. It is incomplete.
Iceland	Icelandic A well done exhibition of the traffic signs, otherwise I do not know what the status of this site is, but it appears to be fairly official.
Ireland	English, unofficial Contains a set of Irish traffic signs, probably incomplete. I do not know whether it is even possible to get a complete set of valid traffic signs.
Italy	Italian, unofficial A site designed to learn you the rules. Bad images, but otherwise well-done (but it takes some time). You better buy their CD-ROM version.
Liechtenstein	Presumably uses Swiss type signs.
Luxembourg	Nothing found yet.
Malta	Nothing found yet.
Monaco	Presumably uses French type signs.
Netherlands	Dutch, unofficial An excellent exhibition of traffic signs. The law is also there.
Norway	Nothing found yet.
Portugal	Portuguese | Portuguese Both from the Portuguese directorate for traffic. The first one gives the rules, the second one the signs. The signs you will find in a zipped archive containing pdf'ed scans of the pages (two pages are missing), when you have gone through all the text.
San Marino	Presumably uses Italian type signs.
Spain	English | Spanish | unofficial The last one shows pictures but does not give explanations, the first two give only the rules and are from the Spanish directorate for traffic.
Sweden	Swedish Excellent traffic sign reproductions. I could not find the rules there. This is the Swedish government institute for road traffic.
Switzerland	German | French | Italian There is something wrong with their PDF, but it gives all rules, the HTML version gives the rules but a horrible display of the signs.
United Kingdom	Nothing found yet. I used paper sources for all information.

Eastern Europe

Belarus	Belarus The complete law plus traffic signs; in Belarus I think, but it can also be Russian. I think the traffic signs are as they were in the Soviet Union

	(considering the standards mentioned in the text: GOST 10807-78 and 23457-86).
Czech Republic	Czech, unofficial Incomplete, and no description of the actual meaning.
Estonia	Estonian, unofficial Complete rules and set of signals (see at the bottom of the menu, lista 1 and following).
Hungary	Hungarian The complete law, alas in Hungarian. The pictures leave something to be desired.
Latvia	Russian The law, in Russian. I think this is the Russian law and do not know whether Latvian law is different at this moment (I think it is not). See also Belarus.
Poland	Polish The complete set is presented here.
Rumania	Rumanian | Rumanian, unofficial The first gives the law, the second (from presumably unofficial source) a set of traffic signs. I think the set is incomplete.
Russia	Russian The law, no signs here. See also Belarus.
Turkey	Turkish | Turkish, unofficial | Turkish, unofficial The first one is from the government, but incomplete. The second one is the most comprehensive, but not official.
Africa	
South Africa	English | English, unofficial | English, unofficial The first is the government which gives the regulations, the other two are companies. The first company site is apparently in progress to show all, but not yet done with it; the second company only gives a subset. Apparently the traffic signs are valid for a large part of Southern Africa, namely the following countries: South Africa, Swaziland, Lesotho, Namibia, Angola, Botswana, Zimbabwe, Zambia, The Democratic Republic of Congo, Malawi, Mozambique, Tanzania, Seychelles and Mauritius (together called the SADC).
Asia	
China	Chinese | Chinese The colours appear not to be well defined here, and the HTML is not entirely correct, but it is the government.
Hong Kong	Chinese | English The complete road rules, including all signs.
India	English and Hindi | English, unofficial | English, unofficial From a police site, not complete I think. The second is from a company and has signs not in the first. The third is from industry and better detailed.

Japan	English | English Two police prefectures, these two are both incomplete, they are overlapping, but not identical.
Korea (North)	English and Korean, unofficial It appears reasonably complete.
Malaysia	English and Malay Apparently all signs.
Taiwan	Chinese, unofficial | Chinese, unofficial A company and a school, for some of the signs I do not yet know what they mean. Click on any link provided and you will get further.

Pacific

Australia	English | English | English | English | English | English | English The first is a pointer to the road rules from Victoria (there are other places where they can be obtained). They do only give the regulatory signs, no others. The other links give some information about warning signs; none is complete, although there is some overlap.

North America

Canada	French | English | French | English | English | English | English | English/French All are incomplete, but not identical. The first two are from the Ontario government, the others from the Quebec, two from Alberta (the first is pdf, the second html), Nova Scotia and British Columbia (this one is complete in pdf, check the link "traffic sign catalogue") governments, the last one is from a company.
USA	English | English, unofficial The new offical year 2000 manual of traffic signs in the USA, and an unofficial, but complete current listing.

South America

Argentina	Spanish Apparently complete. Look in the right part with white background for the text **Señales de Tránsito** the text below gives links to three zip files containing the signs. (You need not click on the **English version** field, you will get the same there.)
Brazil	Portuguese Apparently complete.

ANNEX 4: Links to pictures

Searching for road/traffic signs and their pictures in the Internet yields lots of interesting hits:
http://german.about.com/gi/dynamic/offsite.htm?site=http://www.texhwyman.com/zeichen.htm
http://www.intlsigns.com/world/traffic/
http://www.securiteroutiere.gouv.fr/IMG/pdf/LesSignauxRoutiers-2.pdf
http://www.freefoto.com/browse.jsp?id=21-11-0
Land Transport <http://www.freefoto.com/browse.jsp?id=21-0-0>
American Road <http://www.freefoto.com/browse.jsp?id=21-87-0>
American Truck <http://www.freefoto.com/browse.jsp?id=21-30-0>
Bicycles <http://www.freefoto.com/browse.jsp?id=21-02-0>
Burnt Out Cars <http://www.freefoto.com/browse.jsp?id=21-15-0>
Car Parking 1 <http://www.freefoto.com/browse.jsp?id=21-35-0>
Car Parking 2 <http://www.freefoto.com/browse.jsp?id=21-53-0>
Car Parts <http://www.freefoto.com/browse.jsp?id=21-43-0>
Caravan <http://www.freefoto.com/browse.jsp?id=21-48-0>
Construction Equipment <http://www.freefoto.com/browse.jsp?id=21-09-0>
Country Road <http://www.freefoto.com/browse.jsp?id=21-91-0>
Cycling <http://www.freefoto.com/browse.jsp?id=21-83-0>
Dont Walk <http://www.freefoto.com/browse.jsp?id=21-61-0>
Driving <http://www.freefoto.com/browse.jsp?id=21-59-0>
Driving At Night <http://www.freefoto.com/browse.jsp?id=21-84-0>
Dumped Car <http://www.freefoto.com/browse.jsp?id=21-90-0>
Eddie Stobart Trucks <http://www.freefoto.com/browse.jsp?id=21-47-0>
Floods <http://www.freefoto.com/browse.jsp?id=21-38-0>
Fog <http://www.freefoto.com/browse.jsp?id=21-40-0>
Heavy Haulage <http://www.freefoto.com/browse.jsp?id=21-28-0>
Highways Agency <http://www.freefoto.com/browse.jsp?id=21-10-0>
Impact of cars on our rural environment <http://www.freefoto.com/browse.jsp?id=21-32-0>
London to Brighton 1 <http://www.freefoto.com/browse.jsp?id=21-64-0>
London to Brighton 10 <http://www.freefoto.com/browse.jsp?id=21-74-0>
London to Brighton 11 <http://www.freefoto.com/browse.jsp?id=21-75-0>
London to Brighton 2 <http://www.freefoto.com/browse.jsp?id=21-65-0>
London to Brighton 3 <http://www.freefoto.com/browse.jsp?id=21-66-0>
London to Brighton 4 <http://www.freefoto.com/browse.jsp?id=21-67-0>
London to Brighton 5 <http://www.freefoto.com/browse.jsp?id=21-69-0>
London to Brighton 6 <http://www.freefoto.com/browse.jsp?id=21-70-0>
London to Brighton 7 <http://www.freefoto.com/browse.jsp?id=21-71-0>
London to Brighton 8 <http://www.freefoto.com/browse.jsp?id=21-72-0>
London to Brighton 9 <http://www.freefoto.com/browse.jsp?id=21-73-0>
Mobile Roadworks <http://www.freefoto.com/browse.jsp?id=21-55-0>
Motorcycles <http://www.freefoto.com/browse.jsp?id=21-12-0>
New York Cabs <http://www.freefoto.com/browse.jsp?id=21-41-0>
Parking Ticket <http://www.freefoto.com/browse.jsp?id=21-46-0>
Pedestrian Crossing <http://www.freefoto.com/browse.jsp?id=21-31-0>
Petrol Bloackade <http://www.freefoto.com/browse.jsp?id=21-37-0>
Petrol Station <http://www.freefoto.com/browse.jsp?id=21-34-0>
Recreational Vehicle <http://www.freefoto.com/browse.jsp?id=21-49-0>
Road Traffic Signs 1 <http://www.freefoto.com/browse.jsp?id=21-03-0>

Road Traffic Signs 2 <http://www.freefoto.com/browse.jsp?id=21-05-0>
Road Traffic Signs 3 <http://www.freefoto.com/browse.jsp?id=21-14-0>
Road Traffic Signs 4 <http://www.freefoto.com/browse.jsp?id=21-18-0>
Road Traffic Signs 5 <http://www.freefoto.com/browse.jsp?id=21-76-0>
Road Traffic Signs 6 <http://www.freefoto.com/browse.jsp?id=21-82-0>
Road Traffic Signs 7 <http://www.freefoto.com/browse.jsp?id=21-86-0>
Road Traffic Signs 8 <http://www.freefoto.com/browse.jsp?id=21-04-0>
Road Works <http://www.freefoto.com/browse.jsp?id=21-19-0>
Roads 1 <http://www.freefoto.com/browse.jsp?id=21-11-0>
Roads 2 <http://www.freefoto.com/browse.jsp?id=21-16-0>
Roads 3 <http://www.freefoto.com/browse.jsp?id=21-63-0>
Roads at Night 1 <http://www.freefoto.com/browse.jsp?id=21-17-0>
Roads at Night 2 <http://www.freefoto.com/browse.jsp?id=21-77-0>
Roads at Night 3 <http://www.freefoto.com/browse.jsp?id=21-52-0>
Roundabout <http://www.freefoto.com/browse.jsp?id=21-45-0>
Scrap Metal / Rust <http://www.freefoto.com/browse.jsp?id=21-20-0>
Snow 5 <http://www.freefoto.com/browse.jsp?id=21-24-0>
Snow Vehicles <http://www.freefoto.com/browse.jsp?id=21-56-0>
Speed Camera <http://www.freefoto.com/browse.jsp?id=21-21-0>
Speed Limits <http://www.freefoto.com/browse.jsp?id=21-44-0>
Steam Traction Engines <http://www.freefoto.com/browse.jsp?id=21-22-0>
Street Lights <http://www.freefoto.com/browse.jsp?id=21-39-0>
Stretch Limo <http://www.freefoto.com/browse.jsp?id=21-06-0>
Tarmacadam <http://www.freefoto.com/browse.jsp?id=21-62-0>
Taxis <http://www.freefoto.com/browse.jsp?id=21-36-0>
Traffic Cones <http://www.freefoto.com/browse.jsp?id=21-54-0>
Traffic Congestion <http://www.freefoto.com/browse.jsp?id=21-29-0>
Traffic in the Snow <http://www.freefoto.com/browse.jsp?id=21-57-0>
Traffic Jams 1 <http://www.freefoto.com/browse.jsp?id=21-23-0>
Traffic Jams 2 <http://www.freefoto.com/browse.jsp?id=21-01-0>
Traffic Lights 1 <http://www.freefoto.com/browse.jsp?id=21-33-0>
Traffic Lights 2 <http://www.freefoto.com/browse.jsp?id=21-81-0>
Traffic Rain 1 <http://www.freefoto.com/browse.jsp?id=21-50-0>
Traffic Rain 2 <http://www.freefoto.com/browse.jsp?id=21-78-0>
Traffic Rain 3 <http://www.freefoto.com/browse.jsp?id=21-79-0>
Traffic Rain 4 <http://www.freefoto.com/browse.jsp?id=21-80-0>
Traffic Rain 5 <http://www.freefoto.com/browse.jsp?id=21-85-0>
Traffic USA 1 <http://www.freefoto.com/browse.jsp?id=21-58-0>
Traffic USA 2 <http://www.freefoto.com/browse.jsp?id=21-51-0>
Trams 2 <http://www.freefoto.com/browse.jsp?id=21-68-0>
Trucks 1 <http://www.freefoto.com/browse.jsp?id=21-26-0>
Trucks 2 <http://www.freefoto.com/browse.jsp?id=21-42-0>
Trucks 3 <http://www.freefoto.com/browse.jsp?id=21-25-0>
Vans <http://www.freefoto.com/browse.jsp?id=21-27-0>
Vintage Cars 1 <http://www.freefoto.com/browse.jsp?id=21-07-0>
Vintage Cars 2 <http://www.freefoto.com/browse.jsp?id=21-08-0>
Vintage Cars 3 <http://www.freefoto.com/browse.jsp?id=21-88-0>
Vintage Motorcycles <http://www.freefoto.com/browse.jsp?id=21-13-0>
Vintage Trucks <http://www.freefoto.com/browse.jsp?id=21-60-0>