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International and interinstitutional crisis and disaster management - Guideline for the mapping of terminology and icons

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EUROPEAN COMMITTEE FOR STANDARDIZATION
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EUROPÄISCHES KOMITEE FÜR NORMUNG

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European foreword

This CEN Workshop Agreement (CWA 18023:2023) has been developed in accordance with the CEN-CENELEC Guide 29 "CEN/CENELEC Workshop Agreements – A rapid prototyping to standardisation" and with the relevant provisions of CEN/CENELEC Internal Regulations - Part 2. It was approved by a Workshop of representatives of interested parties on 2023-05-09, the constitution of which was supported by CEN following the public call for participation made on 2021-11-27. However, this CEN Workshop Agreement does not necessarily include all relevant stakeholders.

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Introduction

This CEN Workshop Agreement (CWA) has been elaborated as part of the EU-funded research project STRATEGY, which received funding from the European Union's HORIZON 2020 research and innovation programme under grant agreement (GA) No 883520. More specifically, upon investigation of the standardisation universe across its thematic streams of research and prioritisation of the identified gaps against the operational perspective of end-users, STRATEGY underlined the need and supported the drafting of the CWA in discussion.

In crisis and disaster management, two factors contribute to success:

a) having the appropriate resources available in an adequate time, at the right location and

b) the action of applying clear authority, communications and directives.

In all cases, precise and clear communication is crucial. Experiences of managing large-scale crises and disasters show that language barriers and differences in the operational context, organisation, practices, tools and resources of disaster risk management create a potential for miscommunication. Moreover, the use of different terms and symbols for the same parameters hampers effective information exchange. Translating these terms and symbols is not necessarily trivial, as these do not always have the exact same meaning. In many cases, the meaning of two symbols from different standards overlaps partly. For example, the EUROPEAN EMERGENCY 2D/3D SYMBOLOGY REFERENCE provides symbols for automobiles and trucks, while ÖNORMS2308 only provides one symbol for “motor vehicle” (German: “Kraftfahrzeug”).

In addition to the challenge of mapping in general, simply transferring symbols from one guideline/standard to another might cause a loss of information. That contradicts the success factor ‘clear communication’.

The CWA provides guidelines for matching and mapping symbols regarding international or interinstitutional disaster risk management.

The intended users of the CWA results are authorities, statutory emergency agencies and other practitioners in disaster risk management, including non-governmental agencies, researchers in disaster and emergency management. Each of these prospective beneficiaries may find some parts more useful than others.

The CWA provides methodologies for mapping and matching of symbols and a description of the methodology. It is not a purpose of the CWA to prioritise symbols for one group of users or another. In addition, it should be emphasised that the use of the same symbols and terms carries the least risk of miscommunication and should be preferred whenever possible. This CWA provides a solution when the use of the same symbols is not or is not yet possible – for example, when operators collaborate and are not trained in common symbols.

Reference to existing standards (i.e. local, regional, European and international) is given where appropriate.

However, the CWA does not intend to provide a complete compilation of existing symbols and sets of symbols. The CWA is expected to be used for the improvement of the quality and efficiency of visual communication between actors in crisis and disaster management, independently of the communication channel being used.

1 Scope

This document provides recommendations for the mapping of different sets of terminology and symbols used in international or inter-institutional crisis and disaster management. It provides an ontology for existing terminologies and taxonomies but will not develop a new set of terminologies and symbols or provide a linguistic translation.

This document is applicable to all kind of crisis and all actors of crisis response across European Union that either support or get support by other actors from the same or another Member state.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

CWA 17335, *Terminologies in crisis and disaster management*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardisation at the following addresses:

- ISO Online browsing platform: available at https://www.iso.org/obp
- IEC Electropedia: available at https://www.electropedia.org/

3.1
term
text of the definition

[SOURCE: ISO 22361:2022, 3.3]

3.2
terminology
language, words and terms used in a specific domain

[SOURCE: ISO/TS 22287:2019(en), 3.20]

3.3
symbol
visually perceptible figure used to transmit information independent of language

[SOURCE: ISO 3767-5:2016[en], 3.1]

3.4
symbol set
set set of graphic symbols with related referents or graphical sysmbol elements

[SOURCE: ISO 17724:2023]

3.5
matching
determining the correlation between two symbols from different standards/guidelines

3.6
signifier
The form of a sign. The form might be a sketch, a word, a sound, etc

3.7
signified
The object or the concept that is represented. For example, the concept or object might be a shelter, an evacuation command, or a warning of radioactivity.

4 The context of semiotics for crisis management symbology

This document is related to the analysis of sign (semiotics) used in operational crisis management by diverse organisations. A sign is anything that can represent something else and which is interpreted to have meaning. To study and analyse signs, we need meaning-making semiotics to ensure meaningful communication. This is achieved by exploiting useful tools for identifying and creating the relational patterns that lead to meaning in communication. A sign is the basic unit of meaning made up of two basic parts:

a) The Signifier

b) The Signified

A third part of signs is the *Interpretant*, which explains what the crisis management actors makes of the sign or the sense of what's actually communicated. The interpretant of operational signs used in crisis management and its standardised use is at this document's core.

Signs can take many forms and they are categorised as belonging to one of three categories, symbol, index, or symbol.

a) A Symbol physically resembles the signified (i.e., the thing being represented). A photograph is a good example as it certainly resembles whatever it depicts;

b) An Index shows evidence of what's being represented. A good example is using an image of flames to indicate a fire;

c) A Symbol has no resemblance between the signifier and the signified. The connection between them should be culturally learned. Numbers and alphabets are good examples. There's nothing inherent in the number 9 to indicate what it represents. It must be culturally learned.

A symbol represents products or ideas, whereas an icon represents only items that are visible or physical. Both symbols and icons represent other things, but an icon is a pictorial representation of the object it stands for, whereas a symbol does not resemble what it stands for. An index describes the connection between signifier and signified. On the other hand, one must learn what a symbol stands for, as it is not similar to what it stands for.

Therefore, the type of signs this document focuses on are symbols used to connect signifiers and signified representing objects, resources, and procedures that are common in operational crisis management communication. More specifically, the signs used to communicate during crisis management operations can be considered as symbolic symbols. Symbols communicate by implying what they represent, and they are best used when the actions, objects, or concepts being described are well-established.

Based on the above, we refer in this document to standardised map symbology in crisis management as a mechanism for ensuring that specific information is interpretable between different organisations and countries during an emergency. This work is linked although it goes beyond map symbol standardisation.

5 Methodology for the correlation of Crisis management symbols

5.1 General Outline

This chapter provides a methodological approach to map and match symbols from different standards or guidelines in the domain of crisis and disaster management. This approach is based on an algorithm to calculate the correlation between symbols. This approach is based on mapping terms of the CWA 17335.

5.2 Methodology Specification

As described in the introduction, different organisations of actors in crisis and disaster management, use different sets of symbols, further explanation can be found in Chapter 5.2.1. Still, in many cases, it is necessary to collaborate, which leads to the need for clear and effective communication. Therefore, different sets of symbols need to be matched in advance. The translation derived from the matching needs to be provided to the practitioners by appropriate tools which manage the data of symbols (Chapter 5.2.2). As symbols do not necessarily match exactly, metrics are necessary to calculate the correlation between two symbols (Chapter 5.2.3).

5.2.1 Considered Universe of Operational Application

Signs and symbols are a formal way of communicating and reporting during emergencies and crises. However, to be efficient such communication needs to be based on an adequate and precise definition of the image, allowing the proper and explicit interpretation of the meaning (signified) of the symbol (signifier). The above requires analysing the standardised forms (shapes and figures) used in the symbol to derive the relative meaning (interpretant) and the context of use. This latter is defined considering the target users (type of organisations and geographic area), the intended domain of application (CDM phase, event size, purpose, or use scenario), and the source (data set) of the symbol.

The primary purpose of the CWA is to facilitate the interpretation of symbols when different data sets are used during crisis management operations. Being the focus on the active community of the actors involved in crisis management and emergencies, the universe of discourse is determined from the application viewpoint. Relative scenarios and use cases have been defined to be tested for elaborating on the relative needs of the active community involved in emergency and crisis management. A variant of the T-C-T (TER-CDM-THE) approach, used in CWA 17335, is adopted regarding the symbolic symbols used in crisis and disaster management. We correspond symbols to terms and thesaurus to symbol sets in this approach. Some basic questions that need to be answered according to the above approach include:

a) what type of practitioners is that will make use of the symbols set;

b) for what purpose a practitioner will need to extract the meaning of a symbol and correlate it with standardised signified of crisis management;

c) what type of actions will be linked with such correlation and;

d)which type of symbols are used in the data set (hand-sketched, printed or in electronic format).

According to the intended domain of application, the need of using standardised analysis and translation/correlation of symbolic symbols is required:

UC1) to “communicate and exchange information” among diverse organisations and countries;

UC2) to “read situation reports and operational maps” produced by different organisations;

UC3) to support practitioner “training” in crisis and disaster management;

UC4) to support “debriefing” following exercises;

UC5) to “communicate risk” to the general public;

UC6) in context of “joint projects or other specific activities”;

UC7) to “correlate the meaning of two symbols” coming from two different data sets.

As a limiting factor of this approach, this methodology is a support tool when it comes to matching symbols. Symbols need to be mapped and matched by experts and can at this point not be applied stand-alone.

5.2.2 Data Management and Tools

In this section, the guidelines are intended to support the consistent production and publication of metadata for electronic description of the symbols used in international or inter-institutional crisis and disaster management. The term “meta” is the prefix that means “underlying description or definition.” And since metadata summarises the essential details about the data, this can make finding and working with a specific snippet of information and data much easier. This is particularly relevant because Metadata generically refers to " data that provides information about other data", but not the content of the data, such as the text of a message or the image itself.

From the different types of metadata, the focus is on providing a detailed list of Descriptive Metadata. In its most simplified version, Descriptive Metadata provides an identification of specific data items. It often refers to elements like titles, dates, and keywords. The elements defined in Figure 1 are to support Descriptive Metadata using the Camel case[1] naming convention. The descriptive information about a resource/item is used for discovery and identification. It may include elements such as title, abstract, author, and keywords.

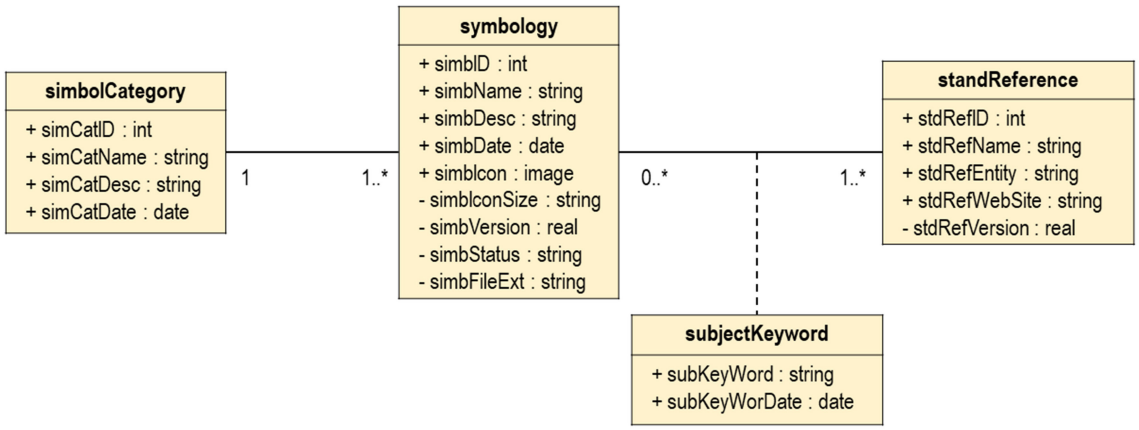

Figure 1 — Domain model of the descriptive metadata for symbols

Descriptive Metadata is considered the most commonly referenced and utilised metadata type. Within the scope of this CWA, it is also the easier type of metadata to understand, providing basic information about each symbol item used in the project catalogue (a.k.a., as a data dictionary). As such, within the proper context, Descriptive Metadata is used for the discovery of objects. This information also increases

[1] Camel case, the practice of writing phrases without spaces or punctuation, indicating the separation of words with a single capitalized letter, and the first word starting with the capitalization of the first latter of upcoming words

the symbol visibility and makes it more searchable on the web or more compliant to promote a common interpretation when analysed in different contexts or by stakeholders with district backgrounds. This information also helps build a connection between the icon and its audience and makes the symbol more searchable and readily available.

Metadata is leveraged to provide information about the symbology that the system is providing for CBRNE evidence. Table 1 provides a detailed description of the metadata attributes (presented in Figure 1) that may be required to meet a standard or the requirements of a system's operations.

Table 1 — Description of the metadata attributes

Metadata Name	**Description/** Remarks
simbID	Symbol Identifier (ID), this attribute uniquely identifies the element within the document and allows the element to be referenced unambiguously from another element.
simbName	Symbol Name, provides a title/Name to the associated file icon.
simbDesc	Symbol Description, provides a text description of the associated file icon.
simbDate	Symbol Date of publication, specifies the date of creation for the associated file icon.
simbIcon	Symbol Icon, specifies the image of the symbol.
simbIconSize	Symbol Icon size, specifies the size in bytes of the associated file or wrapped content.
simbVersion	Symbol Version, provides information about the version of the associated file icon.
simbStatus	Symbol Status, Values: A – Active S – Suspended D – Discontinued P – Proposed
simbFileExt	Symbol file extension, expresses the accepted digital file formats (e.g., .tif, .gif, .png, …).
simCatID	Symbol Category Identifier (ID), this attribute uniquely identifies the element within the document and allows the element to be referenced unambiguously from another element.
simCatName	Symbol Category Name, textual designation of the symbol category
simCatDesc	Symbol Category Description, provides a text description of the associated category.
simCatDate	Symbol Categoty Date, specifies the date of creation of the associated category;
stdRefID	Standard Reference Identifier (ID), this attribute uniquely identifies the element within the document and allows the element to be referenced unambiguously from another element.
stdRefName	Standard Reference Name,
stdRefEntity	Standard Reference Entity, (e.g., ISO, NATO, ….)

Metadata Name	**Description/** Remarks
stdRefWebSite	Standard Reference Web Site
strRefVersion	Standard Reference Version, this attribute identifies the version of the document.
stdRefID & simbID	The Standard Reference Identifier and the Symbol Identifier are part of the identifier of the association table subjectKeyWord.
subKeyWord	Subject Keyword, list of keywords considered within the association between **simbID & stdRefID**
subKeyWorDate	Subject Keyword Date, specifies the date of creation of the associated list of keywords.

5.2.3 Metrics

As explained in Chapter 5.2.1, this CWA provides a methodological approach to support the matching of symbols and ensuring all relevant indicators are considered when deciding if symbols from different guidelines/standards can be translated. As symbols from one guideline/standard do not necessarily have an exact responding symbol in another guideline/standard, the correlation needs to be measurable. Therefore, after mapping symbols, a definition indicator (DefInd) is calculated. This Indicator contains several definition factors (Df) and corresponding correction factors (Chapter 5.2.4). If a Df for both symbols is the same (e.g. same Type of audience), the factor is 1; if the Df is different, it is 0, and if it is not exactly the same, it is a value larger than 0 but smaller than 1. It is helpful to define discrete values for Df. Each definition factor is multiplied with a correction factor (c). These correction factors may be used to weigh the different definition factors in case the relevance of certain factors is more important than the relevance of others; the default setting for these factors is $c_1 = c_2 = \ldots = c_i$.

$$DefInd = \sum Df_i * c_i$$

$$0\left(no\ match\right) \leq DefInd \leq 1\left(exact\ match\right)$$

$$0 \leq Df_i \leq 1$$

$$\sum c_i = 1$$

where

DefInd is Definition Indicator;

Df_i is Definition Factors;

c_i is Correction Factor.

With a Definition Indicator of 0, two symbols can not be matched and not be used in the same context, with a Definition Indicator of 1, the symbols can be translated without any obligation. A value larger than 0 but smaller than 1 is a sign, that special attention is needed when translating.

5.2.4 Definition Factors

As described in Chapter 5.2.3, different Definition Factors should be considered to calculate the correlation between two symbols. These factors are described in table 2:

Table 2 — List of definition factors

DfOrg	Type of Organisation
DfPha	Phase
Dfesc	Range of Escalation
DfSce	Scenario of application
Dfobj	Objects
Dfeff	Effect
Dfreg	Type of Geographical Area
DfTta	Type of Target Audience
DfMuSi	Multi or Single hazardous event

5.2.5 Type of Organisation

The organisation and managing bodies of resources and responsibilities for addressing all aspects of emergencies and effectively respond to a hazardous event or a disaster. They can be explicitly or implicitly mentioned in the definition and offer equivalent choices. The catorgies of this Definition Factor may be found in table 3.

Preselection for multiple choices:

Table 3 — Types of organisation

Governmental
Industry / other business
Standardisation
Research and Education
NGOs
International
General public
First responders
Practitioners
Other (to be specified)
Not Specified

5.2.6 Phase

The temporal or rather incident-oriented location of a definition is focused on the setting of the disaster management cycle. Different models exist for this pattern but are described in Table 4.

Table 4 — Types of phases

Prevention (mitigation)
Preparedness (resilience)
Response
Recovery
Other (to be specified)
Not Specified

The signified can be relevant for one, some or all of the phases. Looking at the range of application of a terminology it might be (predominantly) developed to be applied in the response phase, to give an example.

5.2.7 Range of escalation

a) In regards of the overall objective of the CWA, the focus is on large scale events. However, it is highly relevant to identify terms also used for small scale incidents like common emergencies, disasters (large scale), or other ranges of escalation. The preselection thus allows Emergency (small-scale)

b) Disaster (large scale)

c) Other (to be specified)

d) Not Specified

Again, the defined issue can be subject to one or more of the categories.

5.2.8 Scenario of application

To foster interoperability and facilitate a common understanding of the sub-sets of the definition the scenarios were oriented on the code denoting the category of the subject event of the alert message of the Common Alerting Protocol (CAP) [25] and can also be used in the intended domain of application. The preselection is described in Table 5

Table 5 — List of scenarios of applications

"Geo" - Geophysical (inc. landslide)
"Met" - Meteorological (inc. flood)
"Safety" - General emergency and public safety
"Security" - Law enforcement, military, homeland and local/private security
"Rescue" - Rescue and recovery
"Fire" - Fire suppression and rescue
"Health" - Medical and public health
"Env" - Pollution and other environmental
"Transport" - Public and private transportation
"Infra" - Utility, telecommunication, other non-transport infrastructure
"CBRNE" – Chemical, Biological, Radiological, Nuclear or High-

Other
Not Specified

5.2.9 Object

The definition of the relevant objects "used" or manipulated in the regarding context were highly abstracted up to the following categories:

a) groups of persons

b) equipment

c) infrastructure

d) concept

All included units with active and passive roles in the term/signified environment can be subsumed and included.

5.2.10 Effect

The effects in the course of this definition and specifically for further use in the selection and information gathering process of the intended users of the CWA output can be simplified in the following overall categories:

a) positive

b) negative

c) neutral or none

5.2.11 Type of geographical area

The type of region can be defined in accordance with the above-mentioned categories as

a) Local

b) Regional

c) National

d) International (EU, continent, cross border)

e) Other (to be specified)

f) Not Specified

5.2.12 Type of Target Audience

The definition of the Target Audience is equivalent to the definition indicator "Type of organisation". While "Type of Organisation" refers to the Organisation which is communicating, Target audience is the recipient of the communication. In many cases, symbology is made to be used to communicate within one kind of organisation. In this case, the DfTta is defined as:

a) DfTta=1

When the sender and recipient of the message are from the same type of organisation, but not from the same organisation, the DfTta is defined as

b) DfTta=0,5

In all other cases:

c) DfTta=0

5.2.13 Multi or Single hazardous event

In some cases, the usage of symbols might differ from the type of hazard. It is, therefore, relevant if several or only one hazard is involved. In case the type of hazard is the same:

a) Both multi hazardous events or both single hazardous events: DfMuSi=1

b) One set of symbols is for multi-hazardous events, while the other is specifically for multi-hazardous events: DfMuSi=0

Annex A
(informative)

Testing and exemplatory calculation of the Definition Indicator

The methodology of this CWA was tested in the STRATGY project[2] in two Table Top Excercises and one Full Scale Exercise. In the Full Scale Exercise, which took place on the 29th of March 2023 in Gualdo Tardino, Italy, an exemplar mapping and matching of symbols was performed. Participants were given selected symbols used in the ENGAGE system by SATWAY[3] and SITAC symbols[4]. Mentimeter[5] was used in the exercise. The process and results of this exercise are presented in this annex to provide an example of how the methodology was conducted.

After the content of the CWA was presented, the selected symbols were presented and the participants were asked to find the corresponding symbols from the pre-selection. Figure A.1 shows the symbols and their assignment by the participants. The figure also shows that the symbols do not necessarily have a corresponding symbol in another guideline or standard. This is a circumstance that must be discussed on a case-by-case basis by the experts assigning and matching the symbols.

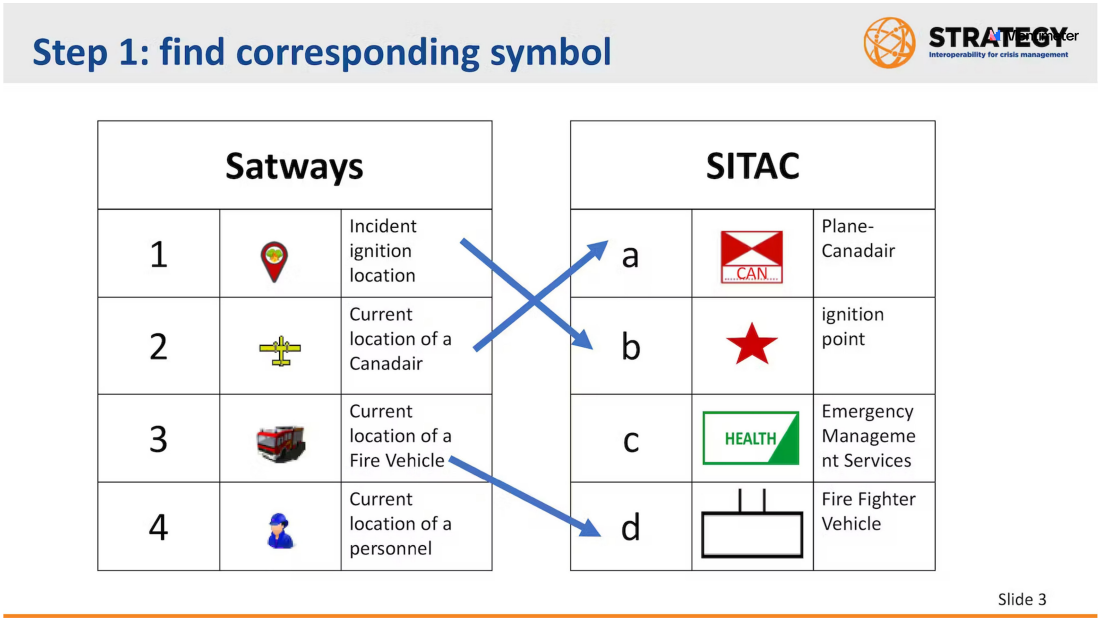

Figure A.1 — Preselected Symbols in the FSX

In the next step, the exercise continues with only one symbol and the corresponding symbol, symbol 2 from the Satways symbology and the corresponding symbol a from the SITAC symbology. The participants now went through the list of definition factors (table 2). As described in section 5.2.3, the

[2] Further information on the project and the exercises may be found under https://strategy-project.eu/ and https://cordis.europa.eu/project/id/883520
[3] https://www.satways.net/products-sw/engage-ims-cad/
[4] https://www.cencenelec.eu/news-and-events/news/2023/workshop/2023-05-12-sitac/
[5] Mentimeter is an online-based presentation tool, where different functionalites are provided to let the auditorium participate with their own devices (e.g. surveys, free text answers, multiple choice questions) https://www.mentimeter.com/

Correction Factors must sum up to 1 – in this case, all Correction Factors were defined as $c_i = \frac{1}{9}$. The next step was to determine the possible values of the definition factors. The values are defined continuously from 0 to 1, but can be discretized to simplify the process. In this case, these were defined as $Df_i = 0 \, v \, Df_i = 0{,}5 \, v \, Df_i = 1$.

In this document the identification of the Definition Factors DfOrg, DfPha and PfObj is described. All other Definition Factors are set on 0,5 for simplification.

This document describes the determination of the definition factors DfOrg, DfPha and PfObj. All other definition factors are set to 0.5 for simplicity.

For the DfOrg (type of organization), 11 categories are defined (Table 3). Participants listed which organization types use the Satways and SITAC symbols. As shown in Figure A.2, the two symbols are partially used by the same organizations, resulting in DfOrg = 0,5.

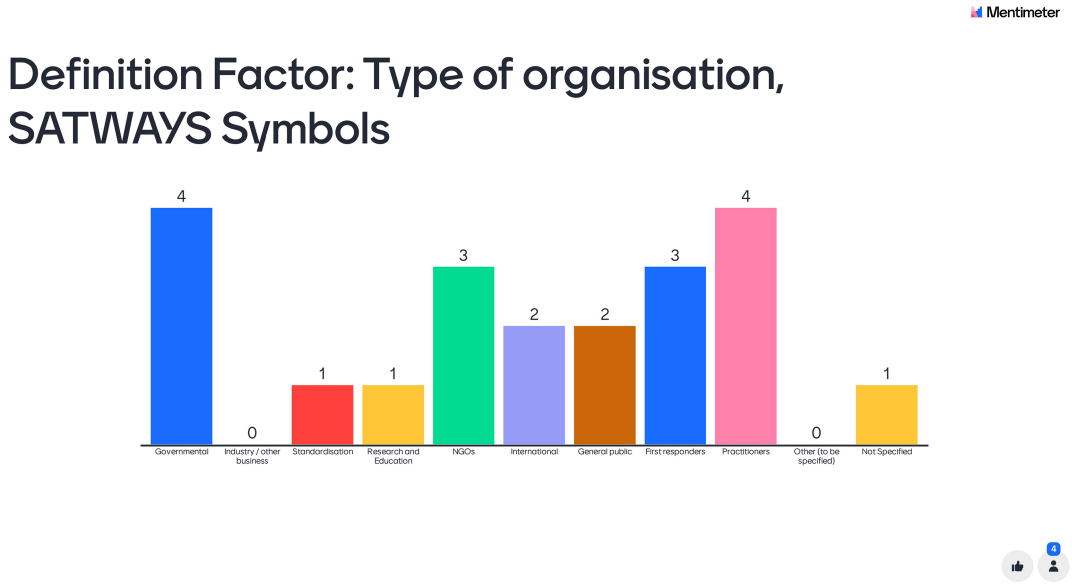

Figure A.2 — Type of organisation for Satways Symbols

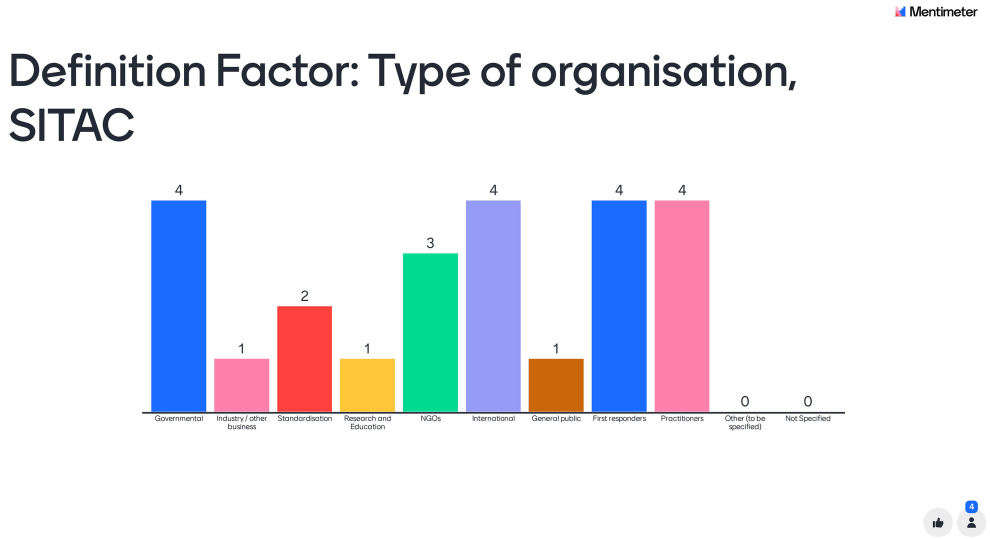

Figure A.3 — Type of organisation for SITAC symbology

The same is true for the definition factor DfPha (Figure A.3). Of the defined phases (Table 4), readiness and reaction apply to both satways and SITAC symbols, while prevention applies only to satways and reaction only to SITAC. It follows, with similarities but also differences, DfPha =0.5.

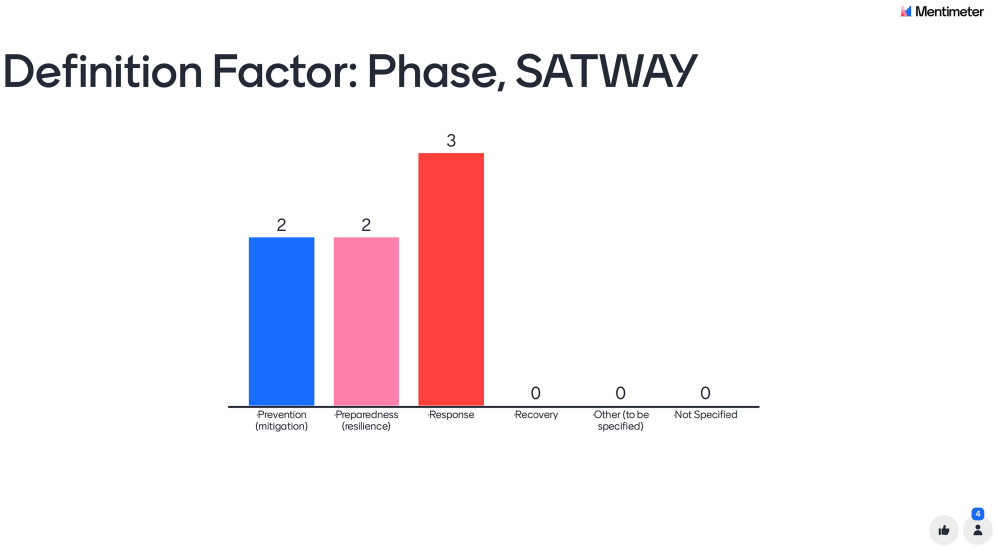

Figure A.4 — Phase of Application for Satways

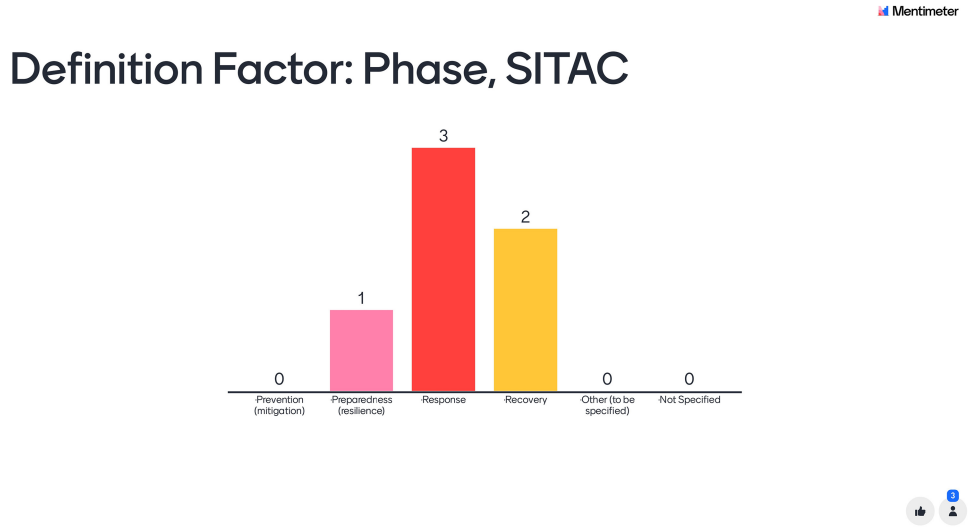

Figure A.5 — Phase of application for SITAC symbology

For the object type (Section 5.2.9), the participants concluded that both symbols describe a device and DfObj = 1.

Now that all values are defined, they are inserted into the formula:

$DfOrg = 0,5; DfPha = 0,5; Dfesc = 0,5; DfSce = 0,5; Dfobj = 1; Dfeff = 0,5; Dfreg = 0,5;$

$DfTta = 0,5; DfMuSi = 0,5;$

$$c_i = \frac{1}{9}$$

$$DefInd = \frac{1}{9} * 0,5 + \frac{1}{9} * 0,5 + \frac{1}{9} * 0,5 + \frac{1}{9} * 0,5 + \frac{1}{9} * 1 + \frac{1}{9} * 0,5 + \frac{1}{9} * 0,5 + \frac{1}{9} * 0,5 + \frac{1}{9} * 0,5 = 0,56$$

In this case, the two symbols have a medium-high definition indicator of DefInd=0.56. This indicator indicates whether it is useful to discuss a possible use of this translation to facilitate collaboration and increase interoperability. It must be emphasized that this metric is an indicator to facilitate decision making in the preparation phase. It is not an exact metric that necessarily leads to a decision. There are two main reasons for this that were identified during the exercises. First, in most cases the definition indicator is below the maximum value of 1, which indicates 100% transferability. This means that there is always a possibility of miscommunication. This risk must be taken into account by experts and the possible consequences must be assessed. Second, even with standardized symbols, understanding may vary in some aspects. Practitioners may interpret the symbols differently depending on the context. This works well in well-rehearsed teams, but can cause problems in the case of interoperability.

In summary, the definition indicator helps experts to consider all relevant aspects when using the definition factors, but the approach does not replace well-organized collaboration preparation.