



### 14.4.3 - SYMBOLS, SYMBOLOGY AND SYSTEMS: A COMPREHENSIVE OVERVIEW

**Contractual Delivery Date:** 08/2010

**Actual Delivery Date:** 08/2010

**Nature:** Report

**Version:** 2.1

**Public Deliverable**

#### ***Abstract***

This report aims to identify lessons learned and draw from the experience of developers worldwide in their respective attempts to create a standardized emergency management symbology set for their region or realm. This amassed knowledge base provides a point of departure and is intended to, within the European Commission (EC) funded INDIGO project, inform the creation of a European emergency management symbology reference appropriate to the European union (EU) context. The rationale for creating such a symbology set is to enhance the ability of emergency managers to better understand information at a glance during critical decision moments, to facilitate the exchange of information between emergency managers, and to strengthen coordination and communication between responders and planners within Europe, and in some cases beyond. Importantly, this initiative is also in line with objectives of the EU INSPIRE Directive on Infrastructure for Spatial Information in Europe with respect to interoperability of geo-information and data.

Preparation Slip				
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<b>For delivery</b>	Lindy Newlove- Eriksson	CRISM	15/03/2011	

**Document Log**

Issue	Date	Comment	Author
V1.0	07/08/2010	First version	Helena Hermansson and Lindy Newlove-Eriksson
V2.0	31/10/2010	Revised and extended following a consortium meeting, an academic seminar, and further research	Helena Hermansson and Lindy Newlove-Eriksson
V2.1	15/03/2011	Revised sensitive information for release. Removed information for public release	Helena Hermansson and Lindy Newlove-Eriksson

**Document Change Record**

Issue	Item	Reason for Change

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## 1 Summary

This report aims to identify lessons learned and draw from the experience of developers worldwide in their respective attempts to create a standardized emergency management symbology set for their region or realm. This amassed knowledge base provides a point of departure and is intended to, within the European Commission (EC) funded INDIGO1 project, inform the creation of a European emergency management symbology reference appropriate to the European Union (EU) context. The rationale for creating such a symbology set is to enhance the ability of emergency managers to better understand information at a glance during critical decision moments, to facilitate the exchange of information between emergency managers, and to strengthen coordination and communication between responders and planners within Europe, and in some cases beyond. Importantly, this initiative is also in line with objectives of the EU INSPIRE Directive on Infrastructure for Spatial Information in Europe with respect to interoperability of geoinformation and data.

An initial global survey reveals a plethora of symbols and symbol schemes but extremely few standardized sets. There are exceptions, namely the emergency management symbology used in the United States, developed by the Federal Geographic Data Committee (FGDC) within their Homeland Security Working Group (FGDC HSWG), and the somewhat less governed symbology set for use in Australia and New Zealand, the Australasian All-Hazards Symbology, developed by the Intergovernmental Committee on Surveying and Mapping (ICSM) and the Victoria-based company Spatial Vision. There are also serious initiatives and dialogues for standardisation which are currently underway, for example within the World Meteorological Organization (WMO) Intergovernmental Oceanographic Commission (of UNESCO).

Emerging from the study of the development processes of these symbology sets are some recommendations and food for thought for the European endeavour to create a European standard for emergency management symbology, undertaken by INDIGO.

In the European context, an extensive, thorough, and inclusive audit process with stakeholders probing into requirements of a symbology set, the current situation and preferred end states will make for promising results to further symbology standardisation. In conjunction with symbol creation and agreement on existing symbol inclusion, levels of comprehension need to be tested across culture, gender, and organisational affiliations, to ensure that symbols are understood and interpreted correctly with an extremely high degree of universality. Endorsing a common European standard undoubtedly entails investment, for example transition costs for covering training, awareness raising, and modifications of standard practises and procedures. Establishing a funding mechanism - but also setting up a clear governance structure for implementation activities - ought to help mitigate these costs. Building on current mapping procedures and work practises rather than replacing them also mitigates transition costs and encourages adoption of new symbols, even though the difficulties of creating one system built on more or less 27 to 31 different European systems is emphasized.

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<sup>1</sup> The INDIGO project aims to research, develop and validate an innovative system integrating the latest advances in Virtual Reality and Simulation in order to homogenise and enhance both operational preparedness and management of actual complex crises. In addition, INDIGO will also propose a European emergency symbology reference for 2D/3D maps. This will fill an important gap by offering a common visual reference that can be used across Europe to facilitate the immediate understanding of incidents, thus improving decision making across organisational boundaries. The INDIGO Consortium is led by Diginext, and membership is further comprised of: Consiglio Nazionale delle Recherche; the Centre for Advanced Studies, Research and Development in Sardinia; Immersion SAS; the European Committee for Standardization; Crisisplan; Crismart at the Swedish National Defence College; and Entente pour la forêt méditerranéenne.

## 2 Introduction and Aims of Report

### 2.1 Why Standardized Symbology?

It is not in the least unusual for contemporary crises to be transboundary in character, necessitating involvement of different nations, their different levels of government and respective agencies in the prevention, management, and even to some degree recovery from such crises. When a crisis demands attention and resources from different jurisdictions and nations, communication and coordination of information becomes yet more troublesome. Maps are a very good means for summarising and describing a situation visually, thereby presenting a variety of actors with a Common Operational Picture (COP). Yet a map itself – at least a conventional non-digital one - typically provides few informational cues beyond geographic location and topographic relief. Rather, it is the symbols placed on maps that convey valuable information of greater detail. Parker, MacFarlane, and Philips claim that “one critical element in ensuring that the message is not only received but understood is map symbolisation. /.../ Certainly there is no national standard map symbology accepted across the domain of IEM [Integrated Emergency Management], and this needs to be addressed.”[PMP08]. As Dymon (2003) points out in her analysis of emergency map symbology, increasing use of integrative Geographic Information Systems (GIS) has highlighted the need for standardised symbology:

*The rapid growth and acceptance of GIS systems and data to manage disasters and local emergency response, coupled with the wide array of symbology choices within GIS packages, has contributed to differing interpretations of the appropriate symbology to use for such maps. [...] In order to achieve the ultimate level of communication during a crisis, symbols need to be standardised to serve as an effective sign language on maps and graphics [D03, p. 232-233].*

The INSPIRE Directive of the EU to which Member States (MS) are obliged to comply is an interoperability initiative along these lines, indeed according to Bernd Wille cited in Hopfstock (2007) a kind of “Esperanto for geodata!” which “demands view services making it possible to display or overlay spatial datasets and to display legend information and relevant metadata” [H07]. Parker, MacFarlane, and Philips argue along the same lines:

*With the need to address issues of data interoperability, not only between local and national agencies but also across national borders and cultures, through both national and international initiatives to develop spatial data infrastructures, such as INSPIRE (2004), addressing standards for map symbology for IEM is even more apparent [PMP08].*

The managing of 9/11 is a case in point where different agencies constructed crisis maps of changing conditions and, in the process, “created their own symbology to convey critical information to emergency managers” [D03, p. 228]. Using a common symbology facilitates the exchange and hasty interpretation of vital information between both decision makers and emergency responders which is often crucial to successful management of a crisis.

In short, a shared symbology benefits emergency managers (adapted from Dymon, 2003, p. 228) by:

- facilitating exchange of information and data;
- promoting universal understanding of hazardous and vulnerable locations;
- addressing the communication of mission critical information across agencies, jurisdictions, and all levels of public and private sectors;
- strengthening coordination and communication between planners; and
- enhancing the ability of emergency managers to better understand information at a glance during critical decision-making moments.

It should be stressed that although there is a stated need for a shared symbology from many quarters, assembling or creating a successful one is a daunting endeavour indeed. Not only must symbols be created or amassed from different sources that are accepted by all who are supposed to use them, but importantly, the concepts, i.e. what symbols convey must also be agreed upon. Even if designers manage to create or present and gain acceptance for a good universally understood symbol to represent for example “cordon”, this still will not guarantee that “cordon” will have the same meaning for all users. This problem may arise from translation difficulties but also may be due to differing Standard Operating Procedures (SOPs), praxis, and differing organisational cultures.

## **2.2 Aims of Report**

This report identifies symbology standards, both currently existing ones and those under development. The overarching aim is to provide an overview of these standards and to identify lessons learned drawing from the experiences and modus operandi of developers in their attempts to create a standardised emergency management symbology set. What steps did the process consist of, what factors need to be considered, and can any major setbacks or pitfalls be identified that the European endeavour might learn from and avoid? Findings are documented in the recommendations section.

Prior to the presentation of existing symbol sets and standards, a contextualisation of symbology as well as examples of different types of symbols are briefly discussed in the following section.



### 3 Symbology and Overview of Symbol Types

#### 3.1 Symbology in a Mapping Context: Semiology of Graphics

The semiology of graphics, which is sometimes also referred synonymously to as the “semiotics of maps”, is a “subfield of cartosemiotics” which is the “sign-theoretic study of maps” [S09]. Five major themes are subsumed under this subfield: “map symbolism (map language), sign processes, contexts in which signs and sign processes are embedded, marginal notes, and peripheral signification phenomenon” [S09]. Map symbolism is the “core subject of the semiotics of maps” [S09], and because, as researcher at the COGIT Laboratory, IGN France, Laurence Jolivet, in his work on user-oriented map design points out, “[s]ymbolisation is the key item in the communication between the map maker and its reader” [J08], symbolism from a semiotic theoretical perspective is worthy of much attention and effort within the INDIGO project.

With his seminal work in semiology on retinal (visual) variables in particular several decades ago, French cartographer Jacques Bertin has shaped the discipline; his highly respected works continue to inform semiology - or semiotics if you will - to this day [GF09]. Graphical semiology

*defends the premise that all and any relations between represented objects can be expressed by six visual variables (size, tone/value, color, form, orientation and granulation), three properties relating to the levels of organization of the data (classified as ordered, quantitative or selective) and three ways of implementation (points, lines and areas/zones). Graphic semiology is connected, at the same time, to several theories of form and of representation and to inform theories, developed by contemporary psychology [CM09].*

Apparently only the first four visual variables are used with regularity and these “visual variables may manifest as points, lines or areas (zones). These are the so-called ways of implementing Graphic Semiology. The three properties of the level of data organization refer to classifying data as ordered, quantitative or as selective” [CM09].

The work of Bertin indeed stretches over disciplinary boundaries, lending further breadth, richness and dimension of perspective to the field. This also serves as an explanation for both the necessary breadth and depth of this overview of symbology systems. Despite the fact that his theories and conclusions have been largely supported by substantial research over the years (note a recent exception with regard to hue, size, and orientation of graphic variables in Wolfe and Horowitz, 2004), Bertin himself ironically “did not cite any perceptual or psychophysical work that would provide evidence to his guidelines” [GF09].

Inspired by the work of Bertin, Jolivet in his research provides reflections regarding developing a “map specifications service” based on end user input [J08]. The motivation to ground his work in end user needs corresponds with work aims in the INDIGO project, for example in the area of questionnaire development, workshops and ongoing dialogue. Jolivet cautions that in building up map specifications that “predefined layers might not always be accurate enough to manage the constraints from the user specifications” [J08]. To get around this Jolivet recommends development of new legends or improvement of existing ones via encoding “in an operational model, principles of cartographic theory, definition of standard maps and research” [J08].

### 3.2 Symbol Types

Because symbols within the INDIGO project will be used both digitally as well as conventionally, we can note from the outset that “in the digital context, a “symbol” is essentially a “bitmap or vector image that is used to represent a point” [AUTODESK]. A “symbol table” or set of symbol metadata on the other hand denotes a “term referring to the storage of named objects, including line types, layers, text styles and blocks” [AUTODESK]. Notwithstanding the methods through which they are conveyed, symbol types are the same, albeit with variation in detail and presentation or “packaging” as it were. Categories of symbol types are thus outlined briefly in the following section, followed by some examples.

MacEachren (1995) divides symbols into three types: geometric; pictorial; and associative. Geometric (sometimes referred to as abstract) symbols are commonly circles, diamonds, and triangles, and their message is not easily conveyed which is why they often need to be complemented with a legend [M95]. Geometric symbols are increasingly categorized in terms of points, lines, or polygons and typically rely upon colour differences and line thickness to demarcate distinction. An example of a geometric symbol provided in MacEachren (1995), derived from Robinson et al. (1984), is a filled circle for showing information centres or a filled triangle representing a historical marker [M95], see Figure 1. below.

Pictorial symbols however are “similar in appearance to their referent” [M95, p. 258]. Hence, with pictorial symbols, legends are usually superfluous – i.e. if the symbol is a successful one. Pictorial symbols, as Edworthy and Adams (1996) point out, are also known as image-related or representational symbols [EA96], see Figure 1. below. The third type, associative symbols, can be regarded as “emblems” which represent the referent through some analogous relation of parts of other commonly recognized symbols in combination. An example given is a filled box with a cross on top to represent a church [M95], see Figure 1.

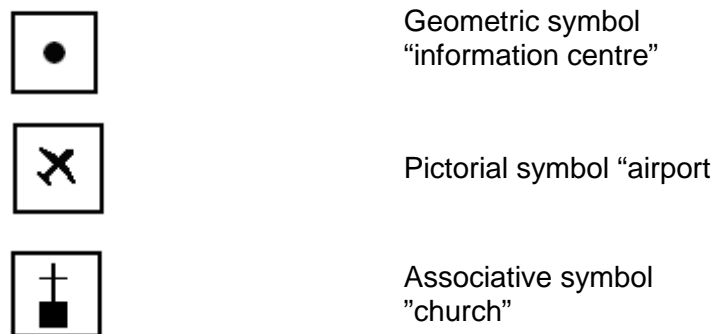


Figure 1: Examples of geometric, pictorial, and associative symbols<sup>2</sup>.

These three types of symbols are prevalent in the literature and similarly defined. However, there is yet another type of less developed symbol, namely that which strives to convey a concept. To be successful, these conceptual symbols should readily evoke the concept, but they are different than for example associative symbols in that the concepts are less widely known, used, and recognized and thus much more challenging to convey. Examples of concepts to be conveyed in the emergency management context are “biohazard” and “radiation”. As Lesch (2003) points out, these concepts are difficult to represent symbolically or pictorially, as the representations of these concepts typically bear no obvious relation to real-world counterparts [L03]. Thus, they are less intuitively understood. The symbol for radiation however has become widely recognised internationally, with bio-hazard lagging probably marginally after.

<sup>2</sup> Source: Adapted from the Atlas of Canada's web page [AOC].

Another way of visualizing this is by using Peirce’s classification of signs used to “describe a semiotic system, regarding the interpretability potential of its signs”, see Figure 2 below [BSP02]. Here the idea is that the further up in the figure, the more easily interpreted are “the cartographic sign[s]”. This is hardly surprising when comparing them below yet the challenge is to also have cartographic signs, or symbols as we refer to them in this report, that are not too dense. When designing symbols the “right” balance must be struck between interpretability and clarity.

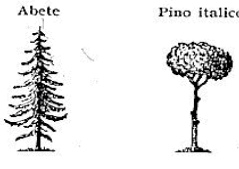


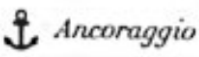

Icon	Image	
	Diagram	
	Metaphor	
Index		
Symbol		<p>Copper</p> <p>Graphite</p>

Figure 2: Peirce’s Taxonomy Illustrated for Cartographic Signs

But what of a conceptual symbol for comparatively new types of hazards, such as nano-hazards? A Canadian-based international think tank raised the issue of the difficulty of conceptual symbology development in 2006 when they launched a contest open to emergency services personnel, developers and the general public alike to develop a universal symbol for nano-hazards [ETCa]. See Figure 3 below which includes internationally recognised conceptual symbols for nuclear, biological and toxic hazards, but no symbol for the comparatively new area of nano-technology.



Figure 3: Conceptual symbols and the lack of an internationally recognised symbol for nano-hazards, Source: [ETCa].

There were over 450 entries received, all of which are linked on the ETC website. The entries were judged by a panel of researchers and other specialists on the subject, as well as by participants at the World Social Forum, Nairobi, Kenya, 20-25 January 2007 [ETC]. The ultimate announcement of the three winning entries did create a considerable degree of controversy with respect to the combined judging process and invisibility of tallied votes, because one of the winning entries (see Figure 4 below) conflates atomic hazards with nano-hazards, which are the result of chemical and not atomic processes, albeit infinitesimal ones.

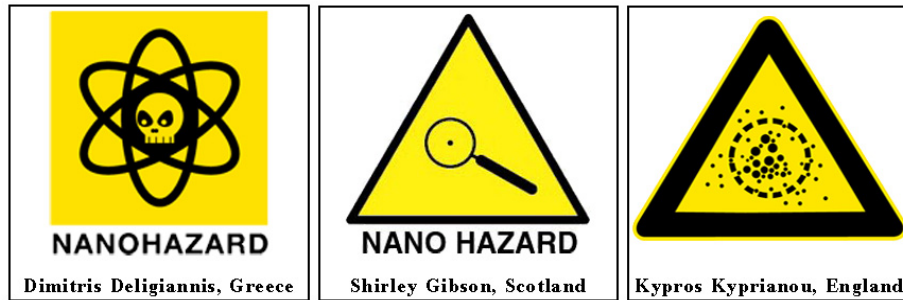


Figure 4: Winning entries of the ETC Group-sponsored competition to devise a conceptual symbol for nano-hazard, Source [ETCb]

Notwithstanding flawed processes in the contest, the example of nano-hazard symbol suggestion is an interesting one which illustrates the socially constructed nature of symbol development, as well as the changing nature of the physical and social world in which we live. Moreover, it can be an example for vicarious learning, whereby the potentially controversial nature of symbols is recognised.

Following on this, we provide another example in Figure 5 below which is much more powerful because the symbol, which is both evocative and confusing, was legitimated and actually put in use. Moreover the impact has been enormous in a manner completely unintended by the original developers of the symbol.



Figure 5: "CAUTION": A failed associative symbol with enduring consequences, Photo: Earnie Grafton, Union-Tribune, Source: [B05].

According to the classification of symbol types above, Figure 5. should be defined as an associative symbol rather than a conceptual one, as the image does not convey something particularly complex and difficult to understand such as a nano-hazard or bio-hazard. We recognise quite clearly a family, as there are two larger persons pulling a child behind them, and we can quite clearly recognise that they are running. The sign is yellow which indicates with a high degree of universality a hazard. The cues that are missing and are not implicit to a universal observer however concern what the people are fleeing from - or to? It is herein in particular that the "associative" nature of this symbol breaks down.

An association that is made that is extremely discomfiting is that to moose, deer, or other animals that may misguidedly and unwittingly run out on to the highway, posing a risk for traffic. We thus experience confusion as this type of symbol would typically have an animal on it and not human beings. This association, of the parallel of the animal to the human being, and to a human as an unassuming "deer in the headlights", typically incognizant of the threat of traffic close at hand is also jarringly incongruent. The overall effect of the symbol is thus bewildering and disturbing to an un-versed audience.

What the “CAUTION” symbol is warning for in fact, is illegal Mexican immigrants fleeing from border patrols in the southern part of California. During the 1980s and early 1990s this was a serious and tragic problem on the freeways in the San Diego area, where dozens of illegal immigrants lost their lives [B05]. This anachronistic and charged symbol remains, despite the tightening up of the border between Mexico and the United States which has eliminated at least this dimension of the problem.

This symbol has become an icon, viewed and used in different ways by different people. “Today, the running family is found on T-shirts, coffee mugs, stickers, book covers and CDs, in fine art and even hanging in an exhibit at the Smithsonian” [B05]. It has “become a Rorschach test for how people feel about illegal immigration and immigrants in general. Some have claimed it as a symbol of Latino identity. Others wear it as a badge of anti-immigrant sentiment” [B05]. Going assuredly far beyond the imagination of symbol developers, it has, according to University of California Los Angeles (UCLA) Professor Otto Santa Anna “become an icon that signals immigration and the political issues surrounding immigration, which are far from resolved in our society” [B05]. However, “some see it as nothing more than a quirky regional souvenir. “Come to San Diego,” one T-shirt reads. “Bring your family.” [B05]. There is much to be learned from a developer perspective from this failed symbol.

Korpi (2007), a researcher working in symbol design and evaluation, has conducted a recognition test of symbols and one of his main findings was that symbols depicting “generally known specific terms” like fire and explosion fared much better than higher level concepts that represent a range of things at the concrete level, such as an emergency or an environmental incident [K07, p. 6]. Related to this is of course that it is more straightforward to design a concrete term than designing a symbol for a term such as an environmental incident, that has more than one possible representation due to causal complexity [K07].

Dymon (2003) convincingly maintains that symbols should be of simple design, have a close relationship to the features they represent, be easily perceived in terms of size, colour, and background, and have a precise meaning without demanding supplementary explanation [D03]. An important reason for this which is covered to only a small degree in the literature is that emergency maps are also used in communication with the public. For a symbology system to gain widespread recognition and indeed comprehension, it is important that the media and public becomes familiar with it [D03]. Psychological research on understanding and processing cartographic and symbolic information has demonstrated that “[t]here is no doubt that we have to learn to read maps and other graphic displays and that there are many facets to this learning” [P89, p 25]. That said, intuitive understanding can be significantly enhanced by integrating commonly understood cues, as is ideally achieved in successful associative symbols.

In this context it is also important to make a distinction between symbols to be used to warn or inform the public and symbols that are to be used by emergency services professionals, such as police or fire fighters. In the latter case, the occupation entails training and cognizance of which symbols are used and what meanings are ascribed to them. This specialised knowledge should thus be part and parcel of the training and education of emergency services personnel. Because these symbols imply specialised knowledge which is learned and practised, symbols used by emergency services professionals typically do not have to be as intuitively understandable as symbols that are used to warn the public. As the public does not receive education on symbols there is a greater demand for symbols used to inform the public to be more intuitive and more pictorial. Notwithstanding, as a main purpose of symbol harmonisation is to facilitate socio-technical interoperability in transboundary crisis response, efforts at arriving at universally understood symbols that are as intuitive as possible should be made.



## 4 Symbol Comprehension and Affecting Factors

To evaluate whether a symbol is understood or interpreted as expected by symbol designers, levels of comprehension need to be tested and evaluated and reach certain reliability and validity levels prior to implementation. Standard organizations provide standards on how these tests are to be conducted. For example, the standards of the International Organization for Standardization (ISO) for testing includes ISO 9186-1:2007 [ISOa], specifying methods for testing the comprehensibility of graphical symbols and ISO 9186-2:2008 [ISOb], specifying a method for testing the perceptual quality of graphical symbols.

A certain correctness level has to be obtained on these tests, even though levels and measure methods vary. ISO, in ISO 3864-3:2006 [ISOc], stipulates a desired level of correctness of 67 percent, while the American National Standards Institute's (ANSI Z.535.3) counterpart is 85 percent [MWB04]. According to the latter standard, participants should be asked both exactly what they think a symbol means and what action they would take in response to the symbol. This method follows from the research of Gibson and his theory of affordances, which briefly summarized maintains that “[i]n any interaction involving an agent with some other system, conditions that enable that interaction include some properties of the agent along with some properties of the other system” [G94, p. 338].

It is also recommended that focus is not limited to the processes and methods embodied in these and other standards and that other perhaps non-standardised and maybe even unconventional yet still high quality or promising methods be looked at wherever possible as well. In developing a truly informed yet innovative and effective symbology standard for Europe which goes well beyond the “state of the art”, a broad “thinking outside the box” approach is advocated herein.

An effort has been made for example to look not only at research, systems and standards originating and employed chiefly in western industrialised communities of practice, but also beyond. However, not much material has been found and greater research efforts in this regard is beyond the scope of this report. Those symbols that have been found appear similar to those used in western industrialised countries. Symbols from Malaysia and Singapore for example are similar, using for example yellow triangles for warning signs. Looking further beyond western industrialised borders for information and inspiration would arguably help ensure not only a more accurate universality, but also a more distributive proportionate one. This is however, beyond the scope of this research effort within the INDIGO project.

The poignant example in the preceding chapter from the United States illustrates the value of a broader and more holistic multi-disciplinary socio-technical, cultural and political perspective in symbol development. Standardisation implies a continuity and one that entails great responsibility as development may result in unintended consequences more far-reaching than the imagination, not properly activated, may conceive.

### 4.1 Theory of Affordances and Other Cognitive Factors

The relational theory of affordances, also described in terms of ability and effectivity [G94], may provide us with insights into what affects our comprehension of symbols. Originally proposed by Gibson in the 1950s it was developed by himself over the course of several decades, and subsequently by a number of other researchers, particularly psychologists. The theory offers an explanation for how people perceive things they see in relation to their earlier frames of reference. According to Gibson, people perceive objects in terms of what they can offer or afford [N09, p. 4]. Hartson (2003) developed the original theory by separating these affordances into four constituents: cognitive; physical; functional; and sensory.

The cognitive and the functional constituents in particular have bearing on the design of emergency symbols. “A cognitive affordance is a design feature that helps, aids, supports, facilitates, or enables thinking and/or knowing about something” [H03 p.319]. Thus, clear and precise symbols could be a cognitive affordance enabling crisis managers to understand the meaning of the symbol.” [H03 p.319]. Functional affordance is a design feature that aids the user in doing something. Without stretching this type of affordance too far, it seems to be applicable to the question regarding what action assessment participants would make in response to a symbol.

More recent behavioural science and geographical research on “display salience and knowledge” and how they affect performance of subjects in drawing inferences from complex graphic stimuli in weather maps is presented by American and European researchers Hegarty, Canham and Fabrikant [HCF10]. Their chief finding is that learning is fundamental to symbol comprehension and that eye fixations are “primarily affected by top-down knowledge, and map design affects performance primarily by facilitating processing of the visual features that represent task-relevant information (feature selection hypothesis)” are important for INDIGO symbology development [HCF10]. This research suggests among other things that guiding visual processes in a top-down fashion will facilitate comprehension of symbols. However, it should be noted that the “Itti saliency map” proposed by Itti and Koch in 2001 did “not reveal top-down components of visual attention” [GF09].

These possibly contradictory findings should be scrutinized and compared in the context of INDIGO. Research on “change blindness”, also discussed in the section below on sensory issues, and referring to visual system failure whereby significant changes remain undetected by observers “when a blank field separates two alternating images”, is also pertinent to directional variables [GF09]. The “flicker paradigm” introduced by Resink et al in 1977 is relevant here; according to research of Wright and Ward in 2008 following from that of Rensink “[a]ttention is characterized by bottom-up (stimulus driven) and top-down (goal-driven) attentional control” [GF09] when interpreting cartographic graphics.

Hegarty et al also found that in the more

*complex inference tasks studied here, display factors enhanced performance only after instruction in the domain and not before, suggesting that in more complex inference tasks, display design becomes irrelevant if the viewer does not have the pertinent knowledge to make the necessary inferences” [HCF10, p52].*

Hence, both knowledge and display design go hand in hand to increase understanding. This is along the lines of the Langefors Infologic Equation which is “a basic model to calculate/evaluate the nature and complexity of data presented by different users during different situations of stress related to both information load and the present task” [PS02]. The infologic equation tells us that whether an individual will understand a symbol or not is not only depending on the symbol itself but also on the individual’s prior knowledge [PS02]. Subsequent research by Fabrikant indicates that flickering graphic information may be even more valuable in enhancing graphic comprehension of maps [GF09] than for example top down or bottom up effects. Further, “change blindness” may be combatted via flickering graphic representations combined with interesting graphics [GF09].

## 4.2 Culture and Gender

To the greatest possible degree, symbol design should attempt cultural independence in order to mitigate potential misunderstandings. It has been argued that pictorial symbols, due to their resemblance to actual objects or processes, have the potential to be “culturally neutral” [EA96]. However, cultural and subcultural bias, as well as gender stereotypes are often deeply entrenched and may very well escape the attention of less astute developers themselves: Thus “culturally neutral” symbols remain rather elusive. The simple example of symbols for male and female rest rooms is illustrative as clothing styles or even dress codes are not only generational but vary for a number of reasons both within and between cultures.

Following from a recent comparison of American and Asian symbol interpretation of American-designed symbols, researchers Chan, Han, Ng and Park (2009) claim for example that sometimes the women wear “trousers”, which “may not be readily understood by people of some cultures” [CHNP09, p. 835]. Moreover, lungis or sarongs are typically worn by men in a number of countries around the world, as are other ‘skirted’ types of apparel. More generally, the Asian study shows that Hong Kong Chinese and Koreans had lower comprehension scores than Americans when interpreting American symbols. The symbols that were tested for comprehension by these researchers were issued by the Department of Homeland Security (DHS) with the aim of communicating the nature of hazards and behaviours necessary to avoid injury or death in the event of nuclear, chemical, or biological terrorist attacks.

Further research on the significance of culture and gender in interpreting symbols would be valuable, as well as symbol design for special populations such as the visually or hearing impaired. The latter is of course more relevant for informing the general public and not specifically emergency services personnel. However, as the following section illustrates, problems with visual interpretation of symbols are similar for the entire population, particularly relating to colour and correct interpretation can be viewed on a sliding scale. Those symbols that are particularly difficult for visually impaired people, for example those suffering from colour blindness, are also typically more difficult for those not diagnosed with any distinct visual impairment.

### 4.3 Sensory Issues and Differences

There are a number of other factors that have a bearing on the ability of people to understand symbols with a high degree of accuracy and speed. Some of these sensory differences arguably warrant discussion outside of the theory of affordances discussed above, which does include a sensory constituent. Examples here include a number of visual impairments, in particular colour blindness. Colour blindness is particularly relevant as an estimated 10% of the population is afflicted [H08, p15]. Further, this genetic affliction which results in a dramatically reduced ability to perceive colour nuances and in particular differentiate between red and green is significantly overrepresented in the male population. There is moreover a rarer form of colour blindness where the ability to distinguish between blue and yellow is diminished, and diagnosis of this rarer form is apparently more difficult.

Importantly for symbol choice and as mentioned in the preceding section, the colours that colour blind people have particular difficulty in differentiating between are also the colours that the regular non-colour blind population also have more difficulty discerning between; red and green are generally harder for humans to differentiate between. The degree and consistency with which emergency services personnel are accurately visually screened is unknown and, albeit with some variation depending on countries and regions, emergency services personnel are typically predominately male, the gender where colour blindness is overrepresented. Moreover, not all colour blindness is easily screenable. Given the above factors, it is apparent that special efforts need to be made when devising colour schemes for symbols and architecture and application development. More attention is given to this topic in the following section.

In recent years research on facilitating understanding of symbols and signals by the visually impaired has exploded, much of it pertaining directly to improving emergency preparedness and response. Focus is not limited solely to devising better colour schemes for clarity, but also more recently, to construction of programs that have applications specifically for sensorily impaired persons. Recent projects at the Department for Informatics at the University Carlos III de Madrid in Spain have for example advanced work in this area, devising ontologies that among other things allow for replacement of traditional graphics with image descriptions able to be read by specialised text-reader software [MAA-PDO08, p203].

Information science and electronic engineering specialists in Taiwan have been conducting research on vision and measuring for what they refer to as “different types of color vision deficiency (CVD)” [HWC08]. They have developed an algorithm which “can run at real-time, and thus can be easily extended to video processing applications”, something which could be of interest to the INDIGO project [HWC08]. Their algorithm, according to them, is a fast one which works by “re-color[ing] images so that the original color contrast can be well preserved for color vision impaired viewers. Also, a user-specified parameter is provided for the trade-off between the enhancement degree and the naturalness in the re-colored images” [HWC08]. They will essentially “re-map the hue components in the original color image through a spatially invariant global color transformation”, enhancing contrast by making the confusing colours take on a wider dynamic scope [HWC08].



It has also been suggested by among others cartographic semiologists that visual cues could be supplemented by carefully constructed and applied auditory and tactile cues [K08]. These additional sensory inputs in the architecture could be essential to some system users, but they are regarded by many as general tools which could, properly utilised, facilitate the understanding of those system users who suffer no sensory impairment. Some research suggests that because visual and auditory perceptions have a tendency to become dulled over time as a natural consequence of aging, additional sensory cues can be a great help in providing multiple input for comprehension. Emergency services personnel have typically been subjected to noise that can lead to decreased auditory perception, for example through their exposure to sirens [DE91] and fire at closer range than the general population. Should auditory cues be built into the symbol system sensitivity to these and other possible factors should be exercised.

Other important sensory issues which should be addressed in the context of symbology development within INDIGO are those of “change blindness”, “foveal vs. peripheral attention” and effects of speed of change and multiple inputs in exposure to map graphics [GB09]. Drawing on the work of Simons and Rensink (2005), American geographers Goldsberry and Battersby note the importance of the change blindness “phenomenon whereby individuals fail to notice change that occurs in a visual stimulus” [GB09, p204]. Over a decade of research in this area reveals that human beings consistently overestimate their ability to detect substantial changes in visual graphics used for example in digital maps [GB09].

This could present serious problems in critical emergency response situations where emergency services personnel may be fallaciously committed to their perceptions of visual stimulus that may in fact, be seriously flawed. Goldsberry and Battersby suggest improvements to animated “choropleth maps” – maps using colour to depict distribution - which might be successfully integrated in the INDIGO architecture, by introducing “methods to quantify the magnitude of change that separates individual scenes within choropleth animations” [GB09, p201].

#### 4.4 Use of Colour

The field of human colour perception and its importance in the interpretation and devising of symbols and other cartographic and graphic tools is rich. Much work has been done in advancing not only the colour perception of those with impairments, but also the general population. This is vital because, as mentioned in the preceding section, the ability to discern colour properly is more accurately viewed on a sliding scale rather than two distinct categories, colour blind or not. Non colour blind have certainly much less trouble with distinguishing red and green than colour blind for example, but these colours remain nonetheless a less readily differentiable colour combination for all people.

Thoughtful research-grounded use of colour in the development of a symbology set is therefore essential. Such an approach to colour use is referred to by researchers at the University of Tokyo as “Colour Universal Design” (CUD) [OI08] and there are an increasing number of resources available for improving colour accessibility for in particular the colour deficient, but which can also improve perception for all. These advancements are noted in the digital 3D mapping field as well as in 2D cartography and should be observed in symbol choice, development, and application. There have also been standards developed on colour use, for example the American USGS colour standard with 1000 colours listed and the Arc/INFO with 999 colours, developed in a fashion complementary to the USGS system. Both of these will be interesting standards for INDIGO developers as they address 3D as well as 2D technology.

At the same time, wherever possible, with regard to not only colour but even to other aspects of icon use, efforts at development of a symbology set within Europe should to a large degree take into account the work done in precursing systems. For example, certain colours and forms, standardised or not, are well-known within extensive communities around the world. The strong purplish pink secondary colour magenta for instance is well-established for use and widely recognised by professionals with experience in both inshore and offshore navigation as the colour which demarcates sensitive areas or areas requiring special attention or care.

Red for example can be manipulated to the secondary colour magenta which is much easier to perceive for colour impaired as well as not [OI08]. It is known that red is not perceived as intense by the colour blind and that red and green should not for that matter be placed together as the green can easily overpower the red for a colour blind person [H08, p15]. The success of magenta over red is why magenta is used for example by the World Meteorological Organization (WMO) who advocates the use of magenta for indicating areas requiring care and attention.

Drawing on Törnqvist (1997) with respect to colour, Hägglund cites a number of general recommendations that can be made:

- Black, white, yellow and blue are most readily seen by all, even colour blind;
- Red is typically used for warning but red is dull for the colour blind; bright yellow is preferable to red but may still be mistaken for green by the colour blind;
- Never red and green in the same symbol;
- Colours and patterns together decrease clarity; black and white patterns more differentiable;
- Colour differences difficult to perceive when several colours in close proximity in limited spaces [H08].

INDIGO should also assess the value of different software approaches for dealing with limitations or afflictions of human beings in perceiving colour, for example, the use of HCL triplets in digital graphic creation. Another method suggested is a fast algorithm for colour blindness which can be operated in real-time video processing applications. Also promising is the work of Goldsberry and Battersby on reduction of and attention to the phenomenon of “change blindness and foveal versus peripheral attention” [GB09]. Solutions proposed by researchers could improve symbol clarity as well as allow the colour blind, overrepresented in the male population, to also better distinguish symbols. References on the topic of colour should be referred to in the development of INDIGO, for example [DJ09] [ZHM08] [HWC08] [GB09] and [OI08].

For example, colour used in graphics is conceived of, data analysts and developers working in the area of statistical graphics point out, in terms of hue, saturation, and brightness (HSB) or hue, lightness, saturation [DJ09]. It is therefore of the essence when digitally constructing coloured graphics to “employ a color model or color space that describes colors in terms of [these] perceptual properties” [ZHM08, p.3259]. The researchers maintain that software packages that commonly support colour models typically involve “the specification of Red-Green-Blue (RGB) triplets” [ZHM08, p.3259]. The problem with this according to the authors, is that RGB triplet specifications correspond to “colour generation on a computer screen (see Roynton 2000) rather than corresponding to human color perception” [ZHM08, p.3259].

It is apparently for humans “virtually impossible to control the perceptual properties of a color in this color space because there is no single dimension that corresponds to, e.g., the hue or the brightness of the color” [ZHM08, p.3259]. In order to address these problems presented by use of software packages that use RGB triplets, “various perceptually-based color spaces have been suggested, where each dimension of the colour space can be matched with a perceptual property.” [ZHM08, p.3259]. A common feature of software entails thus, the authors note, a transformation of RGB triplets to a specification of Hue-Saturation-Value (HSV) triplets [ZHM08, p.3259].

However, and regrettably the researchers assert, “the dimensions in HSV space map poorly to perceptual properties and the use of HSV colors encourages the use of highly saturated colors” [ZHM08, p.3259]. Drawing on the 2003 work of Ihaka on presentation graphics, Zeilis et al argue for the employment of a fruitful colour model or “colour space” that is perceptually based and alleviates the aforementioned problems [ZHM08, p.3259]. This more amenable model, which makes use of Hue-Chroma-Luminance (HCL) triplets, stems, according to the authors, from a transformation of CIELUV colour space [ZHM08, p.3259].

CIELUV is a now standardised (jointly CIE/ISO) colour space created in 1976 by the International Commission on Illumination (CIE) in order to address the colorimetry problem of equal distances between 3D and 2D colour spaces produced by plotting CIE tristimulus values in rectangular coordinates and the chromaticity diagram respectively not being capable of representing “equally perceptible differences between color stimuli” [CIE]. Use of the transformed CIELUV colour space in HCL triplets ultimately allows, Zeileis et al maintain, for production of coloured graphics that are in “harmony” with each other, are not “unappealing” and above all, “work” on principles of human vision and in all contexts [ZHM08].

The preceding summary of Zeilis et al argument for use of HCL triplets in graphics software development of colour models is arguably dense and not particularly easy for those un-versed in colorimetry and illumination to readily comprehend. It does notwithstanding illustrate some important aspects concerning the limitations of human visual perception of coloured graphics. These limitations and their possible resolution through for example use of techniques such as HCL triplets ought to be taken into account and assessed in the development of standardised graphic symbols. More generally, they should also be taken into account in INDIGO project development of an architecture including and employing graphic symbols for use by emergency services personnel in crisis situations. It is highly recommended that the recent work of Daniani and Jeong [DJ09] in 3D constructions should also be reviewed in constructing INDIGO architecture.

Continuing on the topic of illumination but from a perspective that is not necessarily so dependent on colour, symbol creation and/or symbol adaptation appropriate to different contexts is necessary. For example, in crisis situations, there may be no conventional or reserve power lighting up any number of locations where both emergency response personnel as well as the general public may be located and be using human and material resources and equipment in sub-optimal conditions from a lighting perspective. Whereas the INDIGO system is more complex issues such as back-up and alignment with alternatives for transition to other routines should INDIGO suffer from reserve power failure as well as regular power failure be considered as well.

This is particularly relevant as INDIGO, in contrast to its’ forerunner CRIMSON, is intended to be used in realtime crisis response situations. Transition and alignment with other routines should thus be seriously considered. In this regard, work has and is being done in the area of evacuation and symbol efficacy that could fruitfully be brought to bear, for example perhaps the application of iridescent materials, principles or concepts used in the development of reflective emergency exit signs could be used in other more innovative contexts and on other surfaces.

## 4.5 Stress

It is not farfetched to assume that future users of the developed European symbology set will be under pressure from time to time when managing a crisis. Due to the high stakes and pressures involved, crises are times that will be remembered (Caruth 1995, in [BB’tH04]). During the transition process between not only adopting, but also feeling comfortable and competent with a new symbology set and leaving the previously used symbology set, confusion may occur at times, especially when under pressure. When under pressure, we search for familiar cues in personal experience and readily available precedents imbedded in institutional memory [BB’tH04]. In these situations, the old symbols may be more readily available than the new ones, potentially affecting responses to the new symbols in a detrimental manner.

The relationship between stress and performance is clearly established and often presented in the graphic form of an inverted U-curve. Maximum performance levels are reached when stress levels are high enough to be stimulating, yet not higher than our assessed available resources to cope with the task at hand. When stress levels are too low, performance levels decrease, but performance levels also decrease when stress levels are too high. In a similar vein, our capability to process information also follows this pattern. At certain stress levels, it becomes more difficult to process information. Considering the potentially high levels of stress during a crisis, this has implications when introducing a new symbology set.

Both of these phenomena connected to stress can be alleviated or at least mitigated with preparatory courses in awareness raising and training packages on symbols.

## 5 Praxis and Politics of Standardisation

During the last decades, revolutionary technological developments and economic integration on a regional and global have triggered a growth in the number of international and regional standards [MB03]. These developments “have raised the economical and political salience of what were once considered merely ‘technical’ specifications” [MB03, p. 2]. For example, being the initiator of a standard implies lower transaction costs than being an actor having to change its procedures to accommodate to that standard. Mattli and Büthe (2003) have pointed out that significant economic resources and technical expertise are prerequisites for active participation in international standardization, which is why noncommercial interests may find it difficult to be actively involved in these fora [MB03].

Standardization processes have until recently only gained the interests of legal scholars and economists [M01]. Yet, international standardization raises a lot of questions that can be linked to political science and international relations. Mattli and Büther point out some of them; do international standards benefit all or are there winners and losers and what is the role of power and institutions in international disputes or bargains over standards? [MB03] Other relevant issues are whether a standard is the only way to gain widespread recognition and endorsement, and if the standard per se is as important as the latter two. Do “standards” have to be standardized by one of the many standardization organizations to be considered one or can conformity to for example one symbology set by a majority of actors be considered a standard? According to ISO, standards are

*[d]ocumented 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; they are market-driven and therefore based on voluntary involvement of all interests on the market (ISO in [M01]).*

Europeans are said to be quite content with this definition of a standard, while Americans believe that it is too narrow, and has proposed an alternative definition that emphasizes the actual use of a standard for it to be considered one:

*A true international standard... is developed by a standardization body... that is open to all interested parties, regardless of national origin, and... has a demonstrated track record of global acceptance and use by the affected industry or regulatory bodies of various nations (ASTM Standardization News quoted in [OECD]).*

There is a plethora of standards developing organizations (SDOs). Two widely recognized SDOs are the International Organization of Standardization (ISO), the world’s largest SDO, and The European Committee for Standardization (CEN) that will be briefly described below. There are however also “unofficial” standardisation bodies that are highly relevant to INDIGO and its’ aims, such as the Open Geospatial Consortium, OGC. The OGC is “a non-profit, international, voluntary consensus standards organization that is leading the development of standards for geospatial and location based services” [OGC10].

ISO, established in 1947, is a non-governmental network comprised of the national standards institute of 163 states, one member per state. Members can either be affiliated with national governments or have their roots in the private sector [ISO]. Yet, no state or government themselves can be members [MB03]. ISO is allegedly a democratic organization; independent of size or strength of a state’s economy, each participating member in ISO has one vote. ISO is a non-governmental organization, and as such has no legal authority to enforce the implementation of its standards [ISO]. Still, countries may decide to adopt ISO-standards as national legislation. Even though ISO standards are voluntary, certain standards have become a market requirement [ISO].



ISO standards are developed by technical committees comprising experts from the industrial, technical and business sectors which have asked for the standards, and which subsequently put them to use. These experts may be joined by representatives of government agencies, testing laboratories, consumer associations, non-governmental organizations and academic circles [ISO]. The ISO standards are based on international consensus.

CEN “is the only recognized European organization according to Directive 98/34/EC for the planning, drafting and adoption of European Standards in all areas of economic activity with the exception of electrotechnology (CENELEC) and telecommunication (ETSI) [CENa]. CEN has 31 national members that work together to develop voluntary European Standards. The European standards have a unique status since they also are national standards in each of its 31 member countries [CENa]. See Table 1 below for a list of the standardization bodies in each European country. At CEN European standards are developed by experts from a range of interested groups that form technical committees and working groups of the national Standards Developing Organisations (SDO) [MB03].

The CEN-established working group of particular applicability to endeavours of the INDIGO project (of which CEN is a member) was established in 2004 with the title “Protection and Security of the Citizen” and with the identification tag CEN BT/WG 161 [CEN08]. This working group established several expert groups as well; in the 2008 Business Plan for a CEN Workshop on “Emergency Services Management” (ESM) proposed by the working group, the intention to “establish a link also with the Expert Group on Emergency Access (EG/DG INFSO) and with the eCall work in CEN/TC278/WG15” is specifically referred to [CEN08]. The workshop concluded its’ activities in December 2009 and culminated in the publication of CWA 16107: Emergency Services Capability Framework in 2010 [CENb] which is now commercially available, for example on the website of the British Standards Institute (BSI).

Also relevant to the work of the INDIGO project geared at developing a standard symbology set for crisis management in Europe are several standards of the European Committee for Electrotechnical Standardization (CENELEC). Beginning in the 1990s CENELEC developed standards for emergency lighting systems, systems that are for example intended to illuminate and guide evacuation cues in crisis situations. An early CENELEC standard of this nature is EN 1838:1999 which was apparently subsequently submitted to a “Class A deviation” by the British Standards Institution (BSI) [GLAMOX], ostensibly because the initial CENELEC standard was deemed inadequate by the BSI. According to GLAMOX, the BSI standards for emergency lighting “allows for clearly defined and permanently unobstructed escape routes up to 2m wide to have an illuminance of 0.2 lux on the centre line of the floor, but suggests that these routes should preferably be illuminated to 1 lux” [GLAMOX]. The BSI has, in their webpage section entitled “Local authorities –emergency planning”, references to a number of different BSI standards regarding emergency lighting [BSI].

European Country	National Standards Body
Austria	Österreichisches Normungsinstitut (ON)
Belgium	Bureau De Normalisation (NBN)
Bulgaria	Bulgarian Institute for Standardization (BDS)
Croatia	Croatian Standards Institute (CSI)
Cyprus	Cyprus Organization for Standardization (CYS)
Czech Republic	Czech Standards Institute (CNI)
Denmark	Dansk Standard (DS)
Estonia	Eesti Standardikeskus (EVS)
Finland	Finnish Standards Association SFS (SFS)
France	Association française de normalisation (AFNOR)
Germany	DIN Deutsches Institut für Normung (DIN)
Greece	Hellenic Organization for Standardization (ELOT)
Hungary	Magyar Szabványügyi Testület (MSZT)
Iceland	Icelandic Standards (IST)
Ireland	National Standards Authority of Ireland (NSAI)
Italy	Ente Nazionale Italiano di Unificazione (UNI)
Latvia	Latvian Standard (LVS)
Lithuania	Lithuanian Standards Board (LST)
Luxembourg	Service de l'Energie de l'Etat (SEE)
Malta	Malta Standards Authority (MSA)
Netherlands	Nederlands Normalisatie-instituut (NEN)
Norway	Standards Norway (SN)
Poland	Polish Committee for Standardization (PKN)
Portugal	Instituto Português da Qualidade (IPQ)
Romania	Asociatia de Standardizare din România (ASRO)
Slovakia	Slovak Standards Institute (SUTN)
Slovenia	Slovenian Institute for Standardization (SIST)
Spain	Asociación Española de Normalización y Certificación (AENOR)
Sweden	Swedish Standards Institute (SSI)
Switzerland	Schweizerische Normen-Vereinigung (SNV)
United Kingdom	British Standards Institution (BSI)

Table 1: Standardisation bodies in different European Countries.

Source: Adapted from: European Committee for Standardization<sup>3</sup> (CEN)

<sup>3</sup> <http://www.cen.eu/cen/Members/Pages/default.aspx>

In their investigations into international standardization, Mattli and Bütke (2003) mention two contesting views of international standards; the world society approach (sociology) and the realist approach. The world society approach sees “international standardization as a resolutely cooperative venture – devoid of distributional consequences and not reducible to the interests of relative power of regions, states, or firms” [MB03, p.14]. Yet, Mattli and Bütke (2003) believe this view to be devoid of politics and contestation and that it also fails to consider differences in material interests and power. The realist approach however, sees that “the economic might of states is the principal force in setting the agenda and determining success in international standards setting” [MB03, p.17]. Yet according to Mattli and Bütke (2003) this view fails to consider the private sector’s institutional dynamics [MB03]. Mattli and Bütke’s own approach, institutional complementarities approach, posit that

*domestic standardization systems involving high levels of hierarchy consultation/cooperation facilitate the accommodation of new layers of standardization above the national level. Offering greater institutional complementarity with international standards institutions, these organizational characteristics ease the adaptation of national SDOs and their domestic constituencies (firms and other actors interested in standards) to changed circumstances in which economic and political imperatives push toward increasingly setting standards at the international level [MB03, p.22].*

When comparing the European and the American standardization system, Mattli and Bütke (2003) contend that the organizational characteristics of the European system make for a better match between the national and international institutions than the American system, that is more anarchic [MB03]. Based on this, Mattli and Bütke believe the European system to have an informational advantage about international standardization opportunities and proposals and therefore to be more involved (earlier and more effectively) than American counterparts [MB03].

## 6 Symbology Sets and Standards

The preceding sections have documented and discussed relevant theoretical approaches within the subject of symbology as well as design factors that are vitally important to consider when trying to apply or create a successful, i.e. as universally understood as possible symbology applicable to both 2D and 3D contexts. In this chapter we shift our attention from the theoretical aspects to the empirical aspects and thus to existing and applied symbology schemes and sets in use today.

### 6.1 Overview of Symbology Systems

To date, essentially only one comprehensive set of truly standardised emergency symbology exists and that is the emergency symbology set used in the United States, developed by the US Federal Geographic Data Committee Homeland Security Working Group (FGDC HSWG) and standardised by the American National Standards Institute (ANSI). Please find a full list of the current FGDC HSWG symbols in the appendices. Note that even though the system is standardly used in the homeland security field in the US, it is a living or evolving symbology set. The latest revisions to the symbol set with some explanation for the changes is located at the end of the appendix, following the latest version of the symbology set.

The FGDC HSWG symbology set may soon have another standardised contender in the emergency symbology set developed for use in Australia and New Zealand, the Australasian All-Hazards Symbology, developed by the Intergovernmental Committee on Surveying and Mapping (ICSM), and the Victoria-based company Spatial Vision. The symbols in this latter symbology set, available for perusal in the appendices of this report, are currently under review for becoming an Australian standard [T10]. The American FGDC HSWG system is comprised of a standard set of symbols for use by the emergency management and First Responder communities at all levels of need (i.e. national, state, local and “Incident”).

The Australasian ICSM similarly aims to “define a symbology framework that will support emergency management across jurisdictions, agencies, hazard types and technology platforms” [ICSM07, p. 6]. During the development phase of the ICSM symbology, there was a question raised regarding what Europe was doing about symbology standardization. The answer was “nothing or so little”. “Each European country and nearly each emergency or security organization has its own set of symbols” [I09, p 20]. This reflection has spurred the ambitions and indeed necessity of the EC-funded INDIGO project.

Prior to discussing the FGDC HSWG symbology set and ICSM emergency symbology sets in greater detail, additional less unified and coherent standards and symbologies in use are presented, many of which while they have not come as far in standardisation, have nonetheless important information to convey. However, information regarding emergency symbologies and symbols is typically not readily available in catalogued form, something which Professor Ute Dymon (2003) has also observed; she notes that “information regarding symbols and symbology is hidden on webpages and maps” [D03, p. 229]. In 2003, Dymon conducted a preliminary investigation into emergency mapping symbology, “in order to identify and analyse what symbology was currently being used by various agencies and institutions and where these agencies get their symbology from” [D03, p. 229]. It was in fact the work of Dymon that initiated the development of the American FGDC symbology set.

Dymon’s (2003) twelve months of research resulted in a matrix documenting different symbol schemes from, with the exception of Japan and Mexico, the western industrialized world:



Table 2: Different Symbol Schemes Identified by Dymon

Military	MIL-STD-2525B Appendix A, Appendix D
METT-TC	Military METT-TC: The Graphic Representation of the Civil Component
METOC	MIL-STD-2525B Appendix C, Meteorological and Oceanographic Symbology
USGS	Topographic Map Symbols
NOAA	National Oceanic Atmospheric Administration
NCUTCD	National Committee on Uniform Traffic Control Devices
World Bank	World Bank Cartographic, Chart and Graph Symbolism, Administrative Services Department, 1978
GIS Unit EM	Division of Emergency Management GIS Unit
Japan: Pictogram	Japan: Pictogram System for Natural Disaster Reduction
EMIS OES	Centro de Entrenamiento de Bomberos Profesionales
NWA	<a href="http://www.nwas.org">http://www.nwas.org</a> , National Weather Association
Stanford	Environmental Health and Safety Dept, Stanford University
ER Handbook	Kent State University Department of Public Safety and Campus Environment and Operations, Emergency Response Handbook
Unit Transfer	Unit Transfer Symbols, Williams and Heintz Map Corporation
U W and C	Understanding Weather and Climate, Second Edition, Edward Aguado, James E. Burt, 2001
Cartographic Journal	The Cartographic Journal, The British Cartographic Society, Volume 25, Number 1, June 1988
Signet Signal Symbol	Signet Signal Symbol: Handbook of International Signs, ABC Verlag Zurich, Switzerland, 1970
Symbol Source Book	Symbol Source Book, H. Dreyfuss, McGraw Hill Companies, NY, 1976
Handbook of Pictorial Symbols	Modley, R. (1976). Dover Publications Inc., NY, 1976.
ADCA	Australian Department of Civil Aviation
ATA	Air Transport Association
BAA	British Airports Authority
D/FW	Dallas-Fort Worth
D.O.T. .74	Department of Transportation, 1974
D.O.T. Hazard	D.O.T. Hazard Labels
European Road	European Road Signs
IATA	International Air Transport Association
ICAO	International Civil Aviation Organization
KFAI	Sweden
LVA	Las Vegas Airport
Nova Scotia	Netherlands Statistical Foundation
NPS	Nova Scotia Department of Tourism
NRR	National Park Service
O. 64	Netherlands Railroad
O .68	Olympic Games, Tokyo, 1964
O .72	Olympic Games, Mexico, 1968
Pg	Olympic Games, Munich, 1972
Pictografic Safety	Picto' grafics, Paul Arthur, VisuCom Ltd., Toronto, 1974
Port	Pictografic Safety Signs for Factories, Industrial Parks, Industrial Complexes
SP	Port Authority of New York and New Jersey
S/TA	Swedish Standard Recreation Symbols
TA	Seattle-Tacoma Airport
TC	Tokyo Airport
UIC	Transport Canada, Airports
US Road	International Union of Railways
WO. 72	US Road Signs
X .67	Winter Olympic Games, Sapporo, 1972
X .70	Expo 1967, Montreal
ESRI Weather	Expo 1970, Osaka
ESRI Hazmat	Icons
ESRI Forestry	Icons
Dingbats	Icons
Zapf Dingbats	Corel Draw .dingbats. font (Adobe)
Natural Hazards	Natural Hazards Informer, January 2002
Weather Station	The McGraw-Hill Companies, Inc., Weather Station Data Plot
NYCity Map	FEMA GIS New York City Map (11/9/01 World Trade Center)
Paskaville Map	
Air Force	<a href="http://www.af.mil/">http://www.af.mil/</a> , Air Force website
ARMY	<a href="http://www.army.mil/">http://www.army.mil/</a> , Army website

USACE	<a href="http://www.usace.mil/">http://www.usace.mil/</a> , Army Corps of Engineers website
USCG	<a href="http://www.uscg.mil/uscg.shtm">http://www.uscg.mil/uscg.shtm</a> , Coast Guard website
Vet Assoc.	<a href="http://www.avma.org/">http://www.avma.org/</a> , Veterinary Association website
Work Safe	<a href="http://www.worksafefbc.com">http://www.worksafefbc.com</a> , Hazard SYMBOLS key booklet
Atmos UCLA .	<a href="http://www.atmos.ucla.edu/weather/about_IR.html">http://www.atmos.ucla.edu/weather/about_IR.html</a>

Source: Adapted from [D03]

Commenting on her matrix, Dymon states that symbology schemes are “numerous and diversified and often tailored to specific hazard and emergency applications. However, there are currently no standards and guidelines to indicate what symbol is appropriate to present a given feature” [D03, p. 232]. It is illustrative that Dymon found no less than 44 different symbols that were used to represent “medical facilities” [D03].

In addition to the symbology schemes listed in the matrix above, the UN has also created UN standards; the United Nations Military Symbols Handbook [DPK000], focussed on peace keeping, contains primarily military symbols, although those engaged in the Australasian ICSM judge some of the symbols in the set to be more generic in type [ICSM07]. For example, ICSM’s proposed Road Closure/ Traffic Control Point symbol was adapted from the UN’s symbol set [ICSM07]. Moreover, the UN Disaster Assessment and Coordination (UNDAC) Field handbook [DAC00] covers both command and control symbols and symbols used in Search and Rescue (SAR).

The SAR symbols used in UNDAC’s Field Handbook are based on the International Search and Rescue Advisory Group’s (INSARAG) standards. INSARAG is a global network of more than 80 countries and disaster response organisations under the United Nations umbrella focussing on urban search and rescue (USAR). INSARAG has established standards for international USAR teams, including map symbols [OCHA]. See appendices for some of these INSARAG symbols.

Recent research from the Delft University of Technology (TU Delft) tackles a number of problems in using symbols, for example using INSARAG symbols in an interactive context with for example iPhones [VDM10]. These Dutch researchers who have developed a tool for Search and Rescue (SAR) called the Search and Rescue Awareness and Information Tool (SAInT) point out that a shortcoming with INSARAG symbols in particular is that they cannot be drawn in a single motion [VDM10, p. 60]. It is recommended that INDIGO looks at the research and trials conducted by the researchers at TU Delft as they are highly relevant to the project.

Specialists at the Pacific Disaster Center (PDC), located in Hawaii but engaged in risk reduction and impact mitigation around the world, assert their view that UN agencies have come a long way with respect to symbology standardization. Indeed the Office for Coordination of Humanitarian Affairs (OCHA) is deemed to be “closest to the goal of an international data model and set of standardized symbology” [PDC10]. OCHA has published guidelines on the production of OCHA GIS mapping products which are intended to support producers of mapping products within their office in the production of consistent, concise and predictable mapping products reflective of shared OCHA standards [OCHA09]. The OCHA system utilizes point symbols, lines, and polygons. Examples of some of OCHA’s graphic parameters can be found in the appendices.

Just as the UN has adopted its own standards for mapping symbols to assure consistency throughout their organization, so has the Northern Atlantic Treaty Organization, NATO. Their Military Symbols for Land Based Systems are described in NATO’s “Standardized Agreement” - STANAG APP-6A. “The contents of APP-6 constitute a single system of military symbology for landbased formations and units, which can be used for either automated map display systems or for manual map marking” [NATO86]. Symbols are designed to enhance NATO’s joint interoperability by providing a standard set of common Command, Control, Communications, Computers, Intelligence, systems, development, operations, and training symbols [NATO86].

The APP-6 was replaced by APP-6A in 1999, and in 2008, this version in turn was replaced by APP-6b. In these documents the symbols appear to be described and numbered rather than presented pictorially but symbols are commercially available. The entire symbol catalogue is enormous and the vast majority of them are relevant for military operations and not civilian response. As most of the symbols that are relevant to INDIGO can be obtained from secondary sources such as military in other countries, it is deemed beyond the scope of this report to order NATO STANAG documents. Appendix one of this report contains US Army symbols [USA04] which are relevant for civilian crisis management and many of them correspond with the NATO symbology.

In the area of chemicals there is yet another UN standard when it comes to symbols; the Globally Harmonised System of Classification and Labelling of Chemicals (GHS). The main objectives are to “facilitate international trade in chemicals and to maintain the existing level of protection of human health and environment” but also to identify hazardous chemicals and to inform users about these hazards through standard symbols and phrases on the packaging labels and through safety data sheets [EC10a]. The non-text pictorial symbols are not thus for mapping, but are typically used in consumer durable packaging.

Through REACH, the Regulation on Registration, Evaluation, Authorisation and Restriction of Chemicals and CLP, the Regulation on classification, labelling and packaging of substances and mixtures, previous EU legislation within this area has been aligned with the GHS [EC10b]. Note that, similar to STANAG and other symbologies, more specialised symbols for specialists responding to for example hazardous materials (HAZMAT) incidents, the symbols are often descriptive or numerical rather than pictorial. There are ways for incorporating this type of coding in mapping but analysis of this methodology lies beyond the scope of this report. The issue is nonetheless flagged for technical developers within INDIGO to further pursue if they deem it helpful.

Another area where the standardization of symbols is relevant is within mine action. The authors of a report by Geneva International Centre for Humanitarian Demining (GICHD) discuss the area of landmine and minefield symbols for military organizations. It is mentioned that it is not surprising that NATO's member states' symbology sets in this area are very similar to NATO's. However, Australia, not being a member state, adopted the NATO standard even so, which implies that standards have a “broader appeal” [GICHD05]. This further implies that states outside of the EU might adopt the emergency management symbology set proposed by INDIGO, should it be possible to appropriately develop it in a manner deemed useful.

In their endeavour to promote consistency, efficiency, and safety in demining operations, the GICHD, in cooperation with University of Kansas, proposed a world standard for symbols for use in humanitarian demining. The symbol set includes over 150 total symbols for point, line, and polygon features [GICHD07]. In the GICHD symbology, symbols for ordnance (e.g., types of landmines/munitions) were adopted from the NATO standard symbols (APP-6A) and emergency management symbols (e.g., airport, first aid station, police station) were adopted from the FGDC symbology library [GICHD07]. Symbols for the status of demining operations are now in the Environmental Systems Research Institute's (ESRI) symbol catalogue.

In addition to the ESRI symbology schemes Dymon (2003) included in her matrix (weather, hazmat, and forestry), ESRI also has a symbology scheme representing Emergency Services Resources (EMS) symbols [ESRIa]. In addition, ESRI has a number of symbols (ESRI refers to them as character fonts) showing more general features in common usage commonly used around the world, for example in airports, country capitals and hospitals [GICHD05]. It is suggested that INDIGO developers pursue available symbology functions in ESRI, commercially available in among other things, ESRI's new “Product Library” [ESRIb]. Relevant too to symbology standardization are standards for use of colour, particularly relevant in 3D mapping, such as the USGS color standard and ArcINFO's colour standard. As section 4.4 of this report indicates, colour is a critical feature in symbology.

The Government of Canada has developed over the last decade a national standard for hazardous classification and communication, used primarily in environmental and workplace health, but also response, called the Workplace Hazardous Materials Information System, WHMIS [NDC09]. For these and other symbols used in Canada by Health Canada and the Department of Defence, see Appendix 2 [NDC09].

The ISO standard 7010:2003 prescribes safety signs for the purposes of accident prevention, fire protection, health hazard information and emergency evacuation. The shape and colour required to be used for each sign, as prescribed by ISO 3864-1, is given together with the graphical symbols contained within each sign ([http://www.iso.org/iso/catalogue\\_detail?csnumber=31019](http://www.iso.org/iso/catalogue_detail?csnumber=31019)). As mentioned in the earlier section on factors affecting symbol perception, it would be interesting to examine colour choices and effects of iridescent illumination in conjunction with for example emergency exit design.

The International Atomic Energy Agency (IAEA) has two radiation warning standard symbols; the more traditional trefoil radiation warning symbol and the newer supplementary symbol for ionizing radiation warnings [IAEA].

Other relevant symbol sets identified by the Australasian ICSM in their survey of symbology systems are the US National Wildfire Coordination Group's Geographic Information System Standard Operating Procedures on Incidents Project (GSTOP), and the Australian Inter-Service Incident Management System (AIIMS), the latter which is in turn based on the North American National Interagency Incident Management System (NIIMS). GSTOP's manual contains symbols designed for use within the wildfire community and AIIMS has adopted a standard set of symbols covering "the key features of interest during an emergency" [ICSM07]. The AIIMS symbols are shown in Figure 6 below.

According to the Australasian ICSM project report (2007) the Pacific Disaster Center (PDC) was expected to adopt the American FGDC set. However, PDC has since assessed but not adopted either the FGDC nor the ICSM symbology. Notwithstanding, as they converge on a standard data model, the PDC has stated that they will be reassessing the applicability of both the American standard and the potential Australasian standard [PDC]. Preparedness and mitigation activities of the PDC often take place in developing, impoverished areas where the FGDC model for example, while robust, does not necessarily reflect the needs of these areas. Types of infrastructure, attributes, socio-cultural elements, and language are said to be in need of greater consideration [PDC]. Abridged basics of the AIIMS symbology set are presented in Figure 6. below; for the complete latest version please refer to the appendices of this document.

When it comes to national emergency symbology standardization initiatives they seem to be few and far between. Within Europe, French and Swedish national standardization initiatives are quite unique in this field to our knowledge. In 2009, the Swedish initiative - a joint effort between among others SIS, "the centre for work on standards in Sweden" [SIS10] and the Swedish mapping, cadastral and land registration authority – had to be cancelled due to lack of funding. There is also an initiative underway in Great Britain, the Civil Protection Common Map Symbology and Terminology which is likely to be a valuable resource for the symbology component of INDIGO. Updates on both terminology and symbology will reportedly be posted to [www.cabinetoffice.gov.uk/cplexicon](http://www.cabinetoffice.gov.uk/cplexicon).

Although it lacks an explicit standardization aim, there is also symbology development within a research and development project on Shared Information Framework and Technology (SHIFT) and the use of IT/GIS tools in crisis management. Here, symbols have been created to be used on maps showing the situation picture. This is interesting from a European perspective as seven EU member states are represented in this project [KV08].

Use styles, colours and sizes for symbols, lines and polygons as indicated.

Symbol font is ICS Fire Symbols 1.1 24 point unless otherwise stated. Always use Bold and Halo.

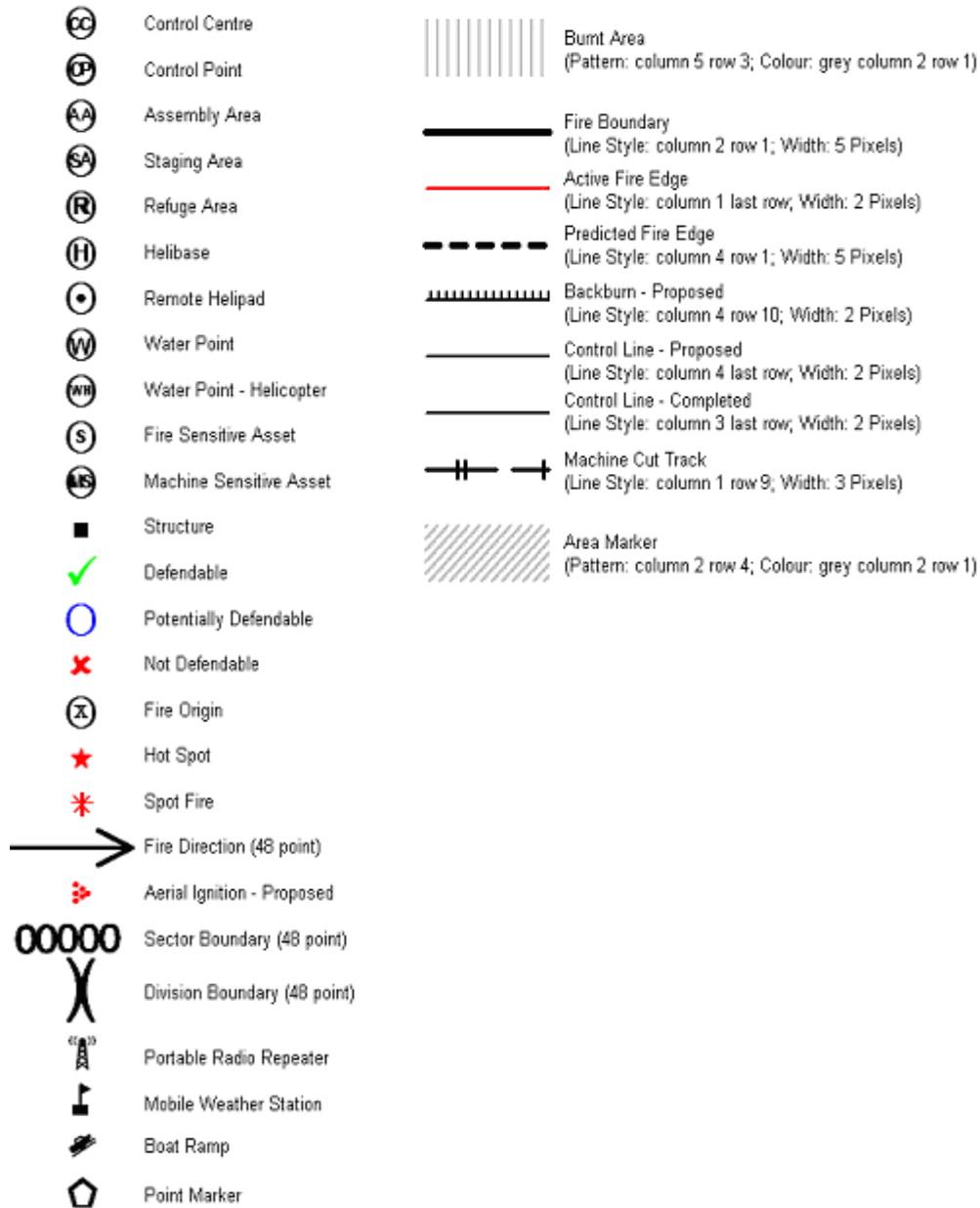


Figure 6: Australian Inter-Service Incident Management System (AIIMS) Symbology

Source: [ICSM07]

As can be concluded from the preceding section, there are a multitude of symbology schemes and guidelines if not standards. Yet only two of these seem to be consistently used by a broader range of emergency managers on a national or regional basis, namely the American FGDC HSWG symbology set and the ICSM Australasian All-hazards symbology set. These sets are thus expounded upon in the following two sections.



## 6.2 The US Federal Geographic Data Committee (FGDC) Homeland Security Working Group Symbology Reference

In the 1990s, the experiences of Hurricane Andrew and Hurricane Fran revealed that the lack of guidelines and standards for production of emergency maps was a critical shortfall when it came to data sharing [D03]. In light of these findings it was concluded that “[i]n order to facilitate the exchange of information and data, to promote universal understanding of hazardous and vulnerable locations and to adequately address the communication of mission critical information across agencies, jurisdictions and all levels of the public and private sectors, a set of standard cartographic symbols need to be developed...” [D03, p. 228]. Work in symbology was embarked upon and in November 2003 the first version of the FGDC’s Emergency Management Symbology was released. Evaluation of and subsequent improvements to the endeavour were continued and changes to the FGDC were implemented in 2004, and again most recently in September 2005 [FGDCa]. See the appendices for a full list which reflects changes at the end.

The FGDC emergency symbology set was formally adopted as an ANSI standard in 2006, entitled “Homeland Security Mapping Standard – Point Symbology for Emergency Management”, with reference number ANSI INCITS 415-2006 [ANSI]. This symbology set is commonly referred to as either US Homeland Security Symbology library or the FGDC symbology library. For reasons of clarity, this symbology will be referred to as the FGDC symbology library throughout the report as there is yet another symbology set developed by Department of Homeland Security (DHS) aimed at communicating the nature of hazards and behaviours necessary to avoid injury or death in the event of nuclear, chemical, or biological terrorist attacks, as referred in a previous section.

Symbols within the FGDC Emergency Management Symbology library are divided into four categories: incidents (cause of action or source of disaster); natural events (phenomenon created by naturally occurring conditions); infrastructure (basic facilities, services and installations needed for the functioning of a community; and operations (capabilities or resources available during or implemented due to an emergency) [KA09]. In addition to the four categories, frames or border patterns around these shapes are also used to visually classify the symbols into their respective groups [FGDCb]. Diamonds, circles, and rectangles are used to visually classify the symbols into their respective groups (Incidents and Natural events; Operations; and Infrastructure). In addition, “the symbols are designed to be distinctive in either a color or a black and white environment” [FGDCb]. Grouping symbols into categories is deemed particularly important for emergency management as it is critical that the information shown on a map is interpreted quickly. Hence, the grouping of symbols in categories is done to improve the ability of emergency responders to recognize key features in a timely manner [ICSM07].

The FGDC symbology library also includes four damage/operational status levels. These levels are used to indicate level of damage to Infrastructure or the Operational status of features associated with Operational activities. “While a colored symbol frame can be used to denote the level of damage or operational status, the pattern of this frame also denotes the status” [FGDCb]. The categorization scheme of the FGDC symbology library is shown in Table 3. and the full FGDC set may be found in the appendices of this document.





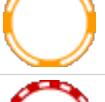
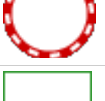
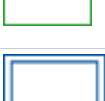


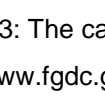
Symbol Types	Symbol Image	Key Stroke	Symbol Terms and Definitions
1.) <b>Incident</b> (Damage/Operational) No Levels		A	<i>Incident (Damage/Operational)</i> - Not Applicable
2.) <b>Natural Event</b> (Damage/Operational) No Levels		B	<i>Natural Event (Damage/Operational)</i> - Not Applicable
3.) <b>Operation</b> (Damage/Operational) Level 1		C	<i>Operation (Damage/Operational)</i> - Fully operational/open.
4.) <b>Operation</b> (Damage/Operational) Level 2		D	<i>Operation (Damage/Operational)</i> - Operational, but filled to capacity or otherwise closed.
5.) <b>Operation</b> (Damage/Operational) Level 3		E	<i>Operation (Damage/Operational)</i> - Operational, but partially damaged or partially incapacitated.
6.) <b>Operation</b> (Damage/Operational) Level 4		F	<i>Operation (Damage/Operational)</i> - Destroyed or Totally incapacitated.
7.) <b>Infrastructure</b> (Damage/Operational) Level 1		G	<i>Infrastructure (Damage/Operational)</i> - Fully operational/open.
8.) <b>Infrastructure</b> (Damage/Operational) Level 2		H	<i>Infrastructure (Damage/Operational)</i> - Operational, but filled to capacity or otherwise closed.
9.) <b>Infrastructure</b> (Damage/Operational) Level 3		I	<i>Infrastructure (Damage/Operational)</i> - Operational, but partially damaged or partially incapacitated.
10.) <b>Infrastructure</b> (Damage/Operational) Level 4		J	<i>Infrastructure (Damage/Operational)</i> - Destroyed or Totally incapacitated.

Table 3: The categorization scheme of FGDC’s symbology library.

Source: [http://www.fgdc.gov/HSWG/ref\\_pages/DamageOperational\\_ref.htm](http://www.fgdc.gov/HSWG/ref_pages/DamageOperational_ref.htm) [FGDCa]

Prior to the FGDC’s development of their Emergency Management Symbology library, a comprehensive three-step review and evaluation was conducted. First, existing emergency and hazard mapping symbols used by international organisations and American federal, state, and local agencies were identified [D03]. Secondly, a matrix was developed to i) identify the hazards and emergency information for which symbology was used, ii) to identify the agencies that at the time used hazard and emergency symbology, and iii) to identify hazard mapping symbols embedded in commercial software [D03, p. 229].

Before the FGDC’s Emergency Management Symbology library was implemented, it went through a public evaluation process available for approximately two months. Moreover, several emergency management organizations were contacted and invited to participate in the survey [FGDCc]. For each feature and accompanying symbol, evaluation participants were asked to either “Accept” or “Reject” the symbol and the accompanying definition of the feature. Symbols receiving a lower than 75 percent approval rating were evaluated for review and re-design. In addition, participants were given space to comment on every symbol and definition. Generally, comments were “critical of specific symbol functionality or design” [FGDCc]. Participants were also apparently helpful in the provision of detailed explanations as to how a symbol might be changed in order to make it more useful.

Issues of cross-disciplinary and cross-cultural flexibility are said to have been considered when developing the FGDC Symbology library, although it is not specified what measures have been taken in that regard. Considering that all evaluation participants originated from the US, it is difficult to ascertain the degree to which the symbols developed are culturally dependent. One speculation is that the target community was conceived of as comprising American first responders alone and thus a broader evaluation was deemed unnecessary. However, even if this accurately reflects the reasoning, the question of subcultural differences within the United States remains, as well as the applicability of the symbology system to Canada and Mexico were a major transboundary incident to occur on the continent.

### 6.2.1 Assessment

The FGDC HSWG Emergency Management Symbology library is arguably the most globally recognised standardised approach to emergency management mapping symbology and is also formally recognised as an American National Standards Institute (ANSI) standard [ICSM07]. As the FGDC Emergency Management library was the pioneer symbology standard for emergency management, later attempts, including the Australasian All-Hazards Symbology set, were inspired by the American forerunner and frequently try to build as much as possible on this system.

An advantage of the FGDC's Emergency Management Symbology library is that it is designed for use in both black and white as well as colour. A coloured frame can be used but the pattern of this frame can also be used to denote the level of damage or operational status. Yet, when researchers interviewed intended users they stated that "there is rarely a situation when a colour printer or screen is unavailable" [RRM10].

Notwithstanding, there are some indications that the FGDC's Emergency Management Symbology library may be less accurate than what is desirable. One evaluation, using an open-ended test method most recommended by ANSI found that only six out of twenty-eight symbols tested reached stipulated comprehension levels [KA09]. Moreover, two of the tested symbols even demonstrated critical confusion, which implies that a symbol is interpreted to have the opposite meaning. This latter problem has to arise in at least five percent of the participants tested to attain critical confusion [KA09].

The current FGDC symbology reference is limited to point symbols, but there are plans for inclusion of lines and polygons as well [FGDCb]. For the ICSM in developing their Australasian Symbology set, the current limitation of the FGDC library implied that the use of FGDC symbols in their set would constrain applicability "to the higher levels (jurisdictional and regional) and severely limit the level of adoption by emergency management agencies. These agencies have a clear need for mapping at the event level to represent features by their geometric characteristics (i.e. point, line or polygon)" [ICSM07].

Another concern of the ICSM and Spatial Vision with respect to the FGDC's symbology reference is that the indications of status levels are too detailed and might be hard to distinguish [ICSM07]. In reality, this concern also pertained to the symbols themselves, not only to the border patterns used to denote status. During interviews with map makers and map users covering a range of DHS mission areas, participants commented that many of the symbols were too intricate and one interviewee stated that the symbols were "just too plain dense, you cannot discern what is inside the frame" [RRM10, p.4]. Regarding the denotation of status none of the fourteen participants interviewed had or made use of data that includes operational status information [RRM10].

Of major concern is also that the same researchers report a very low level of adoption of the FGDC symbology library. Several of their participants "were not familiar with the standard" [RRM10, p.3]. Moreover and importantly, none of the participants interviewed used the standard in its' entirety, rather, participants more often used a small number of symbols, between five and fifteen, "as part of an in house map symbol standard customized to the specific mission of each group" [RRM10, p.3]. Another potential difficulty with the FGDC's symbology library is that the symbols used have not yet been evaluated with regard to cultural independence and generalizability.



In the current effort to develop a symbology standard appropriate to the European context, it is advisable to study changes to the FGDC's emergency management symbology library in greater detail [FGDCd]. Scrutiny of both the original and improved version of FGDC's emergency management symbology library will enable an understanding as to why certain symbols were changed, and in some cases indeed eliminated from the original set. It is evident from initial examination of changes made that revised symbols have been redesigned to more closely resemble their real-world counterpart (pictorial symbols). Below, the old and new versions of the symbol for "bomb threat" are shown to illustrate this observation. For the complete list of most recent changes made in the set, kindly refer to the appendices.

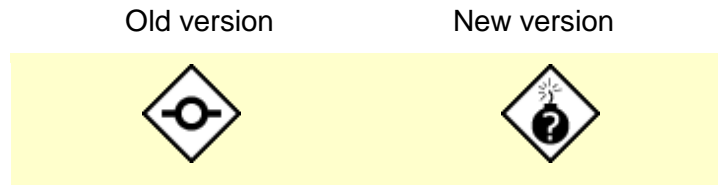


Figure 7: The symbol representing "bomb threat" in the emergency symbology library, prior to and following revision. Source: [FGDCb].

The above figure is an example of a revision from an abstract symbol to an associative symbol. As argued, associative symbols are generally much more effective at communicating messages than abstract symbols. The black ball with the burning fuse is a more widely recognised symbol, known for example, to generations of comic book readers the world over.

Following on this example, it is recommended that the INDIGO project bear in mind not only existing standards (for example military ones as in the old version) but even more universally associative ones. Putting aside the pop culture reference for a moment however and considering the above example from a more specific practitioner and academic perspective, the question mark combined with the associative symbol denotes uncertainty as to the nature of the explosive threat, something which those working in the field will likely associate to the growing threat of for example Improvised Explosive Devices (IEDs).

### 6.3 The Australasian All-Hazards Symbology Project

In 2007, there was no common national standard for map symbols used to represent features relevant to emergency responders in Australia. Yet, a couple of symbols had been adopted within the Australian Inter-Service Incident Management System (AIIMS) framework (see Figure 6). These symbols were partially adopted by non-fire agencies (the AIIMS has historically been associated with fire response) [ICMS07]. ANZLIC – The Spatial Information Council of Australia and New Zealand (formerly known as the Australia New Zealand Land Information Council, hence the acronym) in association with the Intergovernmental Committee on Surveying and Mapping (ICSM) joined forces at this time to encourage consistency in how all-hazards incidents are depicted on maps. The two organizations thus committed themselves to "develop a consistent Australasian All-Hazard symbology set and have it adopted by emergency management agencies across Australia and New Zealand" [ICSM07].

The initial focus when developing the Australasian symbology was on bushfire symbols and state emergency services (SES) symbols; for example flooding, storms, and rescue [T10]. At this time a majority of New Zealand's emergency management sector had adopted or planned to adopt the American FGDC symbology library in combination with agency specific additions or modifications [ICSM07]. More information with respect to the motivations of New Zealand practitioners in looking to colleagues further abroad than their Australian neighbours might provide valuable lessons for development of a symbology set within Europe in the INDIGO project.

The Australasian quest for a consistent symbology was initiated by a discussion of requirements of a future system, the current situation, and the preferred outcomes. Adapted from the 2007 ICSM project report, requirements were agreed upon as follows:

- the need for a consistent scalable and hierarchical symbol set across Australia and New Zealand preferably linked to international standards;
- symbols need to be part of a broader All-Hazard classification;
- symbology set should cover all stages of an event, i.e. from mitigation to recovery;
- symbology set should be intuitive, simple and scalable; and
- governance and custodianship should be built-in to ensure maintenance of the symbol set, recognizing its dynamic nature.

The ICSM report also recommended a “hierarchical approach” in development of the Australasian standard symbology set, as a specification of the symbology framework was that it should be able to cater to all levels of practice or control [ICSM07]. The levels stipulated are Jurisdiction, Region, and Event/Incident and the role of mapping and the specific needs for each level are also outlined, see Table 4. below.

<b>Level</b>	<b>Example of Use</b>	<b>Role of Mapping</b>
Jurisdiction	State Control Centre	<ul style="list-style-type: none"> <li>• Provide strategic oversight</li> <li>• Typically point based features</li> <li>• Broad scale: 1:500,000 – 1,000,000</li> </ul>
Region	Incident Control Centre	<ul style="list-style-type: none"> <li>• Overview of area of responsibility for number and location of incidents</li> <li>• May be point or polygon or line features</li> <li>• Medium scale: 1:100,000 – 250,000</li> </ul>
Event/ Incident	Incident Management Team	<ul style="list-style-type: none"> <li>• High level resolution, mapping of details covering area of concern</li> <li>• Point, polygon and line features</li> <li>• Detail scale: 1:10,000 – 50,000</li> </ul>

Level	Example	Role of Mapping
Jurisdiction	National or State Control Centre	<ul style="list-style-type: none"> <li>• Provide strategic oversight</li> <li>• Broad overview for interagency, multi-agency, national – state coordination</li> <li>• Aggregated view at state or national level</li> <li>• Depict operational support outside auspices of combat agency</li> <li>• Typically point based features</li> <li>• Easy to understand information for non-technical people</li> <li>• Broad scale: 1:500,000 – 1,000,000</li> </ul>
Region	State, Organisational or Incident Control Centre	<ul style="list-style-type: none"> <li>• Overview of area of responsibility for number and location of incidents</li> <li>• Generalised view or district level map</li> <li>• Combination of symbology determined by level / scale</li> <li>• Represent operational support activities to support incident management teams</li> <li>• May be point or polygon / line based features</li> <li>• Medium scale: 1:100,000 – 250,000</li> </ul>
Event/ Incident	Incident Control Centre, Incident Management Team	<ul style="list-style-type: none"> <li>• Information to assist regional planning</li> <li>• High level resolution mapping of area of concern or incident</li> <li>• May be point or polygon / line based features</li> <li>• Detail scale: 1:10,000 – 50,000</li> </ul>

Table 4: ICSM's recommended hierarchy of levels and respective needs

Source: [ICSM07].

Later in the process a project comprising two major tasks was identified. The first task was to “conduct an audit of key agencies involved in emergency management and response to compile a nationally [sic] consistent Incident Management System (IMS) symbology resource catalogue” [ICSM07 p. 10]. Over 40 Australian agencies and one from New Zealand (New Zealand fire service) took part in the audit [ICSM07]. The second task was to investigate which symbols were currently being used and where. Hence, an audit was conducted to “define the major categories of symbols /.../ used or required by emergency managers and response personnel and develop documentation outlining which categories of symbols are relevant to different types of organizations and events, gaps in existing categories and priority areas for additional work” [ICSM07, p. 10]. Questions were also posed regarding whether organizations and agencies were receptive to adopting the proposed symbology set. 92 percent (25 out of 26 audit responses) said that they were. Only one respondent declined, explaining that they preferred to adopt an international standard [ICSM07].

All in all, five workshops were held with key representatives of the emergency management and national security sectors from both Australia and New Zealand. A teleconference, several meetings, and an audit questionnaire were also used in the audit process [ICSM07]. The process revealed a high level of consistency within jurisdictions - but differences between jurisdictions – with respect to the symbols used [ICSM07]. Differences concerned not only actual symbols but also to differences in terminology: “there were significant variations between agencies such as local government, search and rescue, police, health and environmental agencies on what constitutes features such as ‘staging areas’, ‘control areas’, ‘areas of concern’, ‘declaration areas’, and ‘control points’” [ICSM07, p 22].

It would be interesting to examine more closely the reflections and from where they originated to see if there are national differences between Australia and New Zealand that may account for these variations between jurisdictions. Such an endeavour might further inform development of the symbology set to be developed within INDIGO for the patchwork of nations within Europe.

The audits with stakeholders led to a number of issues in need of consideration when creating the actual symbols; these are listed in Table 5 below.

Criteria	Requirement
Effective in Black and White and Colour	Essential
Suited to both paper and digital media	Essential
Available as True Type Fonts, ESRI Styles and Web compatible formats	Essential
Include guidelines for annotation or labelling	User optional
Some defined symbols need to be able to be hand drawn	Essential
Effective over backgrounds or aerial photographs/ satellite imagery and topographic mapping	Essential

Table 5: Technical criteria for symbols to be included in a proposed symbology set Source: [ICSM07]

The Australasian All-Hazard symbology approach is defined by three major parameters: categories; status; and definition. Categories are further divided into incidents (features relevant to incidents for any hazards including natural events , civil activities, policing and counter terrorism), operations (features relevant to planned and operational responses to events and incidents including supporting intelligence), and assets (assets or infrastructures that are relevant to an incident or event or operational response; assets at risk, or critical infrastructure that requires protection), see Figure 8 below.

Recommended Categories	Recommended Definition	FGDC Categories
<b>Incidents</b>	Features relevant to incidents for any hazards including natural event, civil activities, policing and counter terrorism	Incidents
		Natural Events
<b>Operations</b>	Features relevant to planned and operational responses to events and incidents including supporting intelligence	Operations
<b>Assets</b>	Assets or infrastructure that are relevant to an incident or event or operational response; assets at risk, or critical infrastructure that requires protection	Infrastructure

Figure 8: Symbol categorization of the Australasian symbology set. Source: [ICSM07]

Features in each of the three categories are designed to be recognizable by their frame shapes. Diamonds are used for incident features, circles for operations, and rectangles for assets [ICSM07], see Figure 9 below. Each category also has sub-categories; for example, search and rescue (SAR) is a sub-category to operations and hazardous material and fire are sub-categories to incidents.







Proposed Frame Shapes	FGDC
<b>Incidents</b> 	Incidents Natural Events 
<b>Operations</b> 	Operations 
<b>Assets</b> 	Infrastructure 

Figure 9: Proposed frame shapes for the Australasian symbology set. Source: [ICSM07]

Regarding the status levels for the Australasian symbology set, the audit results indicated that emergency management agencies in that region had not developed a consistent approach to indicating status but the consultation found a high level of support for the importance of status indication [ICSM07]. Note that there is an interesting comparative difference here as there is some contradiction with respect to what American interviewees at the DHS stated when they asked about the need to be able to indicate status in the American FGDC system.

With respect to status levels in the Australasian case, it was recommended that they would only be used with features where the definition for the type of status is clearly established. Four states of status were suggested from “possible” to “controlled/ contained”, even though it is acknowledged that many cases only have two values; for example Confirmed/ Unconfirmed [ICSM07]. This system is outlined below in Figure 10 below.

Based on the style in the United Nations Military Symbols Handbook, broken lines in the Australasian set also indicate future or projected locations whereas solid lines indicate present or actual locations of an incident, operations, or asset feature. As status ratings will be in continual flux, it was recommended that they should be accompanied with an annotating time and date stamp.









Geometry	Status - 1	Status - 2	Status - 3	Status - 4
<b>Point</b>	Possible 	Planned Probable Unconfirmed Predicted 	Completed Confirmed Active 	
<b>Line</b>		Planned Probable Unconfirmed Predicted ----- 	Completed Confirmed Active ————— 	Contained Controlled ===== 
<b>Polygon</b>		Planned Probable Unconfirmed Predicted 	Completed Confirmed Active 	

Figure 10: Representation of incident/event status. Source: [ICSM07]

After circulating the first version of the symbology set across all the emergency management agencies within each of the various Australian State jurisdictions, there were some amendments to the initial symbols. In the review there were proposals for forty eight (48) general emergency management symbols, twenty (20) bushfire specific symbols and eight (8) SES specific symbols. These are currently being submitted to the Australian national peak bodies for review for adoption as a national standard. There has also been further development to establish symbols for bio-security and policing requirements which build on this initial proposed symbology set and framework [T10].

### 6.3.1 Assessment

An advantage of the Australasian symbology set is that during its development the audit process with stakeholders very thorough. Over 40 agencies took part from both Australia and New Zealand. Wide inclusion of potential adoptees makes for promising results.

Compared to the FGDC symbology library, the Australasian All-Hazards symbology set has fewer categories, making it less complicated. At the same time, fewer categories also imply that discrimination between events may become more difficult, as one category in this case represents more features. In another comparison with the symbols used in US, the Australasian All-Hazards symbology set is not as dependent on intricate detail as the FGDC library is. This dependence on detail concerns first and foremost the representation of status, where the FGDC library use border patterns and the Australasian set use line style (dashed for unconfirmed and solid for confirmed) to define status.

There seems to be no accessible information regarding how this symbology set was comprehended by users. However, evaluations were made and following these were some amendments to the initial set. In the ICSM project report from 2007, it is stated that the initial focus of the Australasian symbology set was to establish a foundation for emergency management response with a particular focus on wildfire that could be expanded, which implies a rather limited symbology set. However, at present, it appears as though this expansion has already taken place. In the revised Australasian symbology set, “there are proposals for forty-eight (48) general emergency management symbols, twenty (20) bushfire specific symbols and eight (8) [State Emergency Services] SES specific symbols” [T10].

The ICSM identified a number of implementation risks when developing the Australasian symbology set worthy of consideration as these risks might even be more relevant in a European context, considering the number of states hoped to endorse a common symbology set. The different implementation risks identified by the stakeholders in ICSM audits can be categorised under one of three overarching risks:

1. Limited adoption by agencies due to a lack of acceptance of the standard or low prioritization by agencies
2. Symbols do not meet needs of the sector
3. Constraints to adoption presented by costs of changes to systems, procedures, and training [ICSM07].

The first two, at least to some extent, ought to be mitigated by a thorough and inclusive audit process. Iterative tests and evaluations of proposed symbols also address these issues, although it ought to be more effective to be proactive than reactive here, consulting organizations prior to symbol development and not solely after symbols have been developed.

Also, the ICSM advocates a multi-pronged approach to promote the symbology standard and make it as readily accessible to practitioners as possible, suggesting to this end a website enabling users to self-service their inquiries about the symbology: “The website should include features of the FGDC website that enables users to learn more about the symbols, download the latest copy, download example maps and read a Frequently Asked Questions (FAQ)” [ICSM07].



The third risk pertains to the impact the proposed symbology set may have on existing investments of agencies and workforce skills, operational practises and procedures, and system documentation. Endorsment of standard symbols will also need to be supported by awareness raising and training activities<sup>4</sup>. ICSM has observed that the cost for addressing these implications will be “substantial” and that they would impose a barrier to implementation, which is why establishing a funding mechanism to assist agencies in their transition process was recommended [ICSM07].

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<sup>4</sup> [At least when it comes to warning signals, Lesch \(2003\) has shown that relatively simple training conditions can dramatically improve accuracy and speed of response to symbols.](#)

## 7 Conclusions and Recommendations for European Symbology Development

For the INDIGO project effort on symbology, embarking on an arguably overly ambitious and potentially unrealizable goal of a fully standardised European symbology for civil crisis management may simply not be realistic given the material and human resources and time constraints of INDIGO. This comprehensive global overview of symbology and symbology standardisation initiatives indicates that the process is typically long and arduous and demands a multi-faceted approach with respect for a great number of influencing factors of a complex socio-technical nature. Moreover, experience has shown that even when symbology standardisation initiatives appear to be nearing successful completion, dissatisfaction may arise in final stages, inhibiting acceptance and success. Vicariously learning from difficulties in previous initiatives discussed in the preceding sections of this report, a prudent approach would entail careful and comprehensive inclusion of resources and perspectives from all European Union (EU) countries.

At least initially, proposing a limited initial set of workable symbols rather than aspiring to develop an all-encompassing standardised symbology set for Europe is to be advised. Considering the plenitude of agencies and actors that will ultimately need to agree on symbols within Europe in order to effect a European standard, it may be most practicable to focus on proposing symbols for sectors of emergency management that already have similar symbols in their respective symbol documents. To this end, a parallel draft typology of symbols providing an inventory of commonly used symbols in European crisis management has been initiated by the authors of this report. This draft typology will allow comparison of symbols used within Europe by emergency services personnel in civilian crises. It should be noted that thus far comparison has been limited due to the paucity of symbols supplied and to the lack of a sufficient number of symbols for the same resource or activity.

The European environment may well entail different criteria than those found in other symbology initiatives and it is the opinion of the authors that further efforts should be made at identifying European peculiarities or ensuring they don't exist rather than importing a symbology set that may provide poor fit with the European context. In this vein, symbols should be insofar as possible culturally independent, which is anticipated to be more of an issue when 31 different countries are to embrace and share a symbology set than when a federal union such as the United States or a region of two countries such as Australasia, both of which share common hegemonic languages, need to agree on a common set. Moreover, there are some indications that New Zealand practitioners were perhaps not sufficiently involved in the consultative and evaluative processes in the Australasian case; broader engagement is likely to facilitate standardisation agreement in the long term and minimize dissent, something which can be fruitfully borne in mind in the European context.

Contemporary crises are often transboundary in character, necessitating involvement of different nations, different levels of government, and their respective agencies. When a crisis demands attention and resources from different jurisdictions and nations, communication and coordination of information typically becomes troublesome. Maps can be of great assistance, summarising and describing a situation visually, thereby presenting a variety of actors with a Common Operational Picture (COP). Increasing use of integrative Geographic Information Systems (GIS) has highlighted the need for standardised symbology to be used on these maps. Using a common symbology facilitates the exchange and hasty interpretation of vital information between both decision makers and emergency responders which is often crucial to successful management of a crisis.

This report's overarching aim was to provide an overview of symbology standards, both currently existing ones and those under development, and to identify lessons learned drawing from the experiences and modus operandi of previous developers in their attempts to create standardised emergency management symbology sets. Another important objective was to identify factors in need of consideration when initiating a symbology standardization initiative.

To sum up, this initial comprehensively geared survey revealed a plethora of symbols and symbol schemes but few standardized symbology sets. There are a few exceptions, namely the emergency management symbology used in the United States, the FGDC symbology library and



the somewhat less governed symbology set for use in Australia and New Zealand, the Australasian All-Hazards Symbology. The use of symbol sets is not widely spread. Symbology sets seem to be localised in their usage, appealing to a minority of professionals in the regions from which they originated. Even UN standards that ought to be widespread seem to be used only within the UN context, with perhaps the exception of the WMO standards which seem to be accepted and used by mariners around the globe.

What we have learned is that symbology is a highly complex multi-disciplinary area of research engaging many different areas of expertise, such as semiotics, psychology and socio-anthropology. Moreover, factors in need of consideration in symbology set development are not only symbol design but also information processing processes, optical phenomena such as sensory issues and colour use. Relatedly, symbols are not always best depicted pictorially and complex numerical and/or text orderings may be necessary for more complex or information-heavy concepts. The 3D interactive environment in which INDIGO will operate poses further challenges and opportunities for symbol development and application; there are specific constraints with respect to for example colour and size (for example zoom functions) that do not apply in a conventional 2D mapping legend context.

## 7.1 Iterative Audit and Evaluation Processes

Both the FGDC symbology library and the Australasian All-Hazards symbology set made extensive use of thorough audit and evaluation processes. Learning from these examples, a number of aspects should be addressed within these audit processes in the European effort. First, existing emergency and hazard mapping symbols used by European organisations and agencies should be identified. It would also be wise to identify the major categories of symbols used or required by emergency managers and response personnel (and to establish the technical criteria for symbols to be included) as well as to identify the agencies that presently use hazard and emergency symbology. Broader engagement from the beginning of the endeavour is much more likely to facilitate standardisation agreement in the long term.

Levels of comprehension should also be tested and evaluated and reach certain established reliability and validity levels prior to implementing symbols in a European set. Participants should be asked both exactly what they think a symbol means and what action they would take in response to the symbol. It should be noted that in the case of the American FGDC, symbology set adoption has been limited despite audit processes. When commenting on barriers to using the FGDC symbology library, interviewees within the DHS mentioned poor fit of the symbols to the unique missions of each group and that overly complex graphical symbols that are ambiguous [RRM10].

Thus, symbol design is of pivotal importance and the audit processes should be designed to provide opportunities for feedback and subsequent improvement. Towards this end, the authors urge that when the first fairly comprehensive draft of a symbology is compiled, this draft typology should be circulated across as many emergency management agencies within Europe as possible, including those that have not earlier been involved in the process due to earlier lack of response. During this circulation, valuable amendments or comments may be accommodated and the draft typology of symbols successively improved.

The symbols should thus be made as readily accessible to practitioners as possible. As in the case of the American FGDC, a European symbology website (or a component of the INDIGO website) should, in the opinion of the authors, be opened which will enable crisis management professionals to learn more about the symbols, to download copies of them and for example maps, as well as to consult a Frequently Asked Questions (FAQ) section and submit reflections or queries unanswered by them.

Endorsement of the symbols will also need to be supported by awareness raising and training activities. Psychological research on understanding and processing cartographic and symbolic information demonstrates that people need to learn how to read maps and symbols [p89, p 25]. That said, intuitive understanding can be significantly enhanced by integrating commonly understood cues, as is ideally achieved in successful associative symbols. Symbols should always be as intuitive and universally understood as possible. Notwithstanding, receiving preparatory training and courses, beyond increasing comprehension, may also mitigate the negative effects of stress entailed in acquaintance with new material. In the Australasian case the ICSM believed the cost for addressing these implications would impose a barrier to implementation, which is why establishing a funding mechanism to assist agencies in their transition process was recommended.

Conducting an extensive, thorough, and inclusive auditing process in which the receptiveness of organizations and agencies to adopt a European symbology standard (and the rationale for the endeavour), their requirements, current situations and preferred end states are probed will, in the estimation of the authors, increase the chances of success for a European standardised symbology.

Agencies and their workforces in respective European countries have, an initial survey reveals, invested a lot in current mapping procedures and work practises. An excellent example in the European context is Switzerland which has invested greatly in an online national atlas. With respect for these different approaches, expertise, and vested interests in mind, the objective should be to build upon and make interoperable these different national initiatives rather than replacing them, something which would risk limited acceptance and, in turn, adoption, if not outright rejection of a proposed symbology. Practitioners should be enabled to evaluate symbols in an iterative manner during the development process and prior to their implementation.

Symbol comprehension tests should be conducted to ensure that proposed symbols are in fact effective in communicating information as intended. An open-ended testing method is recommended rather than the multiple choice method, as open-ended testing methods have higher ecological validity. Comprehension tests ought to test for not only cognizance but also accommodate for cultural, organizational, and gender differences.

A funding mechanism should be established to assist agencies in their transition process to a harmonised European symbology set. One area where this assistance could be of definite use is in training. Thoughtfully developed training packages and awareness raising to improve comprehension of symbols, as recommended by ANSI (ANSI 535.3-1998) would likely increase the chance of success for a standardised European symbology set.. Lesch (2003) has shown that relatively simple training conditions can dramatically improve accuracy and speed of response in symbol cognizance [L03].

Clearly established governance arrangements to facilitate and support implementation will benefit the European symbology standardisation initiative. ICSM proposes a three tier arrangement with the following design: custodian; steering committee; and operational authority. Such a similar arrangement might be appropriate for the European case as well.

Following thorough testing and evaluation, formal accreditation of the developed symbology for Europe as an endorsed standard should be sought. According to ICSM, endorsement by an independent external agency that the symbology set is deemed appropriate for meeting the needs of emergency managers serves as a powerful argument to support the adoption of the symbology by relevant practicing agencies [ICSM07]. CEN's contribution to the INDIGO project is deemed valuable in this regard. However, it should be kept in mind that formal accreditation is not the only way to gain users' acceptance; widespread recognition, endorsement and conformity to for example one symbology set by a majority of actors might also be a promising method for gaining acceptance. It should also be borne in mind that such acceptance requires time.

In this regard it is also important to mention recent research conducted in the context of the American FGDC symbology library ANSI standard, suggesting that formal standards are not endorsed in favour of in-house standards. “[When] asked their opinion on developing one comprehensive symbol standard for use for all DHS mapmaking, [they] were consistently negative on the prospects of developing such a standard. In contrast, participants suggested that formalizing, refining, and sharing existing in house symbol standards is a fruitful direction for future map symbol standardization efforts” [RRM10 p.4]. This suggests that incremental steps geared at forwarding the symbology component within INDIGO may be taken by gathering existing in-house (in this case, in-country) standards of symbols. This work which is already initiated by the authors at CRISMART will likely prove invaluable in this regard.

## 7.2 Sensory issues

Colour and other visual and cognitive aspects should not be taken lightly in symbol design and architecture development and it is suggested that particular attention is given to earlier sections of this report addressing them. Auditory signals and other sensory appeals where it is possible to incorporate them may improve accessibility of the symbols and messages to be conveyed as well as speed and comfort of the receiver in their uptake. Sound signals in combination with visual icons can be very helpful but they too require a rigorous design approach to be effective [K08].

Thoughtful research-grounded use of colour in the development of a symbology set is essential. At the same time, wherever possible, with regard to colour but even to other aspects of icon use, efforts at development of a symbology set within Europe should to a large degree take into account the work done in precursing systems. For example, certain colours and forms, standardised or not, are well-known within extensive communities around the world, such as mariners subscribing to WMO guidelines. It is known for example that red is not perceived as intense by the colour blind and that red and green should not for that matter be placed together as the green can easily overpower the red for a colour blind person [H08, p15]. Moreover, ability to perceive colour accurately is more correctly viewed on a continuum rather than a simple two category distinction, colour blind or not. Essentially, all humans have limitations with respect to colour perception and some humans are more limited than others in their ability to perceive colour.

Using the transformed CIELUV colour space in HCL triplets that according to Zeileis et al. allows for production of coloured graphics that are in “harmony” with each other, are not “unappealing” and “work” on principles of human vision and in all contexts [ZHM08] appears to be a promising approach for developing symbology within INDIGO. This research illustrates some important aspects concerning the limitations of human visual perception of coloured graphics that should be borne in mind. These limitations and their possible resolution through for example use of techniques such as HCL triplets ought to be taken into account and assessed in the development of standardised graphic symbols.

Cognitive and human-machine-interface issues should be approached through examination of the relevant literature and studies in the field, particularly those relating to symbol comprehension in cartographic contexts. Further, careful attention should be accorded to important sensory problems such as “change blindness”, the “phenomenon whereby individuals fail to notice change that occurs in a visual stimulus” [GB09, p204]. Human beings consistently overestimate their ability to detect substantial changes in visual graphics used for example in digital maps [GB09]. This can lead to grave inaccuracies combined with fallacious assumptions of correct interpretation and management. This is not a human error problem but rather a persistent and universal human perception problem. Experiments with blinking and flashing have demonstrated successes in reduction of change blindness and these functions should be assessed for possible beneficial use and implementation in INDIGO.

### 7.3 Symbology set design

With respect to frame shape, grouping symbols into categories by frame shape is particularly important for emergency management as it is critical that the information shown on a map is interpreted quickly. The Canadian examples in the appendix illustrate the benefit of frame shape.

It should be noted however that in the American FGDC system, the category "operations" refers to vehicles, locations, facilities, acts, as well as activities. Looking at fire suppression as an example, there is one symbol that represents "the extinguishing of a burning (and flaming) object by means of applying an agent, such as water", and another symbol to represent "a facility housing fire-fighting equipment and/or personnel". Considering that the grouping of symbols should be ordered so as to "improve the ability of emergency responders to recognize key features in a timely manner" [ICSM07], categories should thus be as discriminating as possible in order to be of use.

Hence, for the draft European symbology taxonomy currently being worked on by the authors of this report, it is suggested pending evaluation that the category "operations" is split into "resources" and "activities".<sup>5</sup> This splitting of the category "operations" also implies that the same representation can thus be used to show both the resource "fire station" and the activity "fire suppression". Yet, the different frame shapes would distinguish them from one another, as in Figure 11 below. See also the Canadian symbols in the appendix. Such an approach would also minimize the number of symbols to be designed and indeed to be learned. However, great care will need to be taken to ensure that certain frame shapes do not already have widely accepted meanings, for example, the hazard triangle.



Figure 11: An example (the first symbol suggested by Korpi 2007), showing that the same representation can be "recycled" by using different frame shapes

With regard to frame shapes, it may seem counterintuitive to deviate from the ones used in the American FGDC and the Australasian set. However, the suggested frame shapes are concurrent with those used in the MNE5/SHIFT- project. More to the point, seven EU member states are already part of this latter project, and as the INDIGO project strives to create symbols for use within Europe, it is deemed more important to align with approaches already accepted and in use within Europe than to align with those on other continents that have little or no establishment in the European context. The degree to which this is true will be investigated and developments monitored. The frame shapes of the FGDC may eventually be adopted for use in the Australasian symbology set as well, perhaps leading to more widespread recognition of the FGDC proposed frame shapes. Research regarding frame shape in cartographic symbols should first be verified and used to inform decisions taken in this respect.

With respect to adopting or designing symbols in colour or black and white it seems intuitively sound to design a symbol set that is distinctive in both colour and black and white environments, as for example the American FGDC symbology set is devised. If there is a need to print a map for example, the symbology should be useful even without a colour printer. However, DHS interviewees asked about this feature did not deem this to be important. The Australasian All-Hazards symbology is not designed to be used in both colour and black and white environments. It has been found that more important than having a system that works in both colour and black and white is having symbols that are understandable and clear. Arguably this clarity would be much easier accomplished if designers are also able to make use of colour to discriminate between different categories and perhaps even subcategories.

<sup>5</sup> However, after INDIGO end user input, it seems that the three categories used in the FGDC might be sufficient. Their message was clear: "Keep it [symbology] simple, clear, and clean."

A European symbology set should possibly include some status indication. Levels could be used to indicate for example degree of damage to infrastructure/assets, the operational status of features associated with operational activities, or the level of uncertainty of the information that the symbols are meant to convey. Both the FGDC and the Australasian All-Hazards Symbology have this component. The FGDC library use border patterns and the Australasian set use line style, dashed for unconfirmed (or suggested) and solid for confirmed (or established). Based on the style in the United Nations Military Symbols Handbook, broken lines in the Australasian set also indicate future or projected locations whereas solid lines indicate present or actual locations of an incident, operations, or asset feature.

Looking at symbols from France and Sweden these line styles seem to be present in Europe as well, which may provide a plausible argument for the suitability of indicating status in this manner in a European symbology. End users should be consulted regarding this assumption. As status ratings would be in continual flux, it would thus also be recommended that they be accompanied by an annotating time and date stamp. Yet, it should again be remembered that interviewees within DHS did not find a status denotation provided added value.

The Finnish symbol developers within the MNE5/SHIFT- project have a slightly different method for denoting status. A number of design features were tested to display this uncertainty, and results from these tests show that greyness of the borderline of symbols (preferred when asked directly) or saturation of colour in the frame background was preferred (this feature was reportedly relatively well interpreted in the test pictures) [AKS07]. Considering that this project has European members, this may be the more suitable option.

Symbols come in three shapes: point; lines; and polygons. The FGDC symbology library is currently limited to point symbols. According to ICSM, this limitation implied that the use of FGDC symbols in their set would constrain applicability to jurisdictional and regional agencies and severely limit the level of adoption by emergency management agencies. Hence, a European symbology set ought to include point, line, and polygon symbols.

It is advisable to study changes to the FGDC's emergency management symbology library in greater detail [FGDCd]. Scrutiny of both the original and improved version of FGDC's emergency management symbology library will enable an understanding as to why certain symbols were changed, and in some cases indeed eliminated from the original set. It is evident from initial examination of changes made that revised symbols have been redesigned to more closely resemble their real-world counterpart (i.e. pictorial symbols).

Considering the plentitude of agencies and actors that will need to agree on symbols within Europe, it might be practical to focus on proposing symbols for sectors of emergency management that are already similar with their respective symbols. An incremental process with a limited initial set of symbols is thus recommended as opposed to an all-encompassing symbology set from the outset. The fact that most American end users interviewed at the DHS regarding their use of the FGDC symbology library reported that they only used five to fifteen symbols from the entire library of over two hundred symbols would seem to suggest that this is likely a promising approach.



## 7.4 Learning from European research

There is a wealth of European research in the area of symbology and cartography that should be taken into account in the symbology component (as well as other areas) of INDIGO. In several cases European research has led to a number of successful European initiatives or projects with direct bearing for INDIGO. The MNE5/SHIFT- project mentioned comparatively in the preceding section is one such project as are those described below.

In Sweden, a standard for “geographic information on surface water systems” was adopted by the national Swedish Institute of Standards (SIS) in 2006 and not only maps out spatial water data but has gone far in fostering harmonisation and interoperability of hydrological data assets and metadata management [N08]. This endeavour, which has also gained recognition and support from ISO can be instructive in a European standardisation context for symbology.

A highly relevant European example from which INDIGO should learn is the “Atlas of Switzerland” which applies interactive legend techniques and the “dual thematic layer concept where the user can choose an additional map layer. The legend will then be split up in two separate parts, in an active map layer and a passive map layer” [SSW05]. This allows for a high level of flexibility in 3D manipulation of the legend and symbols [SSW05], something which should be looked at in the context of INDIGO.

These same Swiss researchers have gone on to improve the multivariate mapping features, something which they maintain “shows one of the possibilities to solve the “triangle problem” between geographical data, statistical data, and symbolization by employing a bottom-up, tree-like procedure. Because of its open structure, nearly any combination of visual variables and map layer types is theoretically possible. Practical experience with the prototype of the Atlas of Switzerland 3 – as proof of concept – shows the potential for the approach” [HSRH07].

In this regard, it is essential that different highly relevant projects and initiatives particularly within Europe are looked at closely, for example the work of German cartographer and GIS-specialist at the Federal Agency for Cartography and Geodesy in Germany, Anja Hopfstock. Hopfstock has compared topographic maps and systems for motorways within 12 different European countries [H07]. She has analysed the collected “map legends and symbol catalogues” “based on the semantics and the graphical representation to identify national road classification, symbol design and labelling” [H07, p2]. In Hopfstock’s opinion, “[a]s there is no historically grown European cartography, the common principles of representing motorways identified by the inventory should be used to design a common graphical representation of motorways for pan-European topographic datasets” [H07, p5]. Hopfstock has observed that “[a] major challenge in establishing a harmonised European Symbol Catalogue is to reflect the harmonisation effort of the national datasets and at the same time representing the different landscapes, regions and countries with their cultural differences” [H07, p9]. A further challenge identified from the research of Hopfstock is the “handling of mandatory and optional attributes for data visualisation of ERM”, the “harmonised European topographic reference dataset” EuroRegionalMap [H07, p9;pp1-2]. Hopfstock here expresses concern that whereas ERM “supports data collection throughout Europe, it might contradict the principle of comparability of the seamless and harmonised European data” [H07]. Moreover, an end user perspective is not adequately reflected in ERM.

The findings of Hopfstock and other researchers working in this area should be carefully analysed and where possible built upon within the INDIGO project. In this regard, pertaining to symbology but even more generally, findings of the Sixth Framework Program (FP 6) project “OASIS – Open Advanced System, for Improved Crisis Management (IST-2003-004677, 2004-2008)” with respect to the use of visual analytics algorithms should also be looked at [AAB08].

In sum, work done at the COGIT laboratory in France by Renard (2008)<sup>6</sup> where “analysis was carried out on the legends of European topographic maps” should be brought to bear [J08], as well as other areas of research from around the globe documented in earlier sections of this report and referenced in the bibliography.

<sup>6</sup> Renard, J. (2008). *Caractérisation et analyse des légendes des cartes topographiques européennes*. Internship’s report de mastère Carthagéo Paris.



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## 9 APPENDICES

### 9.1 Appendix 1. US Army Installation, Stability, and Support Operations Symbols

FM 1-02/MCRP 5-12A

Table 8-3. Field A: Installation Function









































Installation Function	Friend	Hostile	Neutral	Unknown
Installation				
Aircraft				
Aircraft Civilian Fixed Wing				
Aircraft Civilian Rotary Wing				
Aircraft Military Fixed Wing				
Aircraft Military Fixed Wing Bomber (B)				
Aircraft Military Rotary Wing				
Aircraft Unmanned Aerial Vehicle				
Airport/Airbase				
Ammunition and Explosives				



Table 8-3. Field A: Installation Function









































Installation Function	Friend	Hostile	Neutral	Unknown
Atomic Energy Reactor				
Electric Power				
Electric Power Hydroelectric				
Engineering Equipment				
Engineering Equipment Bridge				
Government Leadership				
Ground Vehicle				
Howitzer				
Medical Facility				
Medical Facility Hospital				



Table 8-3. Field A: Installation Function

























































































































Installation Function	Friend	Hostile	Neutral	Unknown
Railyard/Railroad Station				
Seaport				
Ship Yard				
Tank				
Telecommunications				
Telecommunications Radio				
Telecommunications Telephone				
Telecommunications Television				
Vehicle Maintenance				
Vehicle				
Water Services				









































Table 8-3. Field A: Installation Function

Installation Function	Friend	Hostile	Neutral	Unknown
Military Base/Facility				
Missile Systems				
Mine				
Nuclear, Biological, Chemical (NBC)				
NBC Biological				
NBC Chemical				
NBC Nuclear				
NBC Decontamination				
Petroleum/Gas/Oil				
Police Station				

**Table 9-3. Field AA: Stability Operations and Support Operations Activities, Locations, and Nonmilitary Organizations**

Type	Friendly	Hostile	Neutral	Unknown
<b>Activities</b>				
Arrest				
Arson				
Computer Network Attack (CNA)				
Fire				
Assassination				
Execution				
Murder				
Bomb/Bombing				
Booby Trap Note: By placing the frame around the GCM (chapter 7), it becomes an event.				

**Table 9-3. Field AA: Stability Operations and Support Operations Activities, Locations, and Nonmilitary Organizations**

Type	Friendly	Hostile	Neutral	Unknown
Demonstration				
Drive-By Shooting				
Electronic Warfare Intercept <small>Note: Same as Electronic Warfare Intercept under Military Intelligence in chapter 5.</small>				
Extortion <small>Note: Other currency symbols may also be used, such as for the Euro.</small>				
Foraging/Searching				
Graffiti				
Kidnapping				
Patrolling				
Poisoning				
<i>Hijacking</i>				
Vehicle Hijacking				

**Table 9-3. Field AA: Stability Operations and Support Operations Activities, Locations, and Nonmilitary Organizations**

Type	Friendly	Hostile	Neutral	Unknown
<b>Air Hijacking</b>				
Airplane Hijacking				
Helicopter Hijacking				
<b>Sea Surface Hijacking</b>				
Leisure Craft Hijacking				
Merchant Hijacking				
<b>Psychological Operations</b>				
Psychological Operations Note: Same as Psychological Operations in chapter 5.				
Psychological Operations Distribution Center				
Psychological Operations Face-to-Face				
Psychological Operations Loudspeaker Broadcast				
Psychological Operations Broadcast Aerial (Fixed Wing) Station				

Stability Operations and Support Operations Symbols

**Table 9-3. Field AA: Stability Operations and Support Operations Activities, Locations, and Nonmilitary Organizations**

















































Type	Friendly	Hostile	Neutral	Unknown
Psychological Operations Loudspeaker Broadcast Helicopter (Rotary Wing) Mounted				
Psychological Operations Loudspeaker Broadcast Wheeled Vehicle Mounted				
Psychological Operations Printing Service				
Psychological Operations Radio Broadcast				
Psychological Operations Target Audience Location				
Psychological Operations Television Broadcast				
Psychological Operations Written				
Psychological Operations Written (Leaflets) Aerial (Fixed Wing) Dropped				
Psychological Operations Written (Leaflets) Helicopter (Rotary Wing) Dropped				
<i>Recruitment</i>				
Willing Recruitment (W)				



**Table 9-3. Field AA: Stability Operations and Support Operations Activities, Locations, and Nonmilitary Organizations**









Type	Friendly	Hostile	Neutral	Unknown
Coerced/Impressed Recruitment (C)				
Riot				
Sniping				
<b>Locations</b>				
Ammunition Cache Note: Same as Class V Supply in chapter 5.				
Drug Operation				
Food Distribution Note: Same as Class I Supply in chapter 5.				
Mass Grave Site				
<i>List Locations</i>				
Black List Location				
Gray List Location				
White List Location				

**Table 9-3. Field AA: Stability Operations and Support Operations Activities, Locations, and Nonmilitary Organizations**

Type	Friendly	Hostile	Neutral	Unknown
Medical Treatment Facility Note: Same as Medical Treatment Facility in chapter 5.				
Radio				
Radio Station				
Supply Cache Note: Same as Supply in chapter 5.				
Television Station				
<b>Nonmilitary Organizations</b>				
Civilian Helicopter Note: Same as civilian helicopter for air equipment in MS-2525.				
Drug Vehicle				
Known Insurgent Vehicle (Black List Vehicle)				
Media				
Refugees				
Safe House				
Spy				

## 9.2 Appendix 2. Canadian WHMIS system and other safety symbols

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APPENDIX F	WHMIS SYMBOLS	APPENDIX F
The symbol	The meaning	
	<p><b>Class A – Compressed gas</b></p> <ul style="list-style-type: none"> <li>poses an explosion danger because the contents are held in a container that is under pressure.</li> <li>the container may explode or rupture if heated in a fire or dropped.</li> </ul>	
	<p><b>Class B – Combustible and flammable material</b></p> <ul style="list-style-type: none"> <li>can burn and is therefore a potential fire hazard.</li> <li>may burn at relatively low temperatures; (flammable materials catch fire at lower temperatures than combustible materials).</li> <li>may burst into flame spontaneously in air or may ignite when exposed to heat, sparks, or flames or as a result of friction.</li> </ul>	
	<p><b>Class C – Oxidizing material</b></p> <ul style="list-style-type: none"> <li>may pose a fire and/or explosion risk in the presence of flammable or combustible material.</li> <li>may cause fire when it comes into contact with combustible materials.</li> <li>may react violently or cause an explosion when it comes into contact with combustible materials such as fuels.</li> </ul>	
	<p><b>Class D, Division 1 – Poisonous &amp; infectious material: immediate and serious toxic effects</b></p> <ul style="list-style-type: none"> <li>is a potentially fatal poisonous substance or may cause permanent damage.</li> <li>may enter the body through skin contact.</li> </ul>	
	<p><b>Class D, Division 2 – Poisonous and infectious material: other toxic effects</b></p> <ul style="list-style-type: none"> <li>is a poisonous substance that is not immediately dangerous to health.</li> <li>may cause death or permanent damage as a result of repeated exposures over time.</li> <li>may be a skin or eye irritant.</li> <li>may be a sensitizer and can produce a chemical allergy.</li> <li>may cause cancer and/or may cause birth defects or sterility.</li> </ul>	
	<p><b>Class D, Division 3 – Poisonous and infectious material: biohazardous infectious material</b></p> <ul style="list-style-type: none"> <li>materials that may cause a serious disease resulting in illness or death.</li> </ul>	
	<p><b>Class E, Division 3 – Corrosive material</b></p> <ul style="list-style-type: none"> <li>may cause severe tissue, eye and skin damage.</li> </ul>	
	<p><b>Class F – Dangerously reactive material</b></p> <ul style="list-style-type: none"> <li>is very unstable and may react with water to release a toxic or flammable gas.</li> <li>may explode as a result of shock, friction or a change in temperature or pressure.</li> <li>may explode if heated.</li> <li>undergoes vigorous polymerization.</li> </ul>	

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APPENDIX E

EXAMPLES OF INFORMATION [EMERGENCY] SIGNS  
(WHITE SYMBOL ON A GREEN BACKGROUND)

APPENDIX E

SPECIAL NOTE: "BOLD" SYMBOL TITLES INDICATE CSA SPECIFIED DESIGNS. NON-BOLD TITLES INDICATE EITHER:  
a. D SAFE G recommended signs, where no specific design has yet been adopted by CSA, or  
b. signs currently in use and which do not yet require replacement.



FIRST AID



FIRST AID



STRETCHER



STRETCHER



EMERGENCY  
PHONE



EMERGENCY  
PHONE



EMERGENCY  
SHOWER



EMERGENCY  
SHOWER



EMERGENCY  
EYEWASH



EMERGENCY  
EYEWASH



EMERGENCY  
EYEWASH & SHOWER



FIRE AXE



FIRE HYDRANT



FIRE HYDRANT



FIRE HOSE  
(STANDPIPE)



FIRE HOSE



FIRE  
EXTINGUISHER



FIRE  
EXTINGUISHER



























FIRE ALARM





























EMERGENCY  
ALARM

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APPENDIX G	DANGEROUS GOODS – PLACARDS							APPENDIX G
								
	Class 1 EXPLOSIVES							
								
	Class 2 COMPRESSED GASES							
								
	Class 3 FLAMMABLE LIQUIDS							
								
	Class 4 FLAMMABLE SOLIDS, SPONTANEOUSLY COMBUSTIBLE, DANGEROUS WHEN WET							
								
	Class 5 OXIDIZERS & ORGANIC PEROXIDES							
								
	Class 6 POISONOUS & INFECTIOUS SUBSTANCES							
								
	Class 7 RADIOACTIVES			Class 8 CORROSIVES				
								
	Class 9 MISC. DANGEROUS GOODS			MIXED LOAD				

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APPENDIX G	DANGEROUS GOODS – LABELS							APPENDIX G
								
	Class 1 EXPLOSIVES							
								
	Class 2 COMPRESSED GASES							
								
	Class 3 FLAMMABLE LIQUIDS							
								
	Class 4 FLAMMABLE SOLIDS, SPONTANEOUSLY COMBUSTIBLE, DANGEROUS WHEN WET							
								
	Class 5 OXIDIZERS & ORGANIC PEROXIDES							
								
	Class 6 POISONOUS & INFECTIOUS SUBSTANCES							
								
	Class 7 RADIOACTIVES							
								
	Class 8 CORROSIVES			Class 9 MISC. DANGEROUS GOODS				

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APPENDIX H

FIRE CLASSIFICATION LABELS FOR EXTINGUISHERS

APPENDIX H

The type of fire that a particular extinguisher is designed to be used on.

Using the wrong type of fire extinguisher on a fire can have tragic consequences, therefore personnel must be familiar with the different classes of fire and the appropriate types of fire extinguishers for each class. Within DND and the CF, standardized "fire class labels" are used to provide this vital information to extinguisher users. These fire class labels, which may be any colour, are as indicated below:

**CLASS A FIRES**

Ordinary combustibles such as paper, wood and cloth. White symbols on green background.



**CLASS B FIRES**

Flammable liquids such as gasoline, oil, grease, naphtha and varsol. White symbols on red background.



**CLASS C FIRES**

Anything involving charged electrical power or current such as electrical equipment, appliances and wiring. White symbol on a blue background.



**CLASS D FIRES**

Fires involving metals (such as magnesium). White symbol on yellow background. Only the star is used... no other graphics are authorized.



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Source to above: [NDC09] [http://www.vcds-vcemd.forces.gc.ca/dsafeg-dsg/pd/sm-msg/gss-nsg/doc/C-02-040-009-AG-001\\_e.pdf](http://www.vcds-vcemd.forces.gc.ca/dsafeg-dsg/pd/sm-msg/gss-nsg/doc/C-02-040-009-AG-001_e.pdf)

## 9.3 Appendix 3. US FGDC Homeland Security Working Group Symbology Reference

### 9.3.1 Background

#### Notice

To the extent that any information/material contained herein is a US Government work, it is not subject to copyright protection, and may be published/disseminated without restriction(s).

#### Symbol Availability

The information contained herein is the work of the FGDC Homeland Security Working Group including Federal, State, and local agencies. The set of symbols shown is a work-in-progress. The official symbol set will not be released until the standards process is complete.

#### Purpose

The Federal Geographic Data Committee (FGDC) Homeland Security Working Group has been tasked to develop a standard set of symbols for use by the Emergency Management and First Responder communities at all levels of need (i.e. National, State, Local and Incident).

Federal, state, and local agencies worked together under the auspices of the FGDC's Homeland Security Working Group, to develop the proposed symbology. Symbols and their definitions have been developed for Incidents, Natural Events, Operations, and Infrastructures at a level to provide immediate and general understanding of the situation. While these symbols do not include all emergency management features, they provide an initial framework for emergency management and first responder mapping and communication. Detailed attribution for any feature can be included by the user. Both a category structure and a damage-operational status hierarchy were developed using color and frame shapes with line patterns. The symbology was designed for use in digital and paper map products.

A voluntary evaluation by the Emergency Management and First Response community provided the Working Group with a preliminary assessment of the utility and acceptability of the symbology prior to its formal submission to a consensus-based standards body such as the American National Standards Institute. It is anticipated that when these symbols become standard, their widespread adoption by the emergency management, first responder and software vendor communities will make them readily available and consistently used in emergency management mapping.

#### Background

**The Approach** - A comprehensive review and evaluation of existing symbology was performed prior to the development of the symbols. Whenever possible an authoritative source was used as a starting point. The symbology was designed to ensure scalability and cross-disciplinary/cross-cultural flexibility.

**Point Symbols** - Currently, the scope of this standard is limited to point symbols. However, the standard is expected to expand at a later date to include lines and polygons. Additional details can be stored as attributes and displayed in a way appropriate to your specific map or application. For example, "football stadium" could be carried as an attribute of the "Open Facility" feature within Infrastructure/Public Venue.

**Frame Shapes** - To further distinguish between the four categories, frame shapes or border patterns (diamonds, circles, and rectangles) are used to visually classify the symbols into their respective groups (Incidents, Natural Events, Operations, and Infrastructures).

**Color vs. Black & White** - The symbols are designed to be distinctive in either a color or a black and white environment. While a colored symbol frame can be used to denote the level of damage or operational status, the pattern of this frame also denotes the status. See the damage-operational section of this document.

**Scale** - The symbols were designed for application at the large and medium map scales typically used by emergency managers. If a very small symbol is required (below 12 point), it is recommended that you use the category shape as the symbol. For instance, use a diamond to represent an incident. Additional information can be provided via legend, labels, and attributes.

This page last updated: September 14, 2005 10:15 AM







### 9.3.2 Incidents Symbology Reference














(Version 2.20, Released: September 14, 2005)











Incidents - Category of eight Themes and forty-two Features that symbolize a “cause of action” or “source of disaster.”

Use this page to cross-reference the Incidents symbols with their definitions.












Changed or New symbols are marked by an asterisk (\*) and have a light yellow or green background, respectively.

Symbol Types	Symbol Image	Key Stroke	Symbol Terms and Definitions
1.) <b>Incidents Background Symbol</b> (Background)		!	<i>Incidents Background Symbol (Background)</i> - The background fill shape for the Incidents symbol.
2.) <b>Incidents Frame Symbol</b> (Frame)		#	<i>Incidents Frame Symbol (Frame)</i> - The frame shape for the Incidents symbol.
*3.) <b>Civil Disturbance Incident</b> (Theme)		A	<i>Civil Disturbance Incident (Theme)</i> - Human activities resulting in the disrupting of services or requiring varying levels of support, law enforcement or attention.
*4.) <b>Civil Demonstrations</b> (Civil DisturbanceFeature)		B	<i>Civil Demonstrations (Civil Disturbance)</i> - A public display of group feelings toward a person or cause. (Source: Merriam-Webster Online Dictionary definition)
*5.) <b>Civil Displaced Population</b> (Civil DisturbanceFeature)		C	<i>Civil Displaced Population (Civil Disturbance)</i> - Persons or groups of person who have been forced or obliged to flee or to leave their homes or places of habitual residence, in particular as a result of or in order to avoid the effects of armed conflict, violations of human rights, or natural or human-made disasters. (Source: United Nations Guiding Principles on Internally Displaced Persons, 1998)
*6.) <b>Civil Rioting</b> (Civil DisturbanceFeature)		D	<i>Civil Rioting (Civil Disturbance)</i> - A public disturbance involving (1) an act or acts of violence by one or more persons part of an assemblage of three or more persons, which act or acts shall constitute a clear and present danger of, or shall result in, damage or injury to the property of any other person or to the person of any other individual or (2) a threat or threats of the commission of an act or acts of violence by one or more persons part of an assemblage of three or more persons having, individually or collectively, the ability of immediate execution of such threat or threats, where the performance of the threatened act or acts of violence would constitute a clear and present danger of, or would result in, damage or injury to the property of any other person or to the person of











Symbol Types	Symbol Image	Key Stroke	Symbol Terms and Definitions
			any other individual. (Source: 18 USC Section 2102)
7.) <b>Criminal Activity Incident</b> (Theme)		E	<i>Criminal Activity Incident (Theme)</i> - An unlawful pursuit or action in which an individual participates. (Source: www.dictionary.com; combined definitions of “criminal” and “activity”)
*8.) <b>Bomb Threat</b> (Criminal ActivityFeature)		F	<i>Bomb Threat (Criminal Activity)</i> - A warning of the of the possible presence of a bomb or expression of the intention to detonate a bomb.
*9.) <b>Bomb</b> (Criminal ActivityFeature)		G	<i>Bomb (Criminal Activity)</i> - An explosive device fused to detonate under specific conditions. (Source: International military definition)
*10.) <b>Bomb Explosion</b> (Criminal ActivityFeature)		H	<i>Bomb Explosion (Criminal Activity)</i> - A violent outburst resulting from detonation of a chemical or nuclear explosive or from the loss of a high pressure vessel's integrity.
11.) <b>Looting</b> (Criminal ActivityFeature)		I	<i>Looting (Criminal Activity)</i> - Burglary committed within an affected area during an emergency. (Source: PeaceOfficers.com Glossary)
12.) <b>Poisoning</b> (Criminal ActivityFeature)		J	<i>Poisoning (Criminal Activity)</i> - Use of a poisonous substance to injure or kill (Source: Adapted from Merriam-Webster Online Dictionary definition)
13.) <b>Shooting</b> (Criminal ActivityFeature)		K	<i>Shooting (Criminal Activity)</i> - Use of a firearm to kill or injure or to damage property (Source: Condensed from Merriam-Webster Online Dictionary definition)
14.) <b>Fire Incident</b> (Theme)		L	<i>Fire Incident (Theme)</i> - The destructive act of something burning; caused either by electrical or technological malfunction, lightning, arson, human error or human negligence.
15.) <b>Hot Spot</b> (Fire IncidentFeature)		M	<i>Hot Spot (Fire Incident)</i> - An area of intensified fire activity and increased heat or a particularly active part of a fire.
*16.) <b>Non-Residential Fire</b> (Fire IncidentFeature)		N	<i>Non-Residential Fire (Fire Incident)</i> - A fire that originates at or affects a non-residential or commercial facility, resulting in partial damage or total destruction of the structure and/or bodily injury, smoke inhalation or death.
*17.) <b>Origin</b> (Fire IncidentFeature)		O	<i>Origin (Fire Incident)</i> - Location of where the fire started. (Source: Forest Service Department of Agriculture <a href="http://www.fs.fed.us">http://www.fs.fed.us</a> )
18.) <b>Residential Fire</b> (Fire IncidentFeature)		P	<i>Residential Fire (Fire Incident)</i> - A fire affecting a home or housing complex, resulting in partial or total destruction of the structure and/or bodily injury, smoke inhalation or death.
19.) <b>School Fire</b> (Fire IncidentFeature)		Q	<i>School Fire (Fire Incident)</i> - A fire that originates at or affects an educational facility, resulting in partial or total destruction of the structure and/or bodily injury, smoke inhalation or death.

Symbol Types	Symbol Image	Key Stroke	Symbol Terms and Definitions
20.) <b>Smoke</b> (Fire IncidentFeature)		R	<i>Smoke (Fire Incident)</i> - The visible products of combustion rising above the fire. (Source: www.firewise.org)
21.) <b>Special Needs Fire</b> (Fire IncidentFeature)		S	<i>Special Needs Fire (Fire Incident)</i> - A fire that affects special treatment facilities, such as nursing homes or assisted living centers, resulting in partial or total destruction of the structure and/or bodily injury, smoke inhalation or death.
*22.) <b>Wild Fire</b> (Fire IncidentFeature)		T	<i>Wild Fire (Fire Incident)</i> - An uncontrolled fire in a wooded area. (Source: www.realdictionary.com)
23.) <b>Hazardous Material Incident</b> (Theme)		U	<i>Hazardous Material Incident (Theme)</i> - (Note: all of these proposed definitions are from the following source: Office of Hazardous Materials Safety, Hazmat Regulations and Interpretations)
24.) <b>Chemical Agents</b> (Hazardous IncidentFeature)		V	<i>Chemical Agents (Hazardous Incident)</i> - A chemical substance, which is intended for use in military operations to kill, resulting in psychological disorientation, serious injury, incapacitation or death. (Source: NATO definition, found at http://arch.foxcitieskurgan.org/chem/terms.html)
25.) <b>Corrosive Material</b> (Hazardous IncidentFeature)		W	<i>Corrosive Material (Hazardous Incident)</i> - Uncontrolled or potentially dangerous presence of a liquid or solid that causes full thickness destruction of human skin at the site of contact within a specified period of time.
26.) <b>Hazardous When Wet</b> (Hazardous IncidentFeature)		X	<i>Hazardous When Wet (Hazardous Incident)</i> - Uncontrolled or potentially dangerous presence of a material that, by contact with water, is liable to become spontaneously flammable or to give off flammable or toxic gas at a rate greater than 1 L per kilogram of the material, per hour.
27.) <b>Explosive</b> (Hazardous IncidentFeature)		Y	<i>Explosive (Hazardous Incident)</i> - Uncontrolled or potentially dangerous presence of any substance or article, including a device, which is designed to function by explosion (i.e., an extremely rapid release of gas and heat) or which, by chemical reaction within itself, is able to function in a similar manner even if not designed to function by explosion.
28.) <b>Flammable Gas</b> (Hazardous IncidentFeature)		Z	<i>Flammable Gas (Hazardous Incident)</i> - Uncontrolled or potentially dangerous presence of any material which is a gas at 20°C (68°F) or less and 101.3 kPa (14.7 psia) of pressure (a material which has a boiling point of 20°C (68°F) or less at 101.3 kPa (14.7 psia)) which is ignitable at 101.3 kPa (14.7 psia) when in a mixture of 13 percent or less by volume with air; or Has a flammable range at 101.3 kPa (14.7 psia) with air of at least 12 percent regardless of the lower limit.
29.) <b>Flammable Liquid</b> (Hazardous IncidentFeature)		a	<i>Flammable Liquid (Hazardous Incident)</i> - Uncontrolled or potentially dangerous presence of a liquid having a flash point of not more than 60.5°C (141°F).



Symbol Types	Symbol Image	Key Stroke	Symbol Terms and Definitions
30.) <b>Flammable Solid</b> (Hazardous IncidentFeature)		b	<i>Flammable Solid (Hazardous Incident)</i> - Uncontrolled or potentially dangerous presence of desensitized explosives that when dry are Explosives of Class 1 which are wetted with sufficient water, alcohol, or plasticizer to suppress explosive properties.
31.) <b>Non-Flammable Gas</b> (Hazardous IncidentFeature)		c	<i>Non-Flammable Gas (Hazardous Incident)</i> - Uncontrolled or potentially dangerous presence of any material (or mixture) which Exerts in the packaging an absolute pressure of 280 kPa (40.6 psia) or greater at 20 °C (68 °F) and is not classified as a flammable gas.
32.) <b>Organic Peroxides</b> (Hazardous IncidentFeature)		d	<i>Organic Peroxides (Hazardous Incident)</i> - No Definition.
33.) <b>Oxidizers</b> (Hazardous IncidentFeature)		e	<i>Oxidizers (Hazardous Incident)</i> - Uncontrolled or potentially dangerous presence of a material that may, generally by yielding oxygen, cause or enhance the combustion of other materials.
34.) <b>Radioactive Material</b> (Hazardous IncidentFeature)		f	<i>Radioactive Material (Hazardous Incident)</i> - Uncontrolled or potentially dangerous presence of any material having a specific activity greater than 70 Bq per gram.
35.) <b>Spontaneously Combustible</b> (Hazardous IncidentFeature)		g	<i>Spontaneously Combustible (Hazardous Incident)</i> - Uncontrolled or potentially dangerous presence of a liquid or solid that, even in small quantities and without an external ignition source, can ignite within five (5) minutes after coming in contact with air or a material that, when in contact with air and without an energy supply, is liable to self-heat.
36.) <b>Toxic Gas</b> (Hazardous IncidentFeature)		h	<i>Toxic Gas (Hazardous Incident)</i> - Uncontrolled or potentially dangerous presence of a gas which affords a hazard to human health.
37.) <b>Toxic and Infectious</b> (Hazardous IncidentFeature)		i	<i>Toxic and Infectious (Hazardous Incident)</i> - Uncontrolled or potentially dangerous presence of a poisonous substance that is a specific product of the metabolic activities of a living organism and is usually very unstable and can easily be transferred between organisms.
38.) <b>Unexploded Ordnance</b> (Hazardous IncidentFeature)		j	<i>Unexploded Ordnance (Hazardous Incident)</i> - Uncontrolled or potentially dangerous presence of an unexploded weapon or ammunition.
39.) <b>Air Incident</b> (Theme)		k	<i>Air Incident (Theme)</i> - An event involving aircraft resulting in damage, bodily injury, death, or the disruption of transportation service.
40.) <b>Air Accident</b> (Air IncidentFeature)		l	<i>Air Accident (Air Incident)</i> - A sudden, unexpected event involving aircraft resulting in fuselage damage, bodily injury, death and/or the disruption of transportation service; prompting emergency landing procedures or uncontrolled impact with the ground.






















Symbol Types	Symbol Image	Key Stroke	Symbol Terms and Definitions
41.) <b>Air Hijacking</b> (Air IncidentFeature)		m	<i>Air Hijacking (Air Incident)</i> - The unexpected, unlawful and forceful seizure of control aboard an aircraft by an individual or group of individuals resulting in passenger and crew endangerment, injury or death, and/or the redirection of flight destination. (Source: www.dictionary.com, The American Heritage® Dictionary of the English Language to define “hijack”)
42.) <b>Marine Incident</b> (Theme)		n	<i>Marine Incident (Theme)</i> - An event involving a boat or ship resulting in damage, bodily injury, death, or the disruption of transportation service.
43.) <b>Marine Accident</b> (Marine IncidentFeature)		o	<i>Marine Accident (Marine Incident)</i> - A sudden, unexpected event involving a boat or ship resulting in vessel submerging, damage, bodily injury, death and/or the disruption of transportation service.
44.) <b>Marine Hijacking</b> (Marine IncidentFeature)		p	<i>Marine Hijacking (Marine Incident)</i> - The unexpected, unlawful and forceful seizure of control aboard a boat or ship by an individual or group of individuals resulting in passenger and crew endangerment, injury or death, and/or the redirection of destination. (Source: www.dictionary.com, The American Heritage® Dictionary of the English Language to define “hijack”)
45.) <b>Rail Incident</b> (Theme)		q	<i>Rail Incident (Theme)</i> - An event involving train resulting in damage, bodily injury, death, or the disruption of transportation service.
46.) <b>Rail Accident</b> (Rail IncidentFeature)		r	<i>Rail Accident (Rail Incident)</i> - A sudden, unexpected event involving a wheeled or tracked vehicle resulting in derailment, damage, bodily injury, death and/or the disruption of transportation service.
47.) <b>Rail Hijacking</b> (Rail IncidentFeature)		s	<i>Rail Hijacking (Rail Incident)</i> - The unexpected, unlawful and forceful seizure of control aboard a wheeled or tracked vehicle by an individual or group of individuals resulting in passenger and crew endangerment, injury or death, and/or the redirection of destination. (Source: www.dictionary.com, The American Heritage® Dictionary of the English Language to define “hijack”)
48.) <b>Vehicle Incident</b> (Theme)		t	<i>Vehicle Incident (Theme)</i> - An event involving a wheeled or tracked vehicle resulting in damage, bodily injury, death, or the disruption of transportation service.
49.) <b>Vehicle Accident</b> (Vehicle IncidentFeature)		u	<i>Vehicle Accident (Vehicle Incident)</i> - A sudden, unexpected event involving a vehicle resulting in damage, bodily injury, death and/or the disruption of transportation service.
50.) <b>Vehicle Hijacking</b> (Vehicle IncidentFeature)		v	<i>Vehicle Hijacking (Vehicle Incident)</i> - The unexpected, unlawful and forceful seizure of control aboard a vehicle by an individual or group of individuals resulting in passenger and crew endangerment, injury or death, and/or the redirection of destination.









This page last updated: September 14, 2005 10:15 AM

**9.3.3 Natural Events Symbology Reference**  
[\(Version 2.20, Released: September 14, 2005\)](#)

Natural Events - Phenomenon found in or created by naturally occurring conditions. Use this page to cross-reference the Natural Events symbols with their definitions. Changed or New symbols are marked by an asterisk (\*) and have a light yellow or green background, respectively.

Symbol Types	Symbol Image	Key Stroke	Symbol Terms and Definitions
1.) <b>Natural Events Background Symbol</b> (Background)		!	<i>Natural Events Background Symbol (Background)</i> - The background fill shape for the Natural Events symbol.
2.) <b>Natural Events Frame Symbol</b> (Frame)		#	<i>Natural Events Frame Symbol (Frame)</i> - The frame shape for the Natural Events symbol (unused).
3.) <b>Geologic</b> (Theme)			
4.) <b>After Shock</b> (GeologicFeature)		A	<i>After Shock (Geologic)</i> - An earthquake that follows a larger earthquake and originates at or near the latter's focus. (Source: Dictionary of Geological Terms, 3rd Ed.)
*5.) <b>Avalanche</b> (GeologicFeature)		B	<i>Avalanche (Geologic)</i> - A large mass of snow, ice, soil, or rock, or mixtures of these materials, falling, sliding, or flowing very rapidly under the force of gravity. (Source: Dictionary of Geological Terms, 3rd Ed.)
6.) <b>Earth Quake Epicenter</b> (GeologicFeature)		C	<i>Earth Quake Epicenter (Geologic)</i> - The point on the earth's surface directly above the focus of an earthquake. (Source: Dictionary of Geological Terms, 3rd Ed.)
7.) <b>Landslide</b> (GeologicFeature)		D	<i>Landslide (Geologic)</i> - A general term for a wide variety of processes and landforms involving the down slope movement under the force of gravity of masses of soil and rock material. (Source: Dictionary of Geological Terms, 3rd Ed.)
8.) <b>Subsidence</b> (GeologicFeature)		E	<i>Subsidence (Geologic)</i> - Sinking or downward settling of the earth's surface. (Source: Dictionary of Geological Terms, 3rd Ed.)
9.) <b>Volcanic Eruption</b> (GeologicFeature)		F	<i>Volcanic Eruption (Geologic)</i> - The ejection of volcanic materials (lava, pyroclasts, and volcanic gases) from a vent or fissure in the Earth's crust. (Source: Dictionary of Geological Terms, 3rd Ed.)
10.) <b>Volcanic Threat</b> (GeologicFeature)		G	<i>Volcanic Threat (Geologic)</i> - A vent or fissure in the Earth's crust where volcanic eruption is believed to be imminent. (Source: logical extension of "Volcanic Eruption")
11.) <b>Hydro-Meteorological</b> (Theme)			
12.) <b>Drizzle</b> (Hydro-MeteorologicFeatur		H	<i>Drizzle (Hydro-Meteorologic)</i> - Some time called mist. Very small, numerous, and uniformly dispersed water droplets that appear to float while

Symbol Types	Symbol Image	Key Stroke	Symbol Terms and Definitions
e)			following air currents. Unlike fog droplets, drizzle fall to the ground.
13.) <b>Drought</b> (Hydro-MeteorologicFeature)		I	<i>Drought (Hydro-Meteorologic)</i> - A period of abnormally dry weather sufficiently prolonged for the lack of water to cause a serious hydrologic imbalance across the affected area. Drought severity depends upon the degree of moisture deficiency, the duration, and (to a lesser extent) the size of the affected area. In general, the term should be reserved for periods of moisture deficiency that are relatively extensive in both space and time.
14.) <b>Flood</b> (Hydro-MeteorologicFeature)		J	<i>Flood (Hydro-Meteorologic)</i> - A relatively high stream flow that overtops the stream banks in any part of its course, covering land that is not normally under water. (Source: Dictionary of Geological Terms, 3rd Ed.) A condition that occurs when water overflows the natural or artificial confines of a stream or other body of water, or accumulates by drainage over low-lying areas.
15.) <b>Fog</b> (Hydro-MeteorologicFeature)		K	<i>Fog (Hydro-Meteorologic)</i> - A visible aggregate of minute water droplets suspended in the atmosphere near the earth's surface. According to international definition fog reduces visibility to less than 5/8 mile. Fog differs from clouds only in that the base of the fog is at the earth's surface while clouds are above the surface.
16.) <b>Hail</b> (Hydro-MeteorologicFeature)		L	<i>Hail (Hydro-Meteorologic)</i> - Precipitation in the form of circular or irregular-shaped lumps of ice. (Source: The National Weather Service glossary. <a href="http://www.crh.noaa.gov/lmk/glossary.htm">http://www.crh.noaa.gov/lmk/glossary.htm</a> )
17.) <b>Inversion</b> (Hydro-MeteorologicFeature)		M	<i>Inversion (Hydro-Meteorologic)</i> - A departure from the standard decrease or increase with altitude of value of an atmosphere property. This term almost always means temperature inversion.
18.) <b>Rain</b> (Hydro-MeteorologicFeature)		N	<i>Rain (Hydro-Meteorologic)</i> - Precipitation in the form of liquid water drops which have diameters greater than 0.5mm.
19.) <b>Sand Dust Storm</b> (Hydro-MeteorologicFeature)		O	<i>Sand Dust Storm (Hydro-Meteorologic)</i> - A strong wind carrying sand through the air, the diameter of most of the particles ranging from 0.08 to 1 mm. In contrast to a dust storm, the sand particles are mostly confined to the lowest two feet, and rarely rise more than fifty feet above the ground.
20.) <b>Snow</b> (Hydro-MeteorologicFeature)		P	<i>Snow (Hydro-Meteorologic)</i> - Precipitation composed of white or translucent ice crystals, chiefly complex branched hexagonal form and often agglomerated into snowflakes.
21.) <b>Thunder Storm</b> (Hydro-MeteorologicFeature)		Q	<i>Thunder Storm (Hydro-Meteorologic)</i> - A thunderstorm is a consequence of atmospheric instability and constitutes an overturning of layers in order to achieve a more stable atmosphere. In general a local storm invariably

Symbol Types	Symbol Image	Key Stroke	Symbol Terms and Definitions
22.) <b>Tornado</b> (Hydro-MeteorologicFeature)		R	produces lightning, thunder, usually strong gusts of winds, heavy rain and sometimes hail. <i>Tornado (Hydro-Meteorologic)</i> - A violently rotating column, or funnel, of air in contact with the ground and extending from the base of a thunderstorm. (Source: Modified from the National Weather Service glossary. Link at: <a href="http://www.erh.noaa.gov/er/pit/branick2d.html#Glossary">http://www.erh.noaa.gov/er/pit/branick2d.html#Glossary</a> )
23.) <b>Tropical Cyclone</b> (Hydro-MeteorologicFeature)		S	<i>Tropical Cyclone (Hydro-Meteorologic)</i> - The general term for a cyclone that originates over the tropical oceans.
24.) <b>Tsunami</b> (Hydro-MeteorologicFeature)		T	<i>Tsunami (Hydro-Meteorologic)</i> - A great sea wave produced by an earthquake or volcanic eruption, characterized by high speed of propagation, long wavelength, long period, and low observable amplitude on the open ocean. (Source: Dictionary of Geological Terms, 3rd Ed.) An ocean wave produced by a submarine earthquake, landslide, or volcanic eruption. These waves may reach enormous dimensions and have sufficient energy to travel across entire oceans. Tsunamis have no connection with tides as inferred by the common use of the term tidal wave.
25.) <b>Infestation</b> (Theme)			
*26.) <b>Bird Infestation</b> (InfestationFeature)		U	<i>Bird Infestation (Infestation)</i> - A harassing or troublesome invasion of birds. (Source: derived from the definition of "infestation" found in the FactMonster.com dictionary)
27.) <b>Insect Infestation</b> (InfestationFeature)		V	<i>Insect Infestation (Infestation)</i> - A harassing or troublesome invasion of insects. (Source: derived from the definition of "infestation" found in the FactMonster.com dictionary)
28.) <b>Microbial Infestation</b> (InfestationFeature)		W	<i>Microbial Infestation (Infestation)</i> - A harassing or troublesome invasion of a microbe. (Source: derived from the definition of "infestation" found in the FactMonster.com dictionary)
29.) <b>Reptile Infestation</b> (InfestationFeature)		X	<i>Reptile Infestation (Infestation)</i> - A harassing or troublesome invasion of reptiles. (Source: derived from the definition of "infestation" found in the FactMonster.com dictionary)
30.) <b>Rodent Infestation</b> (InfestationFeature)		Y	<i>Rodent Infestation (Infestation)</i> - A harassing or troublesome invasion of rodents. (Source: derived from the definition of "infestation" found in the FactMonster.com dictionary)

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**9.3.4 Operations Symbology Reference**  
 (Version 2.20, Released: September 14, 2005)







Operations - Organizations, services, capabilities or resources available during or implemented due to an emergency management situation.

Use this page to cross-reference the Operations symbols with their definitions.

Changed or New symbols are marked by an asterisk (\*) and have a light yellow or green background, respectively.









Symbol Types	Symbol Image	Key Stroke	Symbol Terms and Definitions
1.) <b>Operations Background Symbol</b> (Background)		!	<i>Operations Background Symbol (Background)</i> The background fill shape for the Operations symbol.
2.) <b>Operations Frame Symbol</b> (Frame)		#	<i>Operations Frame Symbol (Frame)</i> - The frame shape for the Operations symbol.
3.) <b>Emergency Medical Operation</b> (Theme)		A	<i>Emergency Medical Operation (Theme)</i> - Urgent and unexpected medicinal treatment and/or transport during serious situations which require demands of immediate action. (Source: www.dictionary.com, The American Heritage® Dictionary of the English Language, Fourth Edition. Hybrid definition of “emergency” and “medical.”)
4.) <b>EMT Station Locations</b> (Emergency MedicalFeature)		B	<i>EMT Station Locations (Emergency Medical)</i> - The locus of an emergency medical team.
*5.) <b>Ambulance</b> (Emergency MedicalFeature)		C	<i>Ambulance (Emergency Medical)</i> - A vehicle for taking sick or wounded people to and from a hospital.
6.) <b>Medical Evacuation Helicopter Station</b> (Emergency MedicalFeature)		D	<i>Medical Evacuation Helicopter Station (Emergency Medical)</i> - The locus of an emergency helicopter landing pad, utilized to transport severely injured persons.
7.) <b>Health Department Facility</b> (Emergency MedicalFeature)		E	<i>Health Department Facility (Emergency Medical)</i> - The locus of a facility operated by a public institution which is dedicated to promotion of health and prevention of disease at the community, country, state, or national level. (Source: based on the APHA public health mission description).
8.) <b>Hospital</b> (Emergency MedicalFeature)		F	<i>Hospital (Emergency Medical)</i> - The locus of an institution where the sick or injured are given medical or surgical care.
9.) <b>Hospital Ship</b> (Emergency MedicalFeature)		G	<i>Hospital Ship (Emergency Medical)</i> - The locus of a ship where the sick or injured are given medical or surgical care.
10.) <b>Medical Facilities Out Patient</b> (Emergency MedicalFeature)		H	<i>Medical Facilities Out Patient (Emergency Medical)</i> - The locus of a facility providing medical treatment to patients whose sickness or injury does not require hospitalization.
11.) <b>Morgue</b> (Emergency MedicalFeature)		I	<i>Morgue (Emergency Medical)</i> - The locus of a place where the bodies of persons found dead are kept until identified and claimed by relatives or released for burial. (Source: Merriam-Webster Online Dictionary definition)



<p>12.) <b>Pharmacies</b> (Emergency Medical Feature)</p>		<p>J</p>	<p><i>Pharmacies (Emergency Medical)</i> - The locus a place where medicines are compounded or dispensed. (Source: Merriam-Webster Online definition)</p>
<p>13.) <b>Triage</b> (Emergency Medical Feature)</p>		<p>K</p>	<p><i>Triage (Emergency Medical)</i> - The locus of a place where sorting and allocation of treatment to patients (especially victims of war or disaster) is performed according to a system of priorities designed to maximize the number of survivors. (Source: Merriam-Webster Online Dictionary definition)</p>
<p>14.) <b>Emergency Operation</b> (Theme)</p>		<p>L</p>	<p><i>Emergency Operation (Theme)</i> - Those actions taken during the emergency period to protect life and property, care for the people affected, and temporarily restore essential community services. (Source: modified San Diego State University Emergency Plan glossary; link at: <a href="http://bfa.sdsu.edu/emergencyplan/glossary.htm">http://bfa.sdsu.edu/emergencyplan/glossary.htm</a>)</p>
<p>*15.) <b>Emergency Collection Evacuation Point</b> (Emergency Operation Feature)</p>		<p>M</p>	<p><i>Emergency Collection Evacuation Point (Emergency Operation)</i> - A designated place where displaced persons or victims of war or disaster are assembled and/or evacuated from</p>
<p>16.) <b>Emergency Incident Command Center</b> (Emergency Operation Feature)</p>		<p>N</p>	<p><i>Emergency Incident Command Center (Emergency Operation)</i> - The physical location from which an incident commander manages an incident. (Source: State of Virginia ICS web site)</p>
<p>17.) <b>Emergency Operations Center</b> (Emergency Operation Feature)</p>		<p>O</p>	<p><i>Emergency Operations Center (Emergency Operation)</i> - The physical location where an organization comes together during an emergency to coordinate response and recovery actions and resources and make management decisions. (Source: EMS web site)</p>
<p>*18.) <b>Emergency Public Information Center</b> (Emergency Operation Feature)</p>		<p>P</p>	<p><i>Emergency Public Information Center (Emergency Operation)</i> - No Definition.</p>
<p>19.) <b>Emergency Shelters</b> (Emergency Operation Feature)</p>		<p>Q</p>	<p><i>Emergency Shelters (Emergency Operation)</i> - The locus of a designated emergency / relief shelter.</p>
<p>20.) <b>Emergency Staging Areas</b> (Emergency Operation Feature)</p>		<p>R</p>	<p><i>Emergency Staging Areas (Emergency Operation)</i> - A designated place where emergency management forces, equipment, and supplies are assembled prior to engagement in operations.</p>
<p>21.) <b>Emergency Teams</b> (Emergency Operation Feature)</p>		<p>S</p>	<p><i>Emergency Teams (Emergency Operation)</i> - The locus of an emergency management team</p>
<p>*22.) <b>Emergency Water Distribution Center</b> (Emergency Operation Feature)</p>		<p>T</p>	<p><i>Emergency Water Distribution Center (Emergency Operation)</i> - A place where potable water is distributed to displaced persons or victims of war or disaster.</p>
<p>23.) <b>Emergency Food Distribution Centers</b> (Emergency Operation Feature)</p>		<p>U</p>	<p><i>Emergency Food Distribution Centers (Emergency Operation)</i> - A place where food is distributed to displaced persons or victims of war or disaster.</p>



OperationFeature)					
24.) Fire Suppression Operation (Theme)		V	<i>Fire Suppression Operation (Theme)</i> - The extinguishing of a burning (and flaming) object by means of applying an agent, such as water. (Source: Modified from www.firewise.org glossary of terms)		
25.) Fire Hydrant (Fire SuppressionFeature)		W	<i>Fire Hydrant (Fire Suppression)</i> - A discharge pipe with a valve and spout from which water may be drawn from a water main in sufficient volume and at sufficient pressure for firefighting purposes. (Source: Adapted from Merriam-Webster Online Dictionary definition of hydrant)		
26.) Other Water Supply Location (Fire SuppressionFeature)		X	<i>Other Water Supply Location (Fire Suppression)</i> - Any source of water other than a fire hydrant that is sufficient for the purpose of fire fighting.		
27.) Fire Station (Fire SuppressionFeature)		Y	<i>Fire Station (Fire Suppression)</i> - A facility housing fire-fighting equipment and/or personnel.		
28.) Law Enforcement Operation (Theme)		Z	<i>Law Enforcement Operation (Theme)</i> - Act of insuring obedience to the laws. (Source: www.dictionary.com, WordNet © 1.6, © 1997 Princeton University.)		
29.) ATF (Law EnforcementFeature)		a	<i>ATF (Law Enforcement)</i> - A locus of U.S. Bureau of Alcohol, Tobacco, and Firearms facilities, equipment, or personnel.		
30.) Border Patrol (Law EnforcementFeature)		b	<i>Border Patrol (Law Enforcement)</i> - A locus of U.S. Border Patrol facilities, equipment, or personnel.		
31.) Customs Service (Law EnforcementFeature)		c	<i>Customs Service (Law Enforcement)</i> - A locus of U.S. Customs Service facilities, equipment, or personnel.		
32.) DEA (Law EnforcementFeature)		d	<i>DEA (Law Enforcement)</i> - A locus of U.S. Drug Enforcement Administration facilities, equipment, or personnel.		
33.) DOJ (Law EnforcementFeature)		e	<i>DOJ (Law Enforcement)</i> - A locus of U.S. Department of Justice facilities, equipment, or personnel.		
34.) FBI (Law EnforcementFeature)		f	<i>FBI (Law Enforcement)</i> - A locus of Federal Bureau of Investigation facilities, equipment, or personnel.		
35.) Police (Law EnforcementFeature)		g	<i>Police (Law Enforcement)</i> - A locus of Federal, State, or local police facilities, equipment, or personnel.		
36.) Prison (Law EnforcementFeature)		h	<i>Prison (Law Enforcement)</i> - A facility for the confinement of persons convicted of serious crimes. (Source: Adapted from the Merriam-Webster Online Dictionary definition)		
37.) Secret Service (Law EnforcementFeature)		i	<i>Secret Service (Law Enforcement)</i> - A locus of U.S. Secret Service facilities, equipment, or personnel.		
38.) TSA (Law EnforcementFeature)		j	<i>TSA (Law Enforcement)</i> - A locus of U.S. Transportation Security Administration facilities, equipment, or personnel.		


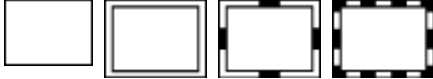






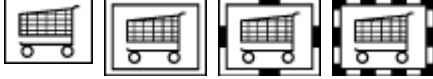
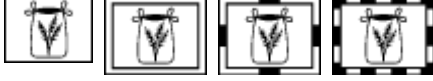
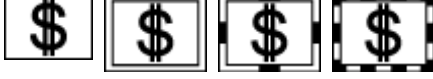

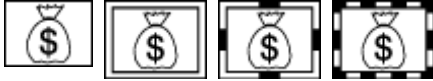
<p>39.) <b>US Coast Guard</b> (Law EnforcementFeature)</p>		<p>k</p>	<p><i>US Coast Guard (Law Enforcement)</i> - A locus U.S. Coast Guard facilities, equipment, or personnel.</p>
<p>40.) <b>US Marshals Service</b> (Law EnforcementFeature)</p>		<p>l</p>	<p><i>US Marshals Service (Law Enforcement)</i> - A locus of U.S. Marshals Service facilities, equipment, or personnel.</p>
<p>41.) <b>Sensor Operation</b> (Theme)</p>		<p>m</p>	<p><i>Sensor Operation (Theme)</i> - A device that receives and responds to a signal or stimulus. (Source: www.dictionary.com, The American Heritage® Dictionary of the English Language, Fourth Edition.)</p>
<p>42.) <b>Biological Sensor</b> (Sensor OperationFeature)</p>		<p>n</p>	<p><i>Biological Sensor (Sensor Operation)</i> - A device designed to respond to the presence of one or more biological substances and to transmit a resulting impulse. (Source: Adapted from the Merriam-Webster Online Dictionary definition of "sensor")</p>
<p>43.) <b>Chemical Sensor</b> (Sensor OperationFeature)</p>		<p>o</p>	<p><i>Chemical Sensor (Sensor Operation)</i> - A device designed to respond to the presence of one or more chemicals and to transmit a resulting impulse. (Source: Adapted from the Merriam-Webster Online Dictionary definition of "sensor")</p>
<p>44.) <b>Intrusion Sensor</b> (Sensor OperationFeature)</p>		<p>p</p>	<p><i>Intrusion Sensor (Sensor Operation)</i> - A device designed to respond to physical penetration of, or attempts to physically penetrate, a protected area or spatial volume and to transmit a resulting impulse. (Source: Adapted from the Merriam-Webster Online Dictionary definition of "sensor")</p>
<p>45.) <b>Nuclear Sensor</b> (Sensor OperationFeature)</p>		<p>q</p>	<p><i>Nuclear Sensor (Sensor Operation)</i> - A device designed to respond to one or more decay product(s) of one or more radioactive nuclides and to transmit a resulting impulse. (Source: Based on the Merriam-Webster Online Dictionary definition of "sensor" and inherent knowledge of the process, detection, and measurement of radioactivity)</p>
<p>46.) <b>Radiological Sensor</b> (Sensor OperationFeature)</p>		<p>r</p>	<p><i>Radiological Sensor (Sensor Operation)</i> - A device designed to respond to one or more decay product(s) of one or more radioactive nuclides and to transmit a resulting impulse. (Source: Based on the Merriam-Webster Online Dictionary definition of "sensor" and inherent knowledge of the process, detection, and measurement of radioactivity)</p>






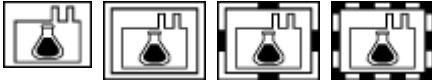
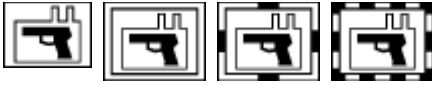





This page last updated: September 14, 2005 10:15 AM

**9.3.5 Infrastructures Symbology Reference**  
 (Version 2.20, Released: September 14, 2005)

Infrastructures - The basic facilities, services, and installations needed for the functioning of a community or society, such as transportation and communications systems, water and power lines, and public institutions including schools, post offices, and prisons. (Source: www.dictionary.com, The American Heritage® Dictionary of the English Language, Fourth Edition.)







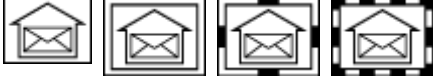



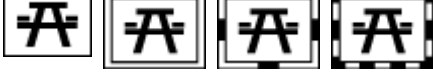

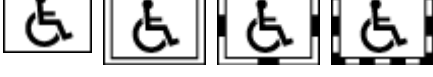
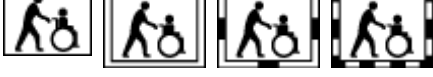

Use this page to cross-reference the Infrastructures symbols with their definitions. Changed or New symbols are marked by an asterisk (\*) and have a light yellow or green background, respectively.

Symbol Types	Symbol Image	Key Stroke	Symbol Terms and Definitions
1.) <b>Infrastructures Background Symbol</b> (Background)		!	<i>Infrastructures Background Symbol</i> background fill shape for the Infrastructures
2.) <b>Infrastructures Frame Symbol</b> (Frame)		#	<i>Infrastructures Frame Symbol (Frame)</i> shape for the Infrastructures symbol
3.) <b>Agriculture and Food Infrastructure</b> (Theme)		\$	<i>Agriculture and Food Infrastructure</i> Production and retail services of food
4.) <b>Agricultural Laboratories</b> (Agriculture and FoodFeature)		%	<i>Agricultural Laboratories (Agriculture and Food)</i> Facilities used for scientific research
5.) <b>Animal Feedlots</b> (Agriculture and FoodFeature)		&	<i>Animal Feedlots (Agriculture and Food)</i> designated for feeding livestock.
6.) <b>Commercial Food Distribution Center</b> (Agriculture and FoodFeature)		(	<i>Commercial Food Distribution Center (Agriculture and Food)</i> - Facilities used for the distribution of marketable foodstuffs.
7.) <b>Farms Ranches</b> (Agriculture and FoodFeature)		)	<i>Farms Ranches (Agriculture and Food)</i> land on which crops or animals are raised
8.) <b>Food Production Center</b> (Agriculture and FoodFeature)		*	<i>Food Production Center (Agriculture and Food)</i> locus where foodstuffs are produced
9.) <b>Food Retail</b> (Agriculture and FoodFeature)		+	<i>Food Retail (Agriculture and Food)</i> foodstuffs are sold for a profit.
10.) <b>Grain Storage</b> (Agriculture and FoodFeature)		,	<i>Grain Storage (Agriculture and Food)</i> the housing of cereal seeds such as wheat, corn, barley, etc.
11.) <b>Banking Finance and Insurance Infrastructure</b> (Theme)		-	<i>Banking Finance and Insurance Infrastructure</i> - The management of money and of their protection. (Source: modified from The American Heritage® Dictionary of the English Language, Fourth Edition.)
12.) <b>ATMs</b> (Banking Finance and InsuranceFeature)		.	<i>ATMs (Banking Finance and Insurance)</i> unattended machine commonly located on the exterior which dispenses money when a coded card is inserted. (Source: Modified from www.hyperdictionary.com.)
13.) <b>Banks</b> (Banking Finance and InsuranceFeature)		/	<i>Banks (Banking Finance and Insurance)</i> establishment in which money is kept for commercial purposes or is invested or exchanged. (Source: www.dictionary.com)


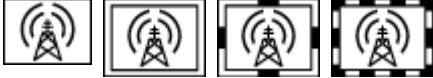

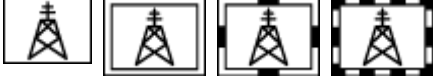

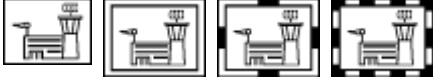

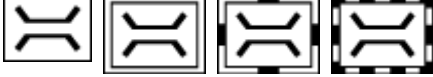




				American Heritage® Dictionary of the Language, Fourth Edition.)
14.) <b>Bullion Storage</b> (Banking Finance and InsuranceFeature)		0		<i>Bullion Storage (Banking Finance and Insurance)</i> - A facility used to deposit and warehouse gold bars or ingots. (Source: www.hyperdictionary.com.)
15.) <b>Federal Reserve Banks</b> (Banking Finance and InsuranceFeature)		1		<i>Federal Reserve Banks (Banking Finance and Insurance)</i> - One of twelve regional banks that act as depositories for banks in their respective regions. (Source: www.hyperdictionary.com.)
16.) <b>Financial Exchanges</b> (Banking Finance and InsuranceFeature)		2		<i>Financial Exchanges (Banking Finance and Insurance)</i> - A marketplace in which shares, options, bonds, commodities, and derivatives are traded. (Source: Yahoo! Finance glossary; http://biz.yahoo.com/f/g/ee.html.)
17.) <b>Financial Services Other</b> (Banking Finance and InsuranceFeature)		3		<i>Financial Services Other (Banking Finance and Insurance)</i> - A business establishment that provides a variety of financial or monetary related products and services other than a bank. Locations which include investment management business.
18.) <b>Commercial Infrastructure</b> (Theme)		4		<i>Commercial Infrastructure (Theme)</i> - A location where a business enterprise is under development. (Source: www.hyperdictionary.com.)
19.) <b>Chemical Plant</b> (Commercial InfrastructureFeature)		5		<i>Chemical Plant (Commercial Infrastructure)</i> - An industrial site where chemical substances and compounds are produced. (Source: www.hyperdictionary.com.)
20.) <b>Firearm Manufacturers</b> (Commercial InfrastructureFeature)		6		<i>Firearm Manufacturers (Commercial Infrastructure)</i> - The location where hand weapons of mass production are manufactured when shot are mass produced. (Source: New World Dictionary; hybrid definition of "manufacture".)
21.) <b>Firearm Retailers</b> (Commercial InfrastructureFeature)		7		<i>Firearm Retailers (Commercial Infrastructure)</i> - A location where hand weapons of mass production are sold. (Source: Webster's New World Dictionary; hybrid definition of "firearm".)
22.) <b>Hazardous Material Production</b> (Commercial InfrastructureFeature)		8		<i>Hazardous Material Production (Commercial Infrastructure)</i> - The locus of where chemicals and-or substances are produced under regulated conditions.
23.) <b>Hazardous Material Storage</b> (Commercial InfrastructureFeature)		9		<i>Hazardous Material Storage (Commercial Infrastructure)</i> - A storing location for a combination of substances that become hazardous by concentration, physical, chemical, radioactive, explosive, or infectious characteristics that pose a potential danger to humans and/or the environment. (Source: San Diego State University emergency plan glossary; link at: http://bfa.sdsu.edu/emergencyplan/)
24.) <b>Industrial Site</b> (Commercial InfrastructureFeature)		:		<i>Industrial Site (Commercial Infrastructure)</i> - A location of an industrial facility or facilities used for the production and selling of goods. (Source: www.dictionary.com.)
25.) <b>Landfill</b> (Commercial InfrastructureFeature)		;		<i>Landfill (Commercial Infrastructure)</i> - An excavation in which wastes are placed and covered.












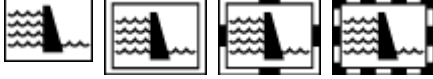


InfrastructureFeature)					permanent disposal, and which is not a unit, surface impoundment, injection well, or underground storage tank. (Source: The Federal Aviation Administration. Link at: <a href="http://wildlife-mitigation.tc.faa.gov/public_html/manuals/glossary.pdf">http://wildlife-mitigation.tc.faa.gov/public_html/manuals/glossary.pdf</a> )
26.) <b>Pharmaceutical Manufacturer</b> (Commercial InfrastructureFeature)		=			<i>Pharmaceutical Manufacturer (Commercial Infrastructure)</i> - The location where pharmaceuticals are mass produced. (Source: Webster's Dictionary; hybrid definition of "pharmaceutical" and "manufacture".)
27.) <b>Superfund Sites NPL</b> (Commercial InfrastructureFeature)		?			<i>Superfund Sites NPL (Commercial Infrastructure)</i> - A location in the United States that has been found to be contaminated by hazardous waste and is on the National Priorities List (NPL) of the Environmental Protection Agency and requires a clean-up because it poses a risk to human health or the environment. (Source: Environmental Protection Agency. Link at: <a href="http://www.epa.gov">http://www.epa.gov</a> )
28.) <b>Toxic Release Inventory</b> (Commercial InfrastructureFeature)		@			<i>Toxic Release Inventory (Commercial Infrastructure)</i> - The location according to a publicly available list of chemical and other toxic waste releases to the Environmental Protection Agency. Link at: <a href="http://www.epa.gov">http://www.epa.gov</a> .
29.) <b>Educational Facilities Infrastructure</b> (Theme)		A			<i>Educational Facilities Infrastructure</i> - A building or collection of buildings or places that provides knowledge. (Source: <a href="http://www.hyperdictionary.com">www.hyperdictionary.com</a> , Hybrid definition of "educational" and "facility".)
30.) <b>College University</b> (Educational FacilitiesFeature)		B			<i>College University (Educational Facilities)</i> - An institution of higher learning offering a course of instruction leading to a Bachelor's or Master's degree. (Source: Adapted from Merriam-Webster Online Dictionary definitions of "college" and "university".)
31.) <b>Schools</b> (Educational FacilitiesFeature)		C			<i>Schools (Educational Facilities)</i> - A place where primary and secondary education is provided. Adapted from Merriam-Webster Online Dictionary definition)
32.) <b>Energy Facilities Infrastructure</b> (Theme)		D			<i>Energy Facilities Infrastructure (Theme)</i> - A collection of buildings and/or places that provides electrical power.
33.) <b>Generation Stations</b> (Energy FacilitiesFeature)		E			<i>Generation Stations (Energy Facilities)</i> - A facility equipped with special equipment used for the production of heat or electricity. (Source: <a href="http://www.hyperdictionary.com">www.hyperdictionary.com</a> , Hybrid definition of "generation" and "station".)
34.) <b>Natural Gas Facilities</b> (Energy FacilitiesFeature)		F			<i>Natural Gas Facilities (Energy Facilities)</i> - A facility equipped with special equipment used to generate nuclear gas power.
35.) <b>Nuclear Facilities</b> (Energy FacilitiesFeature)		G			<i>Nuclear Facilities (Energy Facilities)</i> - A facility with special equipment used to generate nuclear power.
36.) <b>Petroleum Facilities</b> (Energy FacilitiesFeature)		H			<i>Petroleum Facilities (Energy Facilities)</i> - A place that provides and distributes petroleum products.
37.) <b>Propane Facilities</b> (Energy FacilitiesFeature)		I			<i>Propane Facilities (Energy Facilities)</i> - A place that provides and distributes propane.

38.) <b>Government Site Infrastructure</b> (Theme)		J	<i>Government Site Infrastructure (Theme)</i> - where executive, legislative and-or judicial actions take place in the service of the government.
39.) <b>Military Infrastructure</b> (Theme)		K	<i>Military Infrastructure (Theme)</i> - Related to the four major branches of the United States Armed Forces as associated with, or performing military services as contrasted with civilians (Source: www.hyperdictionary.com.)
40.) <b>Military Armory</b> (MilitaryFeature)		L	<i>Military Armory (Military)</i> - A military facility where arms and ammunition and other military equipment are manufactured and stored, and also where they are given in the use of arms. (Source: www.hyperdictionary.com.)
41.) <b>Military Base</b> (MilitaryFeature)		M	<i>Military Base (Military)</i> - The locus of military operations where personnel, weapons and supplies are stored and where attacks and other operations are planned and launched. (Source: "Scholastic Glossary.")
42.) <b>Postal Service Infrastructure</b> (Theme)		N	<i>Postal Service Infrastructure (Theme)</i> - A facility whereby letters, messages and other communications are transmitted and delivered via the postal service. Modified from www.hyperdictionary.com.
43.) <b>Postal Distribution Center</b> (PostalFeature)		O	<i>Postal Distribution Center (Postal)</i> - A U.S. Postal Service (USPS) facility where mail is processed. (Source: USPS web-page description.)
44.) <b>Post Office</b> (PostalFeature)		P	<i>Post Office (Postal)</i> - A U.S. Postal Service facility that directly delivers postal services to the public.
45.) <b>Public Venues Infrastructure</b> (Theme)		Q	<i>Public Venues Infrastructure (Theme)</i> - A place or places and events for a large number of people. (Source: Modified from www.hyperdictionary.com.)
46.) <b>Enclosed Facility</b> (Public VenuesFeature)		S	<i>Enclosed Facility (Public Venues)</i> - A facility with walls.
47.) <b>Open Facility</b> (Public VenuesFeature)		U	<i>Open Facility (Public Venues)</i> - A facility or without walls, e.g., stadium, park.
48.) <b>Recreational Area</b> (Public VenuesFeature)		V	<i>Recreational Area (Public Venues)</i> - A place for the refreshment of strength and spirit. (Source: Merriam-Webster Online Dictionary.)
49.) <b>Religious Institution</b> (Public VenuesFeature)		W	<i>Religious Institution (Public Venues)</i> - A place of worship where religious services are performed. Said by congregation loyal to a belief.
50.) <b>Special Needs Infrastructure</b> (Theme)		Z	<i>Special Needs Infrastructure (Theme)</i> - A facility for people who have specific needs, such as a disability. (Source: www.dictionary.com, American Heritage® Dictionary of the English Language, Fourth Edition.)
51.) <b>Adult Day Care</b> (Special NeedsFeature)		[	<i>Adult Day Care (Special Needs)</i> - A residential facility that provides supervised and assisted living services to adults, typically during daylight hours.
52.) <b>Child Day Care</b> (Special NeedsFeature)		]	<i>Child Day Care (Special Needs)</i> - A facility for the care of other people's children. (Source: www.dictionary.com, WordNet® 1.6, University.)



<p><b>53.) Elder Care</b> (Special NeedsFeature)</p>		<p><i>Elder Care (Special Needs)</i> - The location of a home or a residential assisted living facility where full-time care is provided for chronically ill and elderly.</p>
<p><b>54.) Telecommunications Infrastructure</b> (Theme)</p>		<p><i>Telecommunications Infrastructure</i> - The electronic systems used in transmitting information by telegraph, cable, telephone, radio, or computer. (Source: www.dictionary.com. Heritage® Dictionary of the English Language, 4th Edition.)</p>
<p><b>55.) Telecommunications Facility</b> (TelecommunicationsFeature)</p>		<p><i>Telecommunications Facility (Telecommunications)</i> - Any facility housing telecommunications studios, control rooms, or personnel.</p>
<p><b>56.) Telecommunications Tower</b> (TelecommunicationsFeature)</p>		<p><i>Telecommunications Tower (Telecommunications)</i> - A structure typically higher than its diameter relative to its surroundings to which telecommunications antennae are attached. Adapted from Merriam-Webster Online.</p>
<p><b>57.) Transportation Infrastructure</b> (Theme)</p>		<p><i>Transportation Infrastructure (Theme)</i> - The means of transport, and equipment used for the movement of passengers and/or goods. <a href="http://dict.die.net">http://dict.die.net</a>.)</p>
<p><b>58.) Air Traffic Control Facility</b> (TransportationFeature)</p>		<p><i>Air Traffic Control Facility (Transportation)</i> - A facility operated by appropriate authority to control the orderly and expeditious flow of air traffic. Federal Aviation Administration glossary. <a href="http://www.fly.faa.gov/Products/Glossary/glossary_of_terms.html">http://www.fly.faa.gov/Products/Glossary/glossary_of_terms.html</a>.)</p>
<p><b>59.) Airport</b> (TransportationFeature)</p>		<p><i>Airport (Transportation)</i> - An area of land on the surface, excluding water, that is used for the landing and takeoff of aircraft. It includes its buildings and facilities, including runways. Federal Aviation Administration glossary. <a href="http://wildlife-mitigation.tc.faa.gov/public_html/ma">http://wildlife-mitigation.tc.faa.gov/public_html/ma</a></p>
<p><b>60.) Bridge</b> (TransportationFeature)</p>		<p><i>Bridge (Transportation)</i> - A structure that connects and maintains transportation routes across either sides of the gap. (Source: Merriam-Webster's New World Dictionary.)</p>
<p><b>61.) Bus Station</b> (TransportationFeature)</p>		<p><i>Bus Station (Transportation)</i> - A terminal for bus passengers. (Source: www.hypertext.com)</p>
<p><b>62.) Ferry Terminal</b> (TransportationFeature)</p>		<p><i>Ferry Terminal (Transportation)</i> - A terminal for vehicle-carrying and commuter boats. (Source: Modified from www.dictionary.com)</p>
<p><b>63.) Helicopter Landing Site</b> (TransportationFeature)</p>		<p><i>Helicopter Landing Site (Transportation)</i> - A landing zone that contains one or more helipads for helicopters to land. (Source: Dennis G. and Doctrine Digital Library, military glossary. Link at: <a href="http://www.adtdl.army.mil/cgi-bin/afss/21.38/gloss.htm">http://www.adtdl.army.mil/cgi-bin/afss/21.38/gloss.htm</a>.)</p>
<p><b>64.) Lock</b> (TransportationFeature)</p>		<p><i>Lock (Transportation)</i> - An enclosed chamber in a river equipped with gates for raising and lowering the level of water so that boats and other vessels can pass. (Source: Modified from Webster's Online Dictionary.)</p>

<p><b>65.) Maintenance Facility</b> (TransportationFeature)</p>		<p>k</p>	<p><i>Maintenance Facility (Transportation)</i> - A location where vehicles, machines or any other devices are serviced for inspection or repair. Modified from www.hyperdictionary.com.</p>
<p><b>66.) Port</b> (TransportationFeature)</p>		<p>l</p>	<p><i>Port (Transportation)</i> - A location or facilities for loading and unloading of cargo vessels. (Source: www.dictionary.com, Heritage® Dictionary of the English Language, 3rd Edition.)</p>
<p><b>67.) Rail Station</b> (TransportationFeature)</p>		<p>m</p>	<p><i>Rail Station (Transportation)</i> - A depot where transport vehicles or trains load and unload passengers or goods. (Source: www.hyperdictionary.com, modified from "depot.")</p>
<p><b>68.) Rest Stop</b> (TransportationFeature)</p>		<p>n</p>	<p><i>Rest Stop (Transportation)</i> - A road facility where motorists may purchase refreshments and-or acquire area information.</p>
<p><b>69.) Ship Anchorage</b> (TransportationFeature)</p>		<p>o</p>	<p><i>Ship Anchorage (Transportation)</i> - A facility for securely anchoring ships and other vessels. (Source: www.dictionary.com, Webster's Unabridged Dictionary, © 1996, 1999.)</p>
<p><b>70.) Toll Facility</b> (TransportationFeature)</p>		<p>p</p>	<p><i>Toll Facility (Transportation)</i> - A gate where money is collected before and-or after entering or exit a toll road (turnpike). (Source: Webster's New World Dictionary.)</p>
<p><b>71.) Traffic Control Point</b> (TransportationFeature)</p>		<p>q</p>	<p><i>Traffic Control Point (Transportation)</i> - Absolute signals controlled by an operator to start and maintain transportation flow.</p>
<p><b>72.) Traffic Inspection Facility</b> (TransportationFeature)</p>		<p>r</p>	<p><i>Traffic Inspection Facility (Transportation)</i> - A facility equipped with scales where vehicles transporting goods on public roads are required to stop and obtain gross vehicle weights. (Source: Nextlinx, Link: <a href="http://www.nextlinx.com/tools_glossary.html">http://www.nextlinx.com/tools_glossary.html</a> of "weigh station".)</p>
<p><b>73.) Tunnel</b> (TransportationFeature)</p>		<p>s</p>	<p><i>Tunnel (Transportation)</i> - An underground passage used to connect and maintain transportation between a physical or human-built or natural opening. (Source: Modified from Webster's New World Dictionary.)</p>
<p><b>74.) Water Supply Infrastructure</b> (Theme)</p>		<p>t</p>	<p><i>Water Supply Infrastructure (Theme)</i> - The process of disinfection, filtration and provision of water to the consumer/community by means of pipes, pumps, water towers, wells and other facilities. (Source: County of Maui (Hawaii) Water Department glossary. Link at: <a href="http://mauiwater.org/glossary">http://mauiwater.org/glossary</a> Hybrid definition of "water system" and "water supply".)</p>
<p><b>75.) Critical Valves</b> (Water SupplyFeature)</p>		<p>u</p>	<p><i>Critical Valves (Water Supply)</i> - A valve that regulates the speed, flow or pressure of a fluid. (Source: "Valve World" glossary, definition of "valve." Link at: <a href="http://www.valve-world.net/glossary/index.asp">http://www.valve-world.net/glossary/index.asp</a>.)</p>
<p><b>76.) Dam</b> (Water SupplyFeature)</p>		<p>v</p>	<p><i>Dam (Water Supply)</i> - A barrier constructed across a waterway to control the flow or raise the water level. (Source: www.dictionary.com, The American Heritage Dictionary of the English Language, 4th Edition.)</p>

<p><b>77.) Discharge Outfall</b> (Water SupplyFeature)</p>		<p>w</p>	<p><i>Discharge Outfall (Water Supply)</i> - The effluent that is released into receiving location and within a given period of Hybrid definition from the Ohio Environment Protection Agency glossary (term “c United States Geologic Survey (term Modified. Links at: <a 206="" 232"="" 301="" 94="" href="http://www.epa.s (/ddagw/Documents/swapdocglo.po http://ga.water.usgs.gov/edu/diction&lt;/a&gt;&lt;/p&gt; &lt;/td&gt; &lt;/tr&gt; &lt;tr&gt; &lt;td data-bbox="> <p><b>78.) Ground Well</b> (Water SupplyFeature)</p> </a></p>		<p>x</p>	<p><i>Ground Well (Water Supply)</i> - An ar drilled into the ground for the purpos water from the underground aquifer from the USGS Water Science glos <a href="http://ga.water.usgs.gov/edu/diction">http://ga.water.usgs.gov/edu/diction</a></p>
<p><b>79.) Pumping Station</b> (Water SupplyFeature)</p>		<p>y</p>	<p><i>Pumping Station (Water Supply)</i> - F water up and over hills. (Source: Ridenbaugh.com Link at: <a href="http://www.ridenbaugh.com">http://www.ridenbaugh.com</a></p>			
<p><b>80.) Reservoir</b> (Water SupplyFeature)</p>		<p>z</p>	<p><i>Reservoir (Water Supply)</i> - An off-st facility that is filled with water pump stream. (Source: Ohio Environment Agency glossary (term “upground re <a href="http://www.epa.state.oh.us (/ddagw/Documents/swapdocglo.po">http://www.epa.state.oh.us (/ddagw/Documents/swapdocglo.po</a></p>			
<p><b>81.) Storage Tower</b> (Water SupplyFeature)</p>		<p>{</p>	<p><i>Storage Tower (Water Supply)</i> - A l metallic) container for holding gases (Source: <a href="http://www.hyperdictionary.com">www.hyperdictionary.com</a>.</p>			
<p><b>82.) Surface Water Intake</b> (Water SupplyFeature)</p>		<p>}</p>	<p><i>Surface Water Intake (Water Supply)</i> which wastewater is transferred dire (Source: USGS Water Resources o and Vermont glossary. Hybrid defini and “surface water return flow.” Link <a href="http://nh.water.usgs.gov/Publication 328/ofr01-328_glossary.pdf">http://nh.water.usgs.gov/Publication 328/ofr01-328_glossary.pdf</a>.)</p>			
<p><b>83.) Water Treatment Facility</b> (Water SupplyFeature)</p>		<p>~</p>	<p><i>Water Treatment Facility (Water Su)</i> designed to receive the wastewater sources and to remove materials th quality and threaten public health ar discharged into receiving streams o (Source: USGS Water Science glos <a href="http://ga.water.usgs.gov/edu/diction">http://ga.water.usgs.gov/edu/diction</a></p>			











This page last updated: September 14, 2005 10:15 AM

**Damage/Operational Symbology Reference**  
**(Version 2.20, Released: September 14, 2005)**

Damage/Operational - The damage or operational level of the infrastructures and operations is designated by each symbol's surrounding frame style.













Use this page to cross-reference the Damage/Operational symbols with their definitions.

Changed or New symbols are marked by an asterisk (\*) and have a light yellow or green background, respectively.

Symbol Types	Symbol Image	Key Stroke	Symbol Terms and Definitions
1.) <b>Incident</b> (Damage/Operational) No Levels		A	<i>Incident (Damage/Operational)</i> - Not Applicable
2.) <b>Natural Event</b> (Damage/Operational) No Levels		B	<i>Natural Event (Damage/Operational)</i> - Not Applicable
3.) <b>Operation</b> (Damage/Operational) Level 1		C	<i>Operation (Damage/Operational)</i> - Fully operational/open.
4.) <b>Operation</b> (Damage/Operational) Level 2		D	<i>Operation (Damage/Operational)</i> - Operational, but filled to capacity or otherwise closed.
5.) <b>Operation</b> (Damage/Operational) Level 3		E	<i>Operation (Damage/Operational)</i> - Operational, but partially damaged or partially incapacitated.
6.) <b>Operation</b> (Damage/Operational) Level 4		F	<i>Operation (Damage/Operational)</i> - Destroyed or Totally incapacitated.
7.) <b>Infrastructure</b> (Damage/Operational) Level 1		G	<i>Infrastructure (Damage/Operational)</i> - Fully operational/open.
8.) <b>Infrastructure</b> (Damage/Operational) Level 2		H	<i>Infrastructure (Damage/Operational)</i> - Operational, but filled to capacity or otherwise closed.
9.) <b>Infrastructure</b> (Damage/Operational) Level 3		I	<i>Infrastructure (Damage/Operational)</i> - Operational, but partially damaged or partially incapacitated.
10.) <b>Infrastructure</b> (Damage/Operational) Level 4		J	<i>Infrastructure (Damage/Operational)</i> - Destroyed or Totally incapacitated.














This page last updated: September 14, 2005 10:15 AM

**Version 2.0 Symbology Changes**

Symbol Types	Old (Version 1)	New (Version 2)	Key Stroke	Symbol Terms and Definitions
1.) <b>Civil Disturbance Incident</b> (Theme)		 <b>CHANGED</b> since previous version.	A	Human activities resulting in the disrupting of services or requiring varying levels of support, law enforcement or attention.
2.) <b>Civil Demonstrations</b> (Civil Disturbance Feature)		 <b>CHANGED</b> since previous version.	B	A public display of group feelings toward a person or cause. (Source: Merriam-Webster Online Dictionary definition)
3.) <b>Civil Displaced Population</b> (Civil Disturbance Feature)		 <b>CHANGED</b> since previous version.	C	Persons or groups of person who have been forced or obliged to flee or to leave their homes or places of habitual residence, in particular as a result of or in order to avoid the effects of armed conflict, violations of human rights, or natural or human-made disasters. (Source: United Nations Guiding Principles on Internally Displaced Persons, 1998)
4.) <b>Civil Rioting</b> (Civil Disturbance Feature)		 <b>CHANGED</b> since previous version.	D	A public disturbance involving (1) an act or acts of violence by one or more persons part of an assemblage of three or more persons, which act or acts shall constitute a clear and present danger of, or shall result in, damage or injury to the property of any other person or to the person of any other individual or (2) a threat or threats of the commission of an act or acts of violence by one or more persons part of an assemblage of three or more persons having, individually or collectively, the ability of immediate execution of such threat or threats, where the performance of the threatened act or acts of violence would constitute a clear and present danger of, or would result in, damage or injury to the property of any other person or to the person of any other individual. (Source: 18 USC Section 2102)
5.) <b>Bomb Threat</b> (Criminal Activity Feature)		 <b>CHANGED</b> since previous version.	F	A warning of the of the possible presence of a bomb or expression of the intention to detonate a bomb.
6.) <b>Bomb</b> (Criminal Activity Feature)		 <b>CHANGED</b>	G	An explosive device fused to detonate under specific conditions. (Source: International military definition)

			since previous version.		
7.)	<b>Bomb Explosion</b> (Criminal Activity Feature)		 <b>CHANGED</b> since previous version.	H	A violent outburst resulting from detonation of a chemical or nuclear explosive or from the loss of a high pressure vessel's integrity.
8.)	<b>Commercial Facility Fire</b> (Fire Incident Feature)		<b>DELETED</b> from previous version.	M	A fire that originates at or affects a commercial facility, resulting in partial damage or total destruction of the structure and/or bodily injury, smoke inhalation or death.
9.)	<b>Grassland Fire</b> (Fire Incident Feature)		<b>DELETED</b> from previous version.	O	An uncontrollable fire in areas of vegetation dominated by grasses, grass-like plants, forbs, mosses, lichens, and/or ferns. (Source: Expanded from <i>Forest Fire</i> definition and the Forestry Resource glossary located at <a href="http://forestry.about.com/library/glossary/">http://forestry.about.com/library/glossary/</a> )
10.)	<b>Non-Residential Fire</b> (Fire Incident Feature)		 <b>ADDED</b> since previous version.	N	A fire that originates at or affects a non-residential or commercial facility, resulting in partial damage or total destruction of the structure and/or bodily injury, smoke inhalation or death.
11.)	<b>Industrial Facility Fire</b> (Fire Incident Feature)		<b>DELETED</b> from previous version.	Q	A fire that originates at or affects an industrial facility, resulting in partial damage or total destruction of the structure and/or bodily injury, smoke inhalation or death.
12.)	<b>Origin</b> (Fire Incident Feature)		 <b>CHANGED</b> since previous version.	O	Location of where the fire started. (Source: Forest Service Department of Agriculture <a href="http://www.fs.fed.us">http://www.fs.fed.us</a> )
13.)	<b>Wild Fire</b> (Fire Incident Feature)		 <b>ADDED</b> since previous version.	T	An uncontrolled fire in a wooded area. (Source: <a href="http://www.realdictionary.com">www.realdictionary.com</a> )
14.)	<b>Avalanche</b> (Geologic Feature)		 <b>CHANGED</b> since previous version.	B	A large mass of snow, ice, soil, or rock, or mixtures of these materials, falling, sliding, or flowing very rapidly under the force of gravity. (Source: Dictionary of Geological Terms, 3rd Ed.)
15.)	<b>Bird Infestation</b> (Infestation Feature)			U	A harassing or troublesome invasion of birds. (Source: derived from the definition of <i>infestation</i> found in the FactMonster.com dictionary)



			<b>ADDED</b> since previous version.		
16.) <b>Ambulance</b> (Emergency Medical Feature)			<b>ADDED</b> since previous version.	C	A vehicle for taking sick or wounded people to and from a hospital.
17.) <b>Emergency Collection Evacuation Point</b> (Emergency Operation Feature)			<b>CHANGED</b> since previous version.	M	A designated place where displaced persons or victims of war or disaster are assembled and/or evacuated from.
18.) <b>Emergency Public Information Center</b> (Emergency Operation Feature)			<b>CHANGED</b> since previous version.	P	No Definition.
19.) <b>Emergency Water Distribution Center</b> (Emergency Operation Feature)			<b>CHANGED</b> since previous version.	T	A place where potable water is distributed to displaced persons or victims of war or disaster.
20.) <b>Church</b> (Public Venues Feature)			<b>DELETED</b> from previous version.	R	A building for public and especially Christian worship. (Source: Merriam-Webster Online Dictionary)
21.) <b>Mosque</b> (Public Venues Feature)			<b>DELETED</b> from previous version.	T	A building used for public worship by Muslims. (Source: Merriam-Webster Online Dictionary)
22.) <b>Synagogue</b> (Public Venues Feature)			<b>DELETED</b> from previous version.	X	The house of worship and communal center of a Jewish congregation. (Source: Merriam-Webster Online Dictionary)
23.) <b>Temple</b> (Public Venues Feature)			<b>DELETED</b> from previous version.	Y	A building for Mormon sacred ordinances. (Source: Merriam-Webster Online Dictionary)
24.) <b>Emergency Public Service Center</b> (Emergency Operation Feature)			<b>DELETED</b> from previous version.	P	No Definition.
25.) <b>Forest Fire</b> (Fire Incident Feature)			<b>DELETED</b> from previous version.	N	An uncontrolled fire in a wooded area. (Source: www.realdictionary.com)

[Source: US FGDC Homeland Security Working Group Symbology Reference \[FGDCa\] \[FGDCb\]](#)

9.4 Appendix 4. Australasian All Hazard Features and Symbols

All Hazard Features and Symbols

Category #ID	Symbol (Feature)	Theme	Geometry	System Symbol	Hand-drawn	Hand Symbol	Status	Definition (inc source)	Guidelines and examples
<b>Incident</b>									
1.1	<b>Incident (generic)</b>	General	Point		Y		Unconfirmed Confirmed	An event, accidentally or deliberately caused, which requires a response from one or more of the statutory emergency response agencies. (EMA)	1) Label with Location; Name; DTG 2) Use at Event/Incident to Jurisdictional levels eg. aircraft crash
1.2	<b>Bomb Threat</b>	Criminal	Point		Y		Possible Probable Confirmed	A warning of the possible presence of a bomb or expression of the intention to detonate a bomb. (FGDC)	1) Label with Location; Name; DTG 2) Use at Event/Incident to Jurisdictional levels
1.3	<b>Bomb</b>	Criminal	Point		Y		Possible Probable Confirmed	An explosive device fused to detonate under specific conditions. (Source: International military definition) (FGDC)	1) Label with Location; Name; DTG 2) Use at Event/Incident to Jurisdictional levels
1.4	<b>Insect Plague</b>	Biological	Point		Y		Unconfirmed Confirmed	Insect Infestation (Infestation) - A harassing or troublesome invasion of insects. (Source: derived from the definition of "infestation" found in the FacitMonster.com dictionary) (FGDC)	1) Label with Location; Name; DTG 2) Use at Regional to Jurisdictional levels eg. for Aust Plague Loc
1.5	<b>Animal Health</b>	Biological	Point		Y		Unconfirmed Confirmed	Outbreak of disease that jeopardise the health of livestock, the production of livestock products or have public health implications (adapted from AUSVETPLAN 3.0)	1) Label with Location; Name; DTG 2) Use at Regional to Jurisdictional levels eg. for Foot & mouth
1.6	<b>Plant Health</b>	Biological	Point		Y		Unconfirmed Confirmed	Emergency plant pest or disease incursion affecting the Australian plant industries (adapted from PlantPlan 2.0)	1) Label with Location; Name; DTG 2) Use at Regional to Jurisdictional levels eg. for Citric canker
1.7	<b>Fire</b>	Fire	Point		Y		NA at this time	Fire Incident An incident reported as a fire to a fire agency and requiring a response. (Vic DPC). STATUS: - not applied at this time	1) Label with Location; Name; DTG 2) Use at Regional to Jurisdictional levels
1.8	<b>Fire Origin</b>	Fire	Point		Y		Unconfirmed Confirmed	Location of where the fire started (FGDC)	1) Label with DTG 2) Use at Event/Incident to Jurisdictional levels
1.9	<b>Fire Hot Spot</b>	Fire	Point		Y		NA	An area of intensified fire activity and increased heat or a particularly active part of a fire (FGDC)	1) Label with DTG 2) Use at Event/Incident to Regional levels
1.10	<b>Spot Fire</b>	Fire	Point		Y		NA	Isolated fires started ahead of the main fire by sparks, embers or other ignited material, sometimes to a distance of several kilometres (AFAC)	1) Label with DTG 2) Use at Event/Incident to Regional levels
1.11	<b>Burnt Area</b>	Fire	Polygon		Y		NA	Area comprehensively burnt by recent fire activity (TBC)	1) Label with DTG 2) Use at Event/Incident to Regional levels
1.12	<b>Fire Perimeter/ Boundary</b>	Fire	Line		Y		NA	Fire Perimeter or Fire Boundary. The entire outer boundary of a fire area. (AFAC)	1) Label with DTG 2) Use at Event/Incident to Regional levels
1.13	<b>Fire Edge</b>	Fire	Line		Y	same	Predicted Active Contained	Any part of the boundary of a fire at a given time. (AFAC)	1) Label with DTG 2) Use at Event/Incident to Regional levels

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Category #ID	Symbol (Feature)	Theme	Geometry	System Symbol	Hand-drawn	Hand Symbol	Status	Definition (inc source)	Guidelines and examples
1.14	<b>Hazardous Material Incident</b>	Hazardous Material	Point		Y		Unconfirmed Confirmed	Incident involving a substance or material which has been determined by an appropriate authority to be capable of posing an unreasonable risk to health, safety and property. (adapted from EMA)	1) Label with Location; Name; DTG 2) Use at Regional to Jurisdictional levels
1.15	<b>Oil Spill</b>	Hazardous Material	Point		Y		Unconfirmed Confirmed	An incident involving the accidental or intentional release of oil into the marine environment, or the slick produced by such an incident. (EMA)	1) Label with Location; Name; DTG 2) Use at Regional to Jurisdictional levels
1.16	<b>Gas Leak</b>	Hazardous Material	Point		Y		Unconfirmed Confirmed	Uncontrolled or potentially dangerous presence of a gas which may afford a hazard to human health (adapted from FGDC)	1) Label with Location; Name; DTG 2) Use at Regional to Jurisdictional levels
1.17	<b>Radioactive Material</b>	Hazardous Material	Point		Y		Unconfirmed Confirmed	Materials which spontaneously emit ionizing radiation (AEM_Glossary).	1) Label with Location; Name; DTG 2) Use at Regional to Jurisdictional levels
1.18	<b>Tropical Cyclone</b>	Natural Event	Point		N		NA	Large scale closed circulation systems in the atmosphere with low barometric pressure and strong winds that rotate counterclockwise in the northern hemisphere and clockwise in the southern hemisphere. The system is referred to as a 'cyclone' in the Indian Ocean and South Pacific, 'hurricane' in the western Atlantic and eastern Pacific and 'typhoon' in the western Pacific (AEM_Glossary).	1) Label with Location; Name; DTG 2) Use at Regional to Jurisdictional levels
1.19	<b>Earthquake</b>	Natural Event	Point		N		NA	The vibrations of the Earth caused by the passage of seismic waves radiating from some source of elastic energy (AEM_Glossary).	1) Label with Location; Name; DTG 2) Use at Regional to Jurisdictional levels
1.20	<b>Flood</b>	Natural Event	Point		N		NA	The overflowing by water of the normal confines of a stream or other body of water, or the accumulation of water by drainage over areas which are not normally submerged (AEM_Glossary).	1) Label with Location; Name; DTG 2) Use at Regional to Jurisdictional levels
1.21	<b>Flooded Area</b>	Natural Event	Polygon		Y	same	Predicted Confirmed	Area of water inundation (TBC)	1) Label with Location; Name; DTG 2) Use at Event/Incident to Regional levels
1.22	<b>Landslide</b>	Natural Event	Point		Y		NA	A general term for a wide variety of processes and landforms involving the down slope movement under the force of gravity of masses of soil and rock material (FGDC)	1) Label with Location; Name; DTG 2) Use at Regional to Jurisdictional levels
1.23	<b>Thunderstorm</b>	Natural Event	Point		N	same	NA	Atmospheric disturbances involving perturbations of the prevailing pressure and wind fields, on scales ranging from tornadoes (1 km across) to extra-tropical cyclones (2000-3000 km across) (AEM_Glossary).	1) Label with Location; Name; DTG 2) Use at Regional to Jurisdictional levels
1.24	<b>Storm Surge</b>	Natural Event	Point		Y		NA	The difference between the actual water level under influence of a meteorological disturbance (storm tide) and the level which would have been attained in the absence of the meteorological disturbance (ie. astronomical tide). Syn. 'storm wave' and 'storm tide' (AEM_Glossary).	1) Label with Location; Name; DTG 2) Use at Regional to Jurisdictional levels
1.25	<b>Tsunami</b>	Natural Event	Point		N		NA	A great sea wave produced by an earthquake or volcanic eruption, characterized by high speed of propagation, long wavelength, long period, and low observable amplitude on the open ocean (FGDC).	1) Label with Location; Name; DTG 2) Use at Regional to Jurisdictional levels

Appendix D: All Hazard Features and Symbols (V1.0)

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Category #ID	Symbol (Feature)	Theme	Geometry	System Symbol	Hand-drawn	Hand Symbol	Status	Definition (inc source)	Guidelines and examples
1.26	<b>Air Incident</b>	Transportation	Point		Y		Unconfirmed Confirmed	An event involving aircraft resulting in damage, bodily injury, death, or the disruption of transportation service (FGDC).	1) Label with Location; Name; DTG 2) Use at Regional to Jurisdictional levels
1.27	<b>Marine Incident</b>	Transportation	Point		Y		Unconfirmed Confirmed	An event involving a boat or ship resulting in damage, bodily injury, death, or the disruption of transportation service (FGDC).	1) Label with Location; Name; DTG 2) Use at Regional to Jurisdictional levels
1.28	<b>Rail Incident</b>	Transportation	Point		Y		Unconfirmed Confirmed	An event involving train resulting in damage, bodily injury, death, or the disruption of transportation service (FGDC).	1) Label with Location; Name; DTG 2) Use at Regional to Jurisdictional levels
1.29	<b>Vehicle Incident</b>	Transportation	Point		Y		Unconfirmed Confirmed	An event involving a wheeled or tracked vehicle resulting in damage, bodily injury, death, or the disruption of transportation service (FGDC).	1) Label with Location; Name; DTG 2) Use at Regional to Jurisdictional levels

Assets									
2.1	<b>Asset (Generic)</b>	General	Point	   	Y	same	No status  Potential defensible  Defensible  Not defensible	Assets and infrastructure that provide the basic facilities, services, and installations needed for the functioning of a community or society, such as transportation and communications systems, water and power lines, and public institutions including schools, post offices, and prisons. (adapted from FGDC).  The status of the asset is defined by the judged ability to counter the known threat of an active incident. ie Potential defensible: .....(AIIMS) Defensible: .....(AIIMS) Not defensible: .....(AIIMS)	1) Label with DTG for status 2) Use at Event/Incident to Regional levels
2.2	<b>Indigenous Site</b>	General	Point		N		NA	Site of indigenous artifacts or cultural importance that emergency responders need to be aware of to minimise impact. (TBC)	1) Use at Event/Incident to Regional levels
2.3	<b>Hazardous Material Storage</b>	General	Point		N		NA	A storing location for a substance or combination of substances that because of quantity, concentration, physical, chemical, radiological, explosive, or infectious characteristics poses a potential danger to humans and/or the environment (FGDC)	1) Use at Event/Incident to Regional levels
2.4	<b>Historic Site</b>	General	Point		N		NA	Site of historical significance that emergency responders need to be aware of to minimise impact. (TBC)	1) Use at Event/Incident to Regional levels
2.5	<b>Significant Flora</b>	General	Point		N		NA	Site of significant flora that emergency responders need to be aware of to minimise impact. (TBC)	1) Use at Event/Incident to Regional levels
2.6	<b>Significant Fauna</b>	General	Point		N		NA	Site of significant fauna that emergency responders need to be aware of to minimise impact. (TBC)	1) Use at Event/Incident to Regional levels
2.7	<b>Fire Sensitive Asset</b>	Fire	Point		Y		NA	Asset that may be destroyed or significantly damaged by fire. Emergency responders need to be aware of to minimise impact. (TBC)	1) Label with DTG 2) Use at Event/Incident to Regional levels

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Category #ID	Symbol (Feature)	Theme	Geometry	System Symbol	Hand-drawn	Hand Symbol	Status	Definition (inc source)	Guidelines and examples
2.8	Machine Sensitive Asset	Fire	Point		Y		NA	Asset that may be destroyed or significantly damaged by vehicles or heavy equipment. Emergency responders need to be aware of to minimise impact. (TBC)	1) Label with DTG 2) Use at Event/Incident to Regional levels
2.9	Threatened Asset	Fire	Point		Y		NA	Asset identified at risk of being destroyed or significantly damaged by wildfire. (TBC)	1) Label with DTG 2) Use at Event/Incident to Regional levels

Operations									
Category #ID	Symbol (Feature)	Theme	Geometry	System Symbol	Hand-drawn	Hand Symbol	Status	Definition (inc source)	Guidelines and examples
3.1	Access Points	General	Point		Y		NA	To be defined (TBC)	1) Use at Event/Incident Regional levels
3.2	Area of Interest	General	Polygon		Y	Same	NA	The extent and location anticipated at being at risk from a particular incident or event. Syn: Area of Concern. (TBC)	1) Label with DTG 2) Use at Event/Incident Regional levels
3.3	Assembly Area	General	Point		Y		NA	A designated location used for the assembly of emergency-affected persons. The area may also incorporate an emergency relief centre (AEM_Glossary)	1) Use at Event/Incident to Regional levels
3.4	Base Camp	General	Point		Y		NA	A location where personnel are accommodated and fed for a period of time. A camp usually contains catering, ablution and accommodation facilities, a water supply and a lighting system., and may include other facilities such as car parking, maintenance and servicing (AEM_Glossary)	1) Use at Event/Incident to Regional levels
3.5	Control Area	General	Polygon		Y	Same	NA	A declared area in which defined conditions apply to the movement into, out of, and within, of specified animals or things. Conditions applying in a control area are of lesser intensity than those in a restricted area. The limits of a control area and the conditions applying therein may be varied rapidly according to need (AEM_Glossary).	1) Label with DTG 2) Use at Event/Incident to Regional levels
3.6	Control / Operations Point	General	Point		Y		NA	To be defined (TBC)	1) Label with DTG 2) Use at Event/Incident to Regional levels
3.7	Declaration Area	General	Polygon		Y		NA	A defined tract of land for the time being subject to emergency management restrictions (adapted from Declared Area in AUSVETPLAN 3.0)	1) Label with DTG 2) Use at Event/Incident to Regional levels
3.8	Escape Route	General	Point		Y		NA	A pre-planned route away from danger areas at a fire (AFAC)	1) Use at Event/Incident to Regional levels
3.9	Escape Route	General	Line		Y		NA	A pre-planned route away from danger areas at a fire (AFAC).	1) Use at Event/Incident to Regional levels
3.10	Evacuation Route								
3.11	Evacuation Area	General	Point		Y		Planned Established	A predetermined place where patients, visitors and staff are taken or are assembled in the event of an evacuation. Syn: 'evacuation assembly area' (AEM_Glossary).	1) Label with DTG for status 2) Use at Event/Incident to Regional levels

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Category #ID	Symbol (Feature)	Theme	Geometry	System Symbol	Hand-drawn	Hand Symbol	Status	Definition (inc source)	Guidelines and examples
3.12	Evacuation Centre	General	Point		Y		Planned Established	Centre that provides affected people with basic human needs including accommodation, food and water. In addition, to enhance the recovery process, other welfare/recovery services should also be provided (AEM_Glossary).	1) Label with DTG for status 2) Use at Event/Incident to Regional levels
3.13	Animal Shelter								
3.14	Refuge	General	Point		Y		NA	A community fire refuge is a building where people may seek shelter from the danger of wildfire. A building constructed or designated as a fire refuge should have consideration given to its vulnerability to wildfire, parking for users, availability of water, telephone and electric power, and location and accessibility in relation to its service area (AEM_Glossary).	1) Use at Event/Incident to Regional levels
3.15	Incident Command/Control Centre	General	Point		Y		Planned Established	The location where the incident controller and, where established, members of the incident management team provide overall direction of response activities in an emergency situation. Syn. emergency operations centre (AEM_Glossary).	1) Label with DTG for status 2) Use at Event/Incident to Jurisdictional levels
3.16	Division Boundary	General	Point		Y		NA	Division: A portion of the fire perimeter comprising of two or more sectors. The number of sectors grouped in a division should be such as to ensure effective direction and control of operations. Divisions are generally identified by a local geographic name (AEM_Glossary).	1) Use at Event/Incident to Regional levels
3.17	Division Command	General	Point		Y		NA	Location at an incident from which the Division Commander of that division operates (AIIMS)	1) Use at Event/Incident to Regional levels
3.18	Sector Boundary	General	Point	00000	Y	00000	NA	To be defined (TBC)	1) Use at Event/Incident to Regional levels
3.19	Sector Command	General	Point		Y		NA	Location at an incident from which the Sector Commander of that section operates (AIIMS)	1) Use at Event/Incident to Regional levels
3.20	Staging Area	General	Point		Y		NA	A location close to the incident where personnel and equipment are available (AFAC).	1) Use at Event/Incident to Regional levels
3.21	Portable Weather Station	General	Point		Y		NA	To be defined (TBC)	1) Use at Event/Incident to Regional levels
3.22	Portable Radio Repeater	General	Point		Y		NA	To be defined (TBC)	1) Use at Event/Incident to Regional levels
3.23	Wind Observation	General	Point		Y		NA	Observation of the direction from which the wind blows and speed in knots. Barb points to direction that wind is coming from. (adapted from www.weather.gov)	1) Label with DTG 2) Use at Event/Incident to Regional levels
3.24	Fire Direction	Fire	Point		Y	Same	NA	To be defined (TBC)	1) Label with DTG 2) Use at Event/Incident to Regional levels
3.25	Aerial Ignition	Fire	Point		Y	Same	Planned Completed	The igniting of fine fuels for prescribed purposes by dropping incendiary devices or materials from aircraft (AFAC)	1) Label with DTG for status 2) Use at Event/Incident to Regional levels
3.26	Back Burn	Fire	Line		Y		Planned Completed	A fire started intentionally along the inner edge of a fireline to consume the fuel in the path of a wildfire (AFAC)	1) Label with DTG for status 2) Use at Event/Incident to Regional levels



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Category #ID	Symbol (Feature)	Theme	Geometry	System Symbol	Hand-drawn	Hand Symbol	Status	Definition (inc source)	Guidelines and examples
3.27	Machine Cut Track	Fire	Line		Y		NA	To be defined (TBC)	1) Use at Event/Incident to Regional levels
3.28	Fire Control Line	Fire	Line		Y		Planned Completed	A natural or constructed barrier, or treated fire edge, used in fire suppression and prescribed burning to limit the spread of fire (AFAC)	1) Label with DTG for status 2) Use at Event/Incident to Regional levels
3.29	Fire Engine/ Vehicle	Fire	Point		Y		NA	The location of any motor vehicles that carry firefighters and equipment to a fire and support extinguishing operations (TBC)	1) Label with DTG 2) Use at Event/Incident to Regional levels
3.30	Water Point	Fire	Point		Y		NA	Natural or artificial water storage of value in fire operations. Generally indicated by a signpost with 'W', 'WP' or 'WATER' (AEM_Glossary).	1) Use at Event/Incident to Regional levels
3.31	Water Point Helicopter	Fire	Point		Y		NA	To be defined (TBC)	1) Use at Event/Incident to Regional levels
3.32	Water Point Vehicle	Fire	Point		Y		NA	To be defined (TBC)	1) Use at Event/Incident to Regional levels
3.33	Sand Bag Levee	Flood	Line		Y		NA	A levee constructed from sandbags that is used to confine streamflow within a specified area along the stream or to prevent flooding due to waves or tides. (adapted from EMA_Glossary)	1) Use at Event/Incident to Regional levels
3.34	Police Vehicle	Law Enforcement	Point		Y		NA	The location of police vehicles. (TBC)	1) Label with DTG 2) Use at Event/Incident to Regional levels
3.35	Ambulance Location	Medical	Point		Y			The location of medical transport located at the disaster site but in a safe location. (TBC)	1) Use at Event/Incident to Regional levels
3.36	First Aid Station	Medical	Point		Y		NA	An area located at the disaster site but in a safe location for undertaking triage, emergency treatment of casualties prior to transport away from the disaster scene. (AEM_Glossary) Syn: Patient Treatment Post; Triage	1) Use at Event/Incident to Regional levels
3.37	Potential Victim	Search & Rescue	Point		N		NA	The location of any known or potential victim. (www.reliefweb.int/undac/documents/insarag/guidelines)	1) Label with DTG 2) Use at Event/Incident to Regional levels
3.38	Victim Location Confirmed	Search & Rescue	Point		Y		NA	The location of a victim has been confirmed either visually, vocally or hearing specific sounds which would indicate a high probability of a victim. (www.reliefweb.int/undac/documents/insarag/guidelines)	1) Annotate underneath with the letter "L" with a number to denote the number of live victims 2) Label with DTG 3) Use at Event/Incident to Regional levels
3.39	Victim Located Dead	Search & Rescue	Point		Y		NA	The location of a victim has been confirmed either visually, vocally or hearing specific sounds which would indicate a high probability of a victim. Only dead victim(s) remain. (www.reliefweb.int/undac/documents/insarag/guidelines)	1) Annotate underneath with the letter "D" with a number to denote the number of dead victims 2) Label with DTG 3) Use at Event/Incident to Regional levels
3.40	Victim Extracted Alive	Search & Rescue	Point		Y		NA	Symbol to indicate that the last live victim has been extricated from that location. (www.reliefweb.int/undac/documents/insarag/guidelines)	1) Annotate underneath with the letter "L" with a number to denote the number of live victims 2) Label with DTG 3) Use at Event/Incident to Regional levels
3.41	Victim Extracted Dead	Search & Rescue	Point		Y		NA	Symbol to indicate when all dead victims have been removed. (www.reliefweb.int/undac/documents/insarag/guidelines)	1) Label with DTG 2) Use at Event/Incident to Regional levels



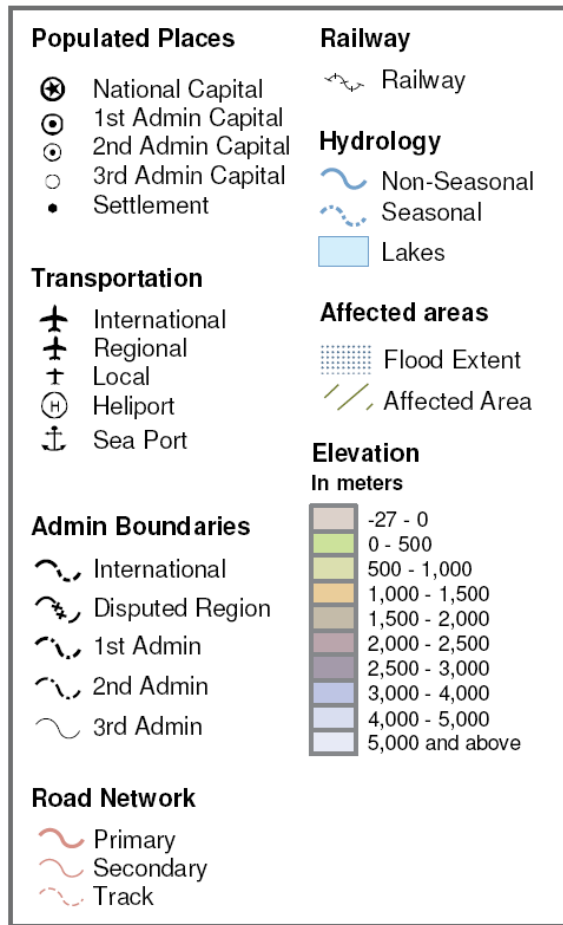
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Category #ID	Symbol (Feature)	Theme	Geometry	System Symbol	Hand-drawn	Hand Symbol	Status	Definition (inc source)	Guidelines and examples
3.42	Airbase	Transport	Point		N		NA	An area of land or other hard surface, excluding water, that is used or intended to be used for the landing and takeoff of aircraft, and includes its buildings and facilities, if any. (FGDC)	1) Use at Event/Incident to Jurisdictional levels
3.43	Helibase	Transport	Point		N		NA	A site within a landing zone that contains one or more points for helicopters to land. (FGDC)	1) Use at Event/Incident to Jurisdictional levels
3.44	Helipad	Transport	Point		Y		NA	To be defined (TBC)	1) Use at Event/Incident to Regional levels
3.45	Road Closure / Traffic Control Point	Transport	Point		Y		Planned Active	Road check point or barricade to maintain compliance with movement control restrictions (AEM_Glossary).	1) Label with DTG for status 2) Use at Event/Incident to Regional levels

Source: [ICSM07]

## 9.5 Appendix 5. UN OCHA Field Map Production Style Sheet

### 9.5.1 Sample legend including all elements of standard reference maps:



9.5.2 Point Symbols for populated places:

*Relief goods*

Symbol	Feature	Symbol	Feature	Symbol	Feature	Display Scale	Legend	Elements
				ë	Blankets	All	Yes	Symbol
				í	Bucket/Jerry cans	All	Yes	Symbol
				ì	Clothing	All	Yes	Symbol
				î	Food	All	Yes	Symbol
				ï	Kitchen sets	All	Yes	Symbol
				ñ	Mattresses	All	Yes	Symbol
				ò	Medicines	All	Yes	Symbol
				ó	Medical supplies	All	Yes	Symbol
				ô	Mosquito nets	All	Yes	Symbol
				ö	NFI	All	Yes	Symbol
				õ	Plastic sheeting	All	Yes	Symbol
				ú	Relief goods	All	Yes	Symbol
				ù	Stove	All	Yes	Symbol
				û	Tarpaulin	All	Yes	Symbol
				ü	Tent	All	Yes	Symbol
				ä	Bottled water	All	Yes	Symbol

Symbol	Feature	Symbol	Feature
⊗	National Capital (Map & inset)	U	International Airport
⊙	Admin 1 capital	U	Regional Airport
⊚	Admin 2 capital	T	Local Airport
○	Admin 3 capital	U	Airfield
•	Village	T	Military Airport
		H	Heliport
		P	Port
		S	Tunnel
		T	Bridge

*General infrastructure*

Symbol	Feature	Display Scale	Legend	Elements
P	Government office		Yes	Symbol
Q	Community building		Yes	Symbol
R	Police station		Yes	Symbol
X	Church		Yes	Symbol
Y	Mosque		Yes	Symbol
Z	Hindu temple		Yes	Symbol
4	Buddhist temple		Yes	Symbol
2	School		Yes	Symbol
3	Warehouse		Yes	Symbol

*Relief goods*

Symbol	Feature
ë	Blankets
í	Bucket/Jerry cans
ì	Clothing
î	Food
ï	Kitchen sets
ñ	Mattresses
ò	Medicines
ó	Medical supplies
ô	Mosquito nets
ö	NFI
õ	Plastic sheeting
ú	Relief goods
ù	Stove
û	Tarpaulin
ü	Tent
ÿ	Bottled water

*Security*

*Physical closures*

Symbol	Feature	Symbol	Feature
'	Arrest/Detention	]	Border crossing
(	Assault	;	Check point
)	Attack	>	Earth mound
*	Forced entry/Office occupation	\	Military gate
+	Harassment/Intimidation	=	Observation tower
,	Hijacking	:	Physical closure
-	Murder	@	Road barrier
.	Robbery	?	Road block
&	Security	<	Road gate
/	Threat	[	Trench

*Telecommunications*

Symbol	Feature
À	Fax
Á	Radio
Â	Mobile phone
Ã	Internet

*Line symbols*

	Symbol	Detailed Category	
		International	
		International (Inset)	
Admin		Disputed Areas	
		Admin 1	
		Admin 2	F
Transportation		Admin 3	
		Primary roads	F
		Secondary roads	
		Tracks	
		Railway	
Hydrology		Seasonal	
		Non-seasonal	
		Non-seasonal (Inset)	
		Coastline	
		Coastline (inset)	








*Water and Sanitation*

Symbol	Feature
ã	Borehole
ê	Latrine
é	Potable water source
è	Spring water
â	Submersible pump
ç	Tap stand
â	Water sources
ä	Well





























*Other symbols*

Symbol	Feature	Display Scale	Legend Elements
▲	Mountain Peaks	All	Yes Symbol
+	Ticks Lat/Long	All	No Symbol

### 9.5.3 Polygon Symbols














	Scale	Legend
 Affected Area	All	Yes
 Affected Country (thematic maps and Inset map)	All	No
 Non Affected Country (thematic maps and Inset map)	All	No
 Flooded Area	All	Yes
 Major Lake	All	Yes
 Major Lake - Inset	All	Yes
 Sea (main map/inset /map background)	All	No

*Recommended colour ramps for thematic maps*

Color	Description RGB CMYK	Color	Description RGB CMYK	Color	Description RGB CMYK	Color	Description RGB CMYK
<b>Red</b>		<b>Orange</b>		<b>Green #1</b>		<b>Green #2</b>	
	230,0,0 10,100,100,0		255,102,0 0,60,100,0		127,117,17 50,54,93,0		102,184,33 60,28,87,0
	234,72,47 8,72,82,0		253,149,61 1,42,76,0		166,156,72 35,39,72,0		148,208,86 42,18,66,0
	241,148,117 5,42,54,0		253,195,135 1,24,47,0		203,197,139 20,23,45,0		194,230,150 24,10,41,0
	251,228,216 2,11,15,0		254,240,223 0,6,13,0		242,240,223 5,6,13,0		240,249,227 6,2,11,0
<b>Cyan #1</b>		<b>Cyan #2</b>		<b>Brown</b>			
	0,148,126 100,42,51,0		0,160,198 100,37,22,0		134,100,49 47,61,81,0		
	78,183,153 69,28,40,0		75,188,215 71,26,16,0		166,140,93 35,45,64,0		
	153,215,190 40,16,25,0		149,215,231 42,16,9,0		203,186,151 20,27,41,0		
	230,246,237 10,4,7,0		222,243,248 13,5,3,0		244,239,228 4,6,11,0		

### 9.5.4 Digital Elevation Model –

this colour palette is the one recommended for DEM Representation

Symbol	Elevation (meters above sea level)	C	M	Y	K
	Below Sea Level	13	15	17	0
	0 – 200	22	0	50	0
	200 – 400	15	5	37	0
	400 – 600	11	13	36	0
	600 – 800	8	18	43	0
	800 – 1,000	19	20	39	0
	1,000 – 1,500	24	22	33	0
	1,500 – 2,000	28	34	24	0
	2,000 – 2,500	38	37	23	0
	2,500 – 3,000	32	32	0	0
	3,000 – 4,000	24	18	0	0
	4,000 – 5,000	13	9	0	0
	Above 5,000	8	5	0	0

Source: UN Office for the Coordination of Humanitarian Affairs (OCHA) [UN09]



## 9.6 Appendix 6. Globally Harmonised System of Classification and Labelling of Chemicals (GHS) and Other Symbols from NCEC UK

GHS is the internationally agreed Globally Harmonised System of Classification and Labelling of Chemicals. GHS aims to improve the health and safety of workers, consumers and the environment by ensuring consistent hazard communication on the chemicals being used.

In the EU, GHS has been implemented through the CLP Regulation (EC) No 1272/2008.

[More information on GHS](#)

Explosive/  
Extremely self-reactive/  
Organic Peroxide



Pressurised gases/  
Compressed gas/  
Liquefied gas/  
Refridgerated liquefied gas/  
Dissolved gas



Flammable/  
Self-reactive/  
Pyrophoric/  
Self-heating/  
Emits flammable gas/  
Organic peroxide



Oxidising



Corrosive/  
Corrosive to metals/  
Corrosive to skin/  
Severe eye damage



Acutely Toxic



Health hazard/  
Carcinogen/  
Mutagen/  
Reproductive toxicity/  
Specific target organ toxicity/  
Aspiration hazard/  
Respiratory sensitiser



Harmful/  
Irritant/  
Skin sensitiser/  
Specific target organ toxicity/



Narcotic effects

Hazardous to the environment



Hazard Warning Diamonds

**Class 1**  
Explosive substance  
or article



**Class 2**  
Gases



**Class 3**  
Flammable liquids



**Class 4.1**  
Flammable solids,  
self-reactive  
and desensitised  
explosive



**Class 4.2**  
Substances liable to  
spontaneously  
combust



**Class 4.3**  
Substances which,  
in contact  
with water emit  
flammable gases



**Class 5.1**  
Oxidizing  
substances



**Class 5.2**  
Oxidizing  
peroxides



**Class 6.1**  
Toxic substances



**Class 6.2**  
Infectious substances



**Class 7**  
Radioactive material



**Class 8**  
Corrosive substances



Elevated Temperature Substances



**Class 9**  
Miscellaneous dangerous substances and articles









Environmentally hazardous / Marine Pollutant



Supply Labelling  
CHIP

Explosive



Oxidising	
Toxic / Very Toxic	
Dangerous for the Environment	
Highly / Extremely Flammable	
Corrosive	
Harmful / Irritant	

Supply labelling uses the same, or similar symbols to those seen on the Hazard warning diamonds used for transport labelling. However, as well as being a different shape and colour, different criteria are used to assign the risks. So, something classified as "Toxic" (Class 6.1) for transport may only be classified as "Harmful" for supply. Equally, something classed as "Toxic" (skull and cross-bones) for supply, such as a carcinogenic substance, may not be classified as hazardous for transport at all.

Equally, a particular substance may have different classifications for each system. Solvents may be classed as "Flammable" (Class 3) for transport, but "Harmful" or "Toxic" (equating to class 6.1) for supply. The reasons for this are the different types of risk exhibited in different situations. The end user, dealing with small quantities on a frequent basis over long time-periods, is at greater risk from any harmful/toxic effects due to contact with the product than from its flammable characteristics. The Emergency Services, however, will be dealing with a "one-off" situation which is not supposed to happen ever, involving several drums or tankerloads of the product, where the flammability hazard far outweighs the effects of contact with the product.

Classification can therefore be more intricate than it first appears; if you need any advice or guidance, see the Consultancy pages on this website.

Source for the above Appendix 4: National Chemical Emergency Centre (NCEC) of the United Kingdom. Available at: <http://the-ncec.com/hazchem> [NCEC]







## 9.7 Appendix 7. French Graphic Chart

Each graphic object located on a map is a spatial object defined both by its position and a graphic. Each object is characterized by a mode of implementation: punctual (water point,...), linear (road, pathway,..) or surface (operational sector,...).

Graphic identity is materialized through 4 “visual parameters”: form; colour; status; and overload.







### 9.7.1 Form

It is the object’s contour or envelope, with a geometrical type (square or circle) or pictogram type, expressing the object identity. The main elementary forms and their significance are :

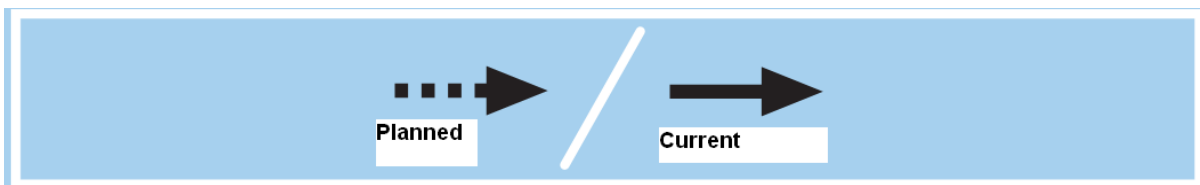
Elementary forms	Signification	Elementary forms	Signification
	Means and/or rescue infrastructure		Water resources
	Warning / hazard		Disaster
	Uniformity		Movement

### 9.7.2 Colours

6 colours are used in function of the themes:

Color	Signification	Color	Signification
	Pathway		Related to water
	Related to persons		Related to particular risks
	Related to fire		Related to commandment

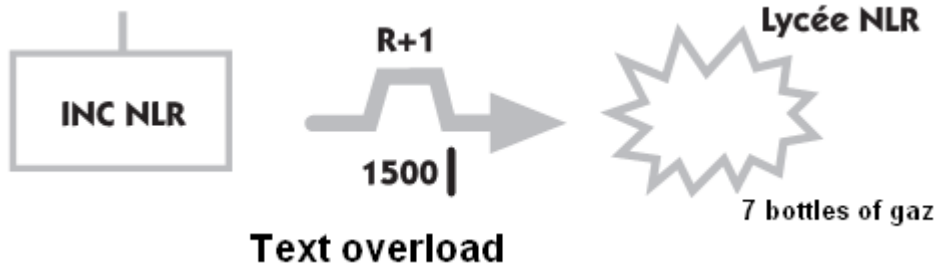
### 9.7.3 Status



**9.7.4 Overload**

It is text or graphics that will complete the previous objects

Example of text overload



Example of graphic overload:



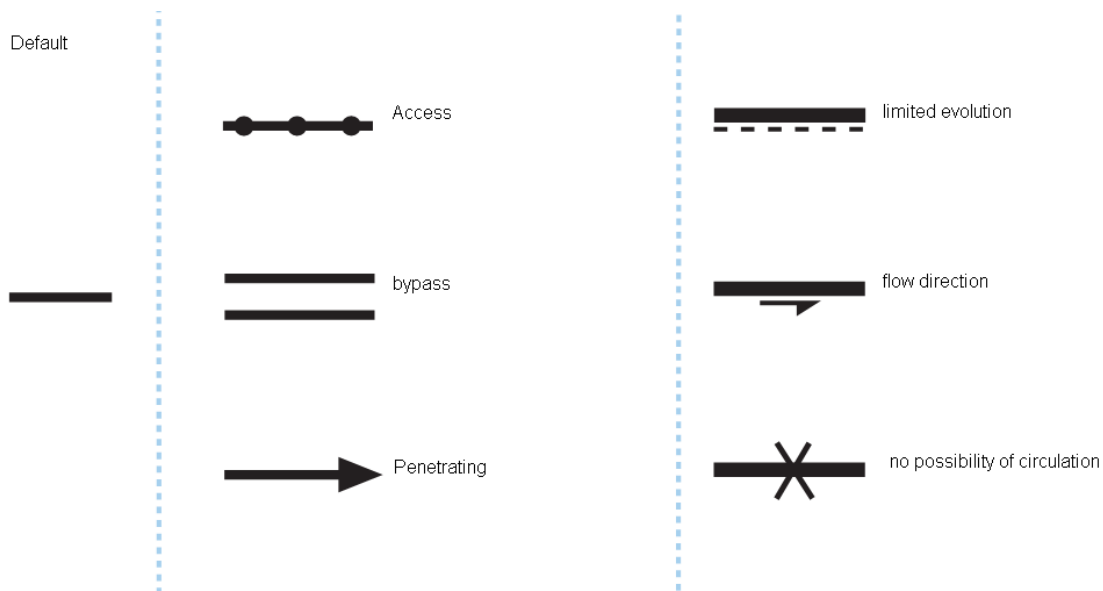
**Graphic overload**

Analysis and mapping of the intervention area

Resources of the intervention area

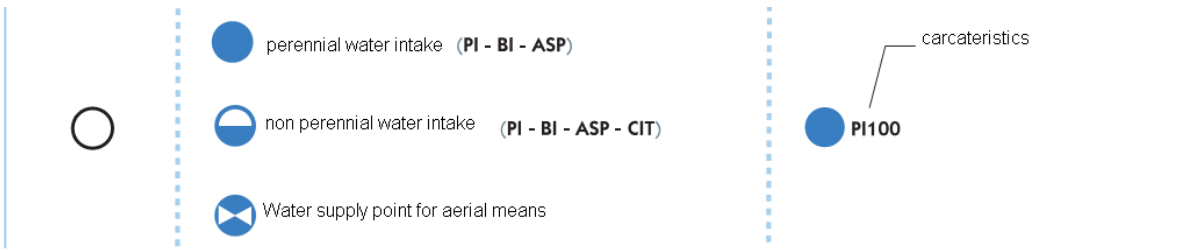
**9.7.5 Pathways**

**Pathways materialize communication channels used by rescue vehicles and personnel**

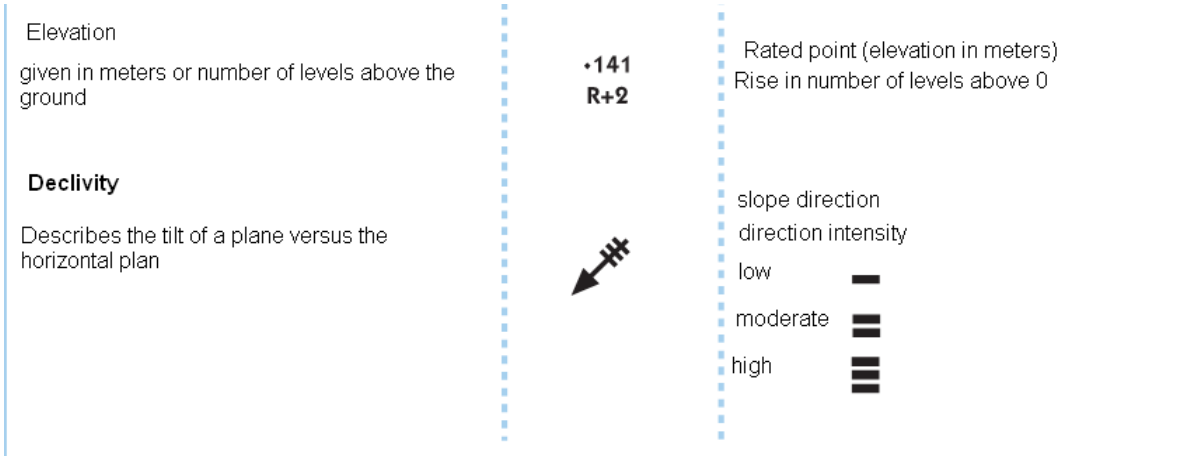


**9.7.6 Waterholes, Water supply point for rescue means**

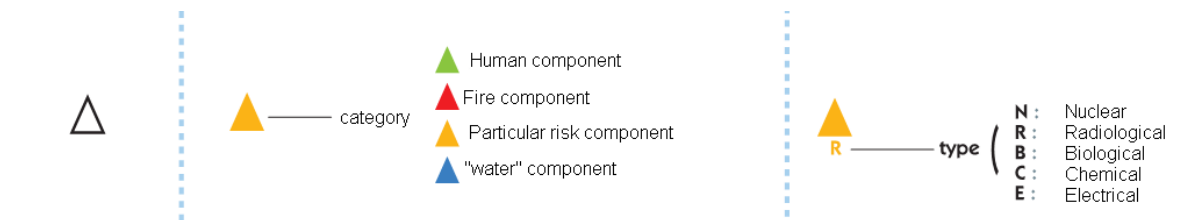




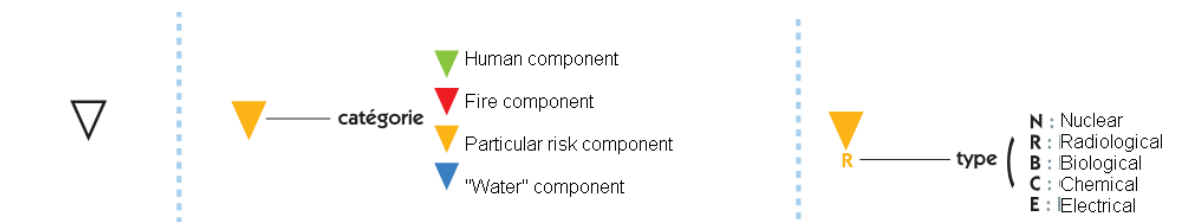
### 9.7.7 Area intervention morphology



### 9.7.8 Source de danger



### 9.7.9 Sensitive points

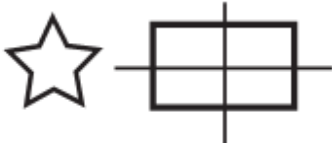


### 9.7.10 The disaster

#### Location of the disaster ignition

The disaster can be located by a:

Point:

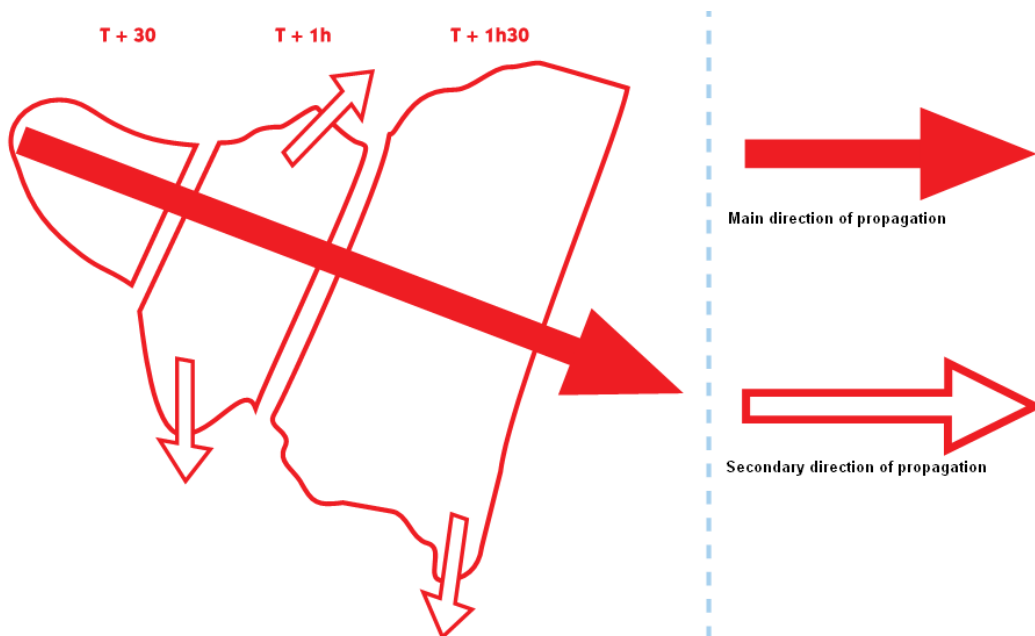


Surface



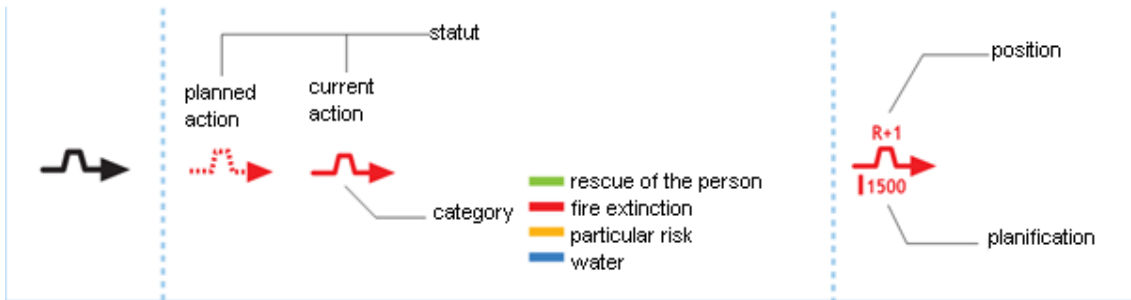
It is associated to a color in function of the risk

#### The disaster development

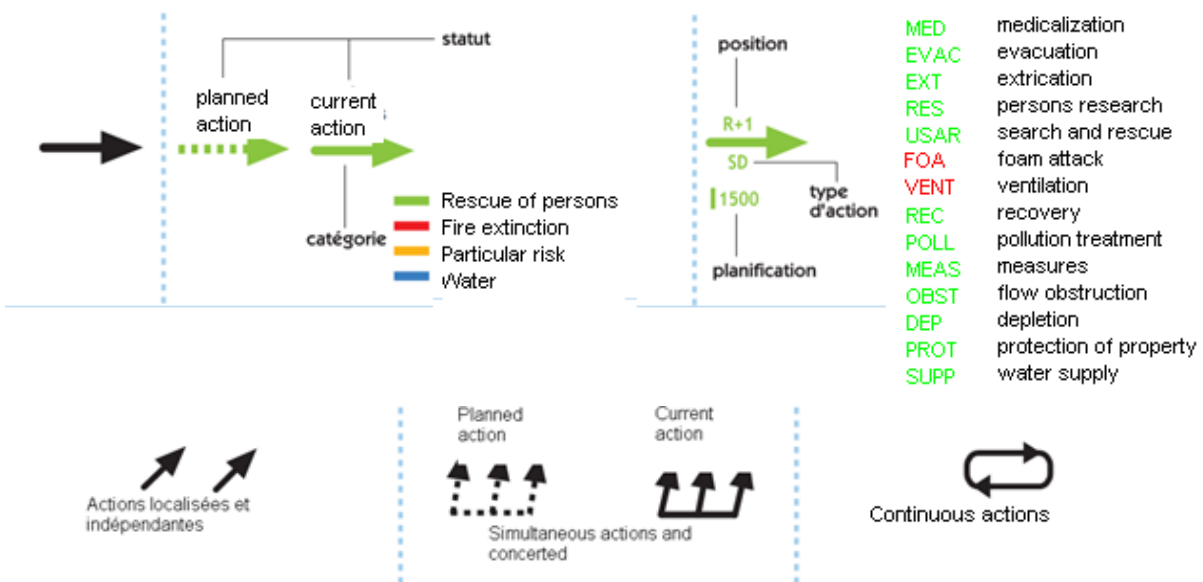


### 9.7.11 Actions

#### Recognition



#### Offensive actions



- Aerial offensive action  
water bomber helicopter



Helicopter water dropping



Helicopter retardant dropping

- Action offensive aérienne  
Avion Bombardier d'Eau (ABE)

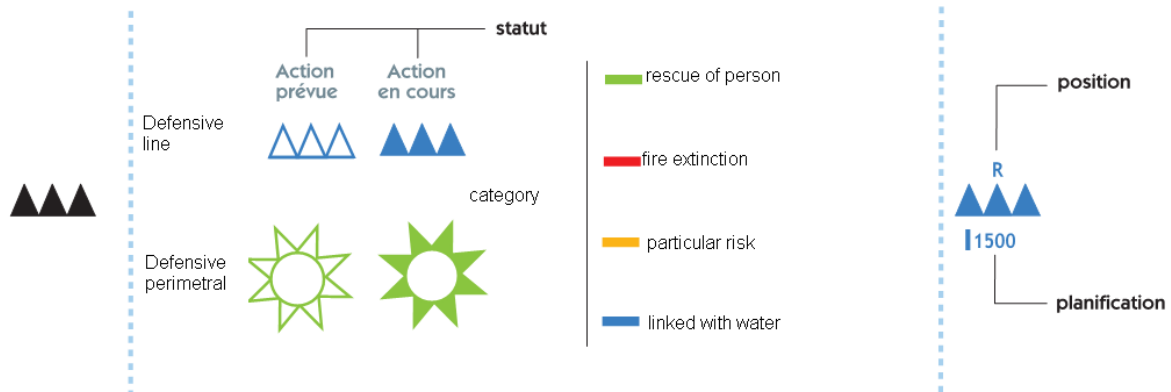


Aircraft water dropping



Aircraft retardant dropping

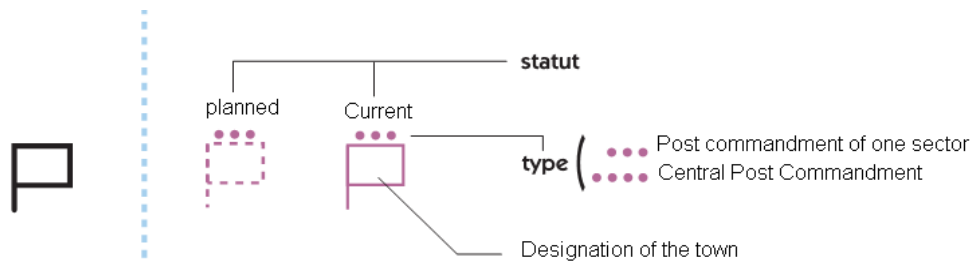
**Defensive actions**



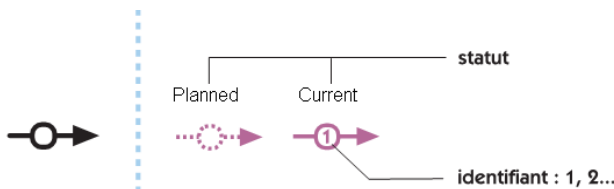
### 9.7.12 The means

#### The coordination and commandment means

#### The commandment post

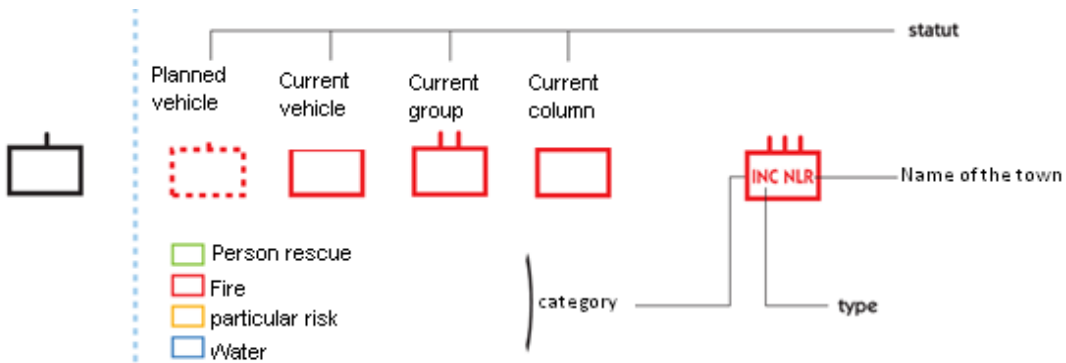


#### The transit point



#### The intervention means

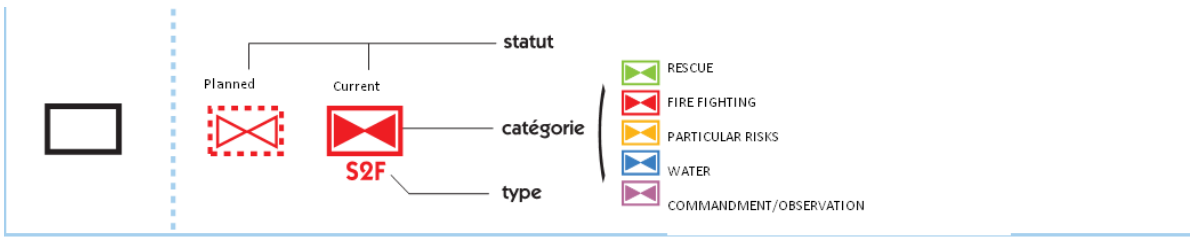
#### Firefighters ground intervention means



#### Non firefighters ground intervention means

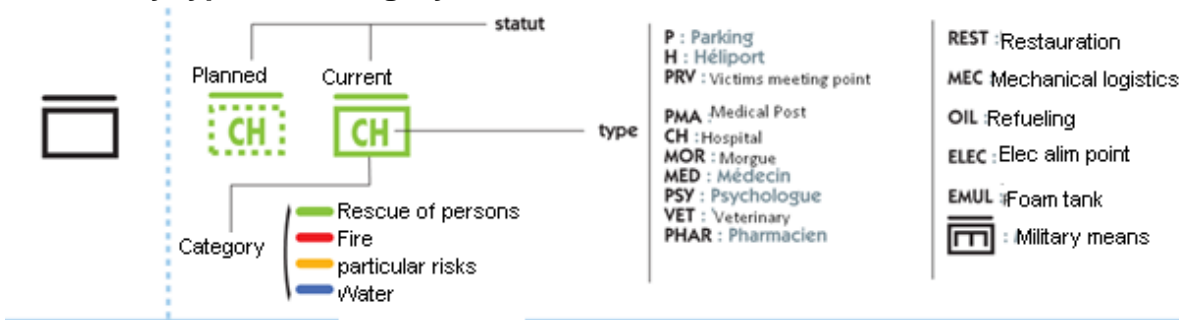


#### Aerial means



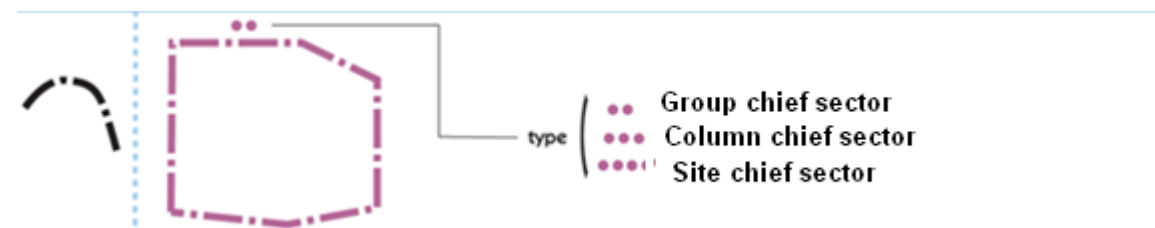
**Resources, infrastructures and operational logistics**

**Defined by type and category**

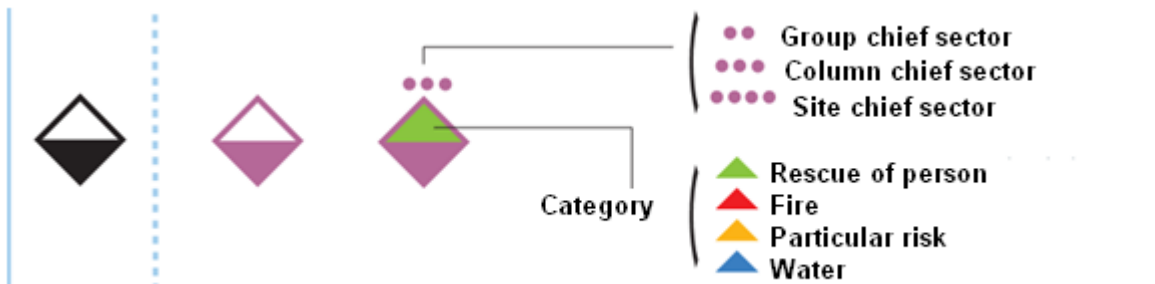


**Operational organization of the intervention area**

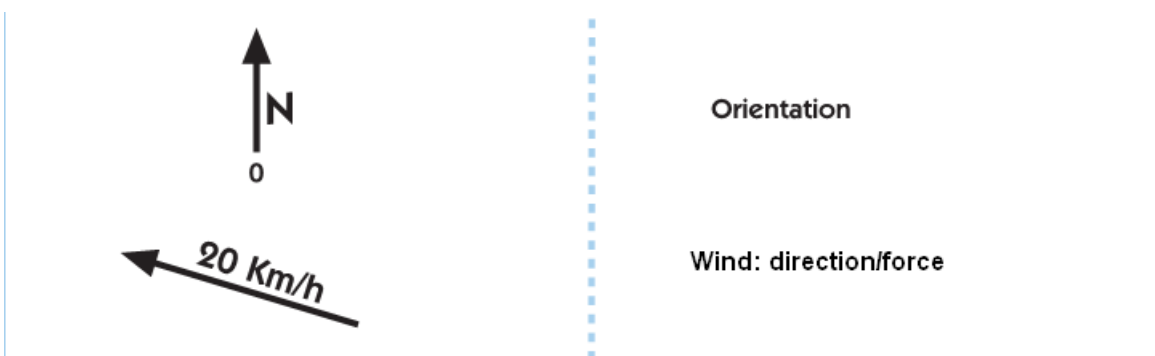
**Geographical sectorization**



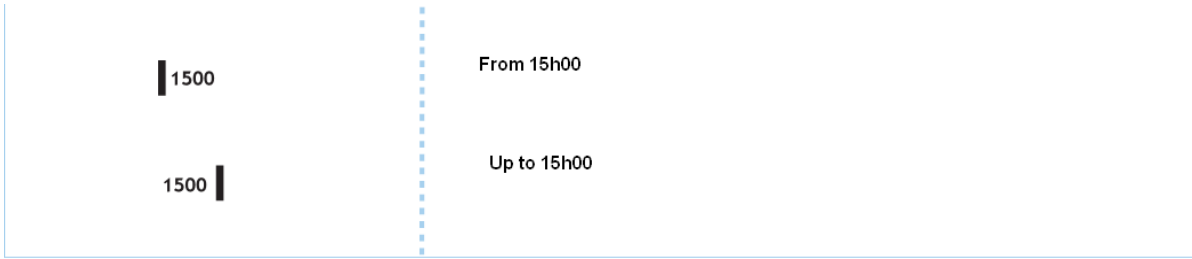
**Functional sectorization**



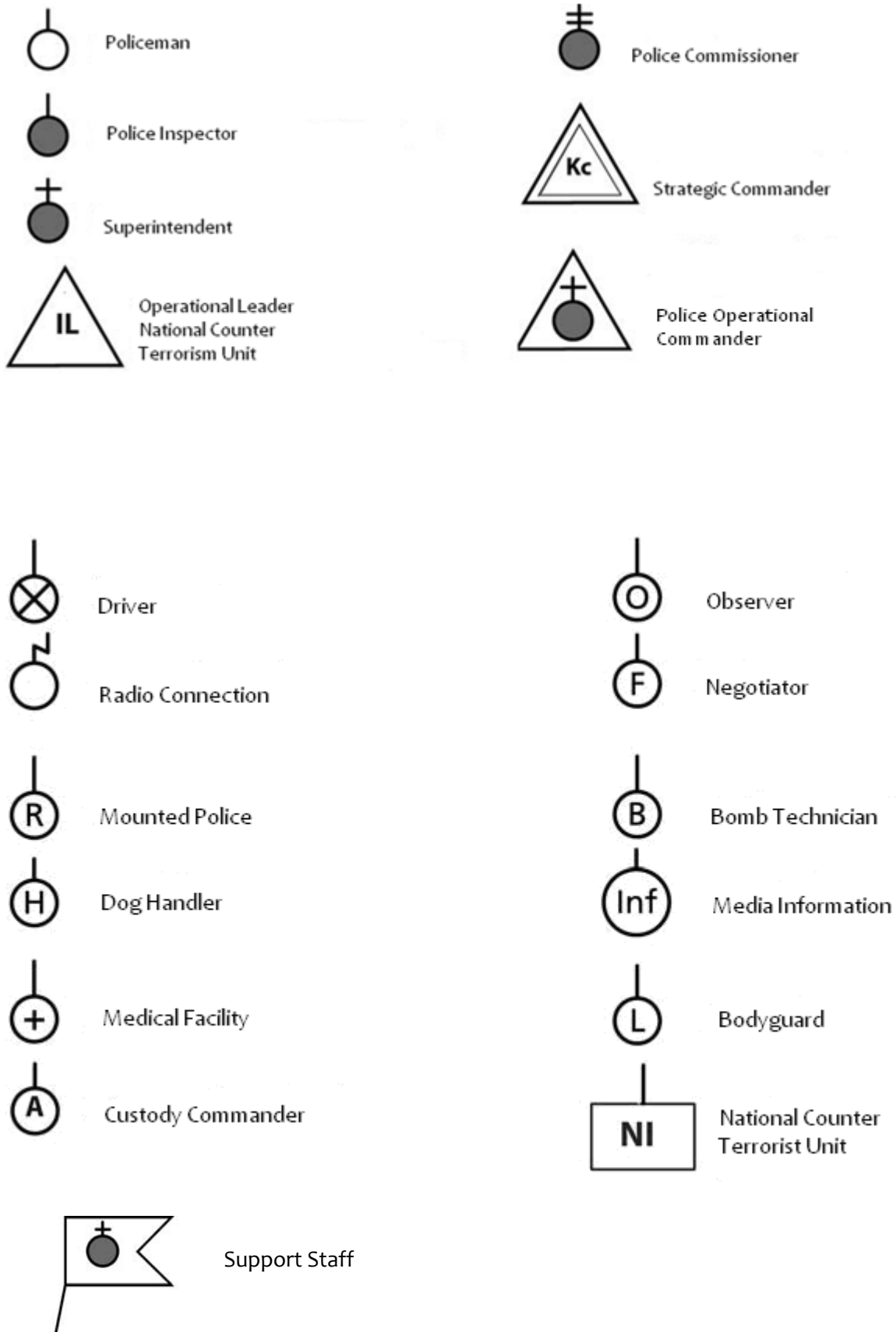
**Environmental data collection**

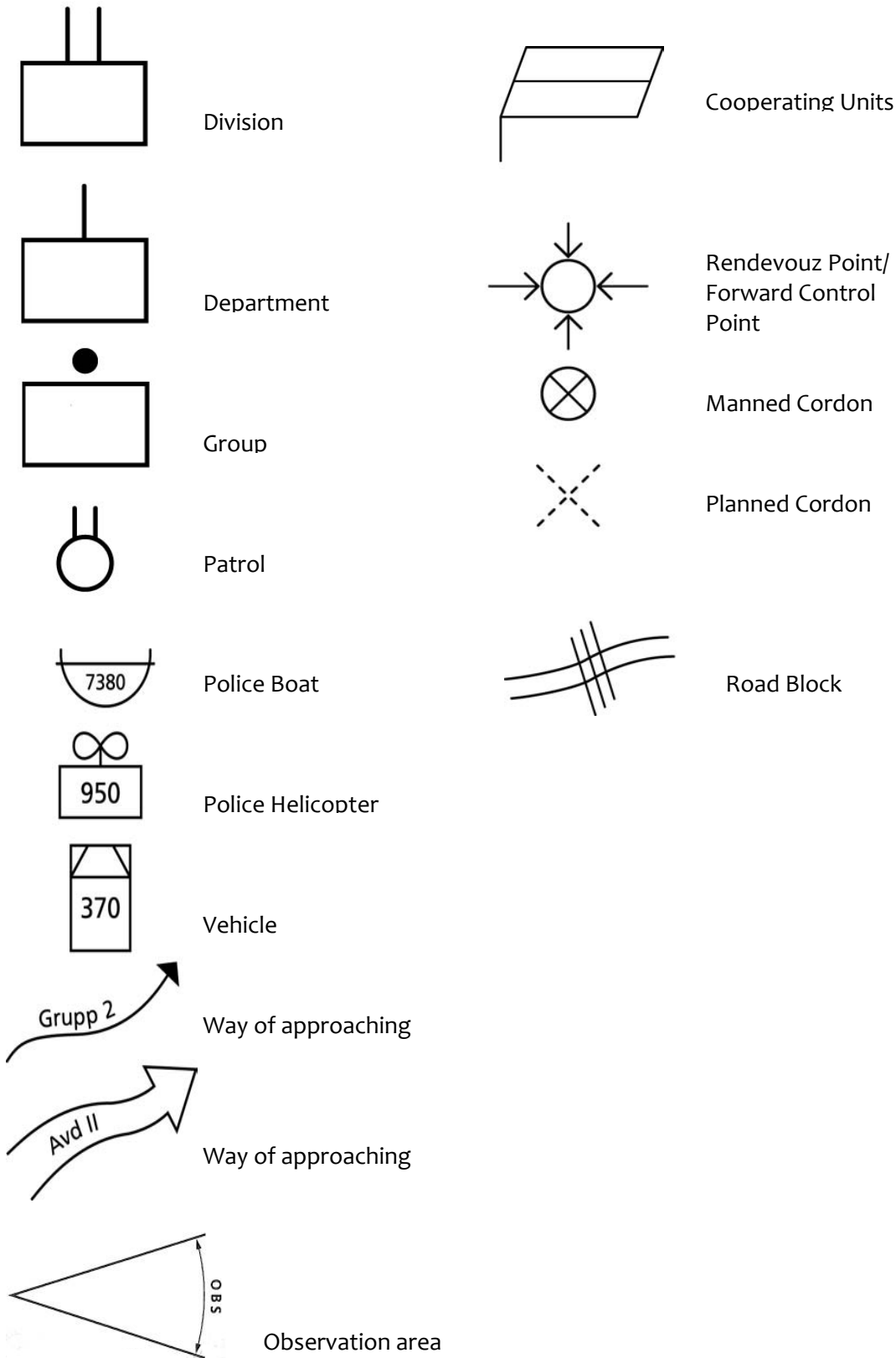






### 9.8 Appendix 8. Swedish Police Symbols







Point of Traffic Regulation



Assembly Point



Evacuation Station

Assembly Points:



Survivors



Casualties



Dead/Body



Homeless



Property

9.9 Appendix 9. Military Symbols used in United Nations Civil-Military Operations –

Annex G. from the document: United Nations Civil-Military Coordination Officer Field Handbook, version E 1.1 jointly launched by OCHA and DG ECHO on 10 March 2008 [UN08].

## Annex G Military Map Symbols

In addition to the standard topographical symbols (figure 1) used to represent natural and manmade features, the military uses specific symbols to designate locations of units, activities and installations. Common military symbols are presented here for your information. (figure 2).

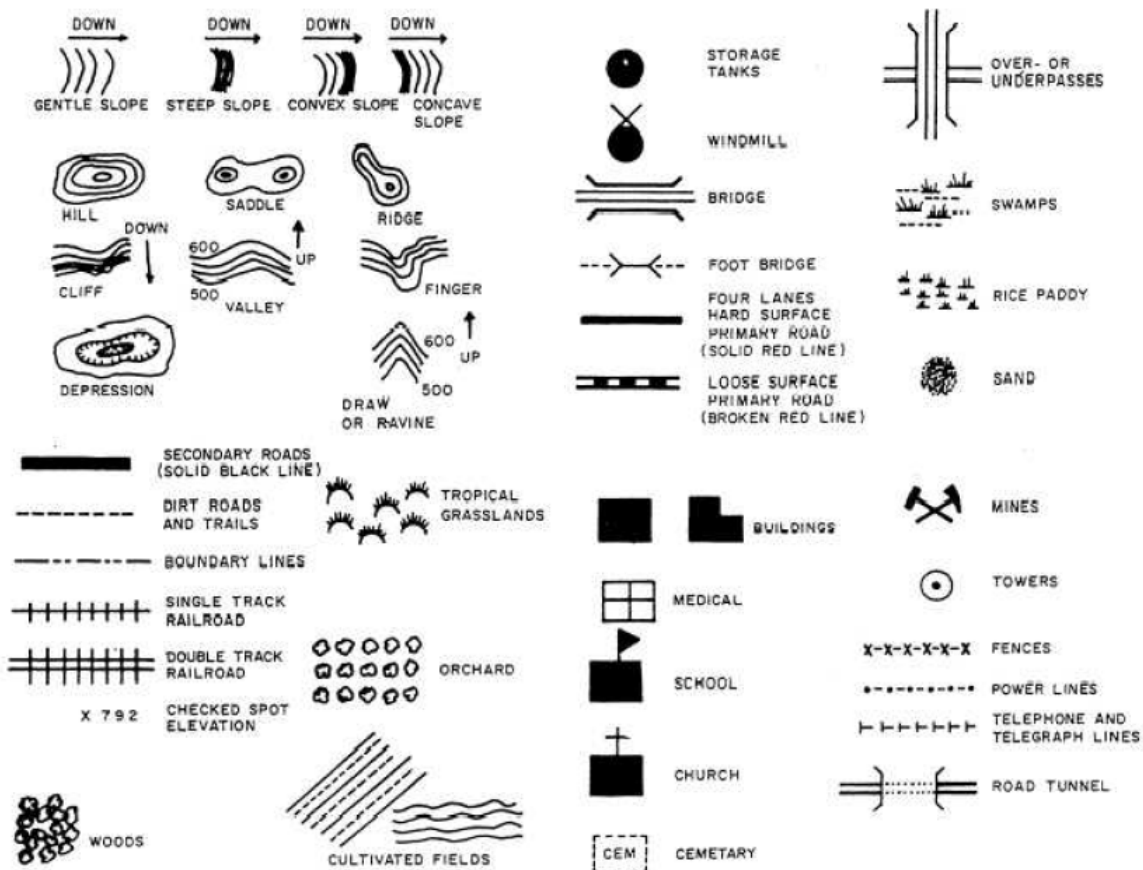


Figure 1 - Topographical Map Symbols

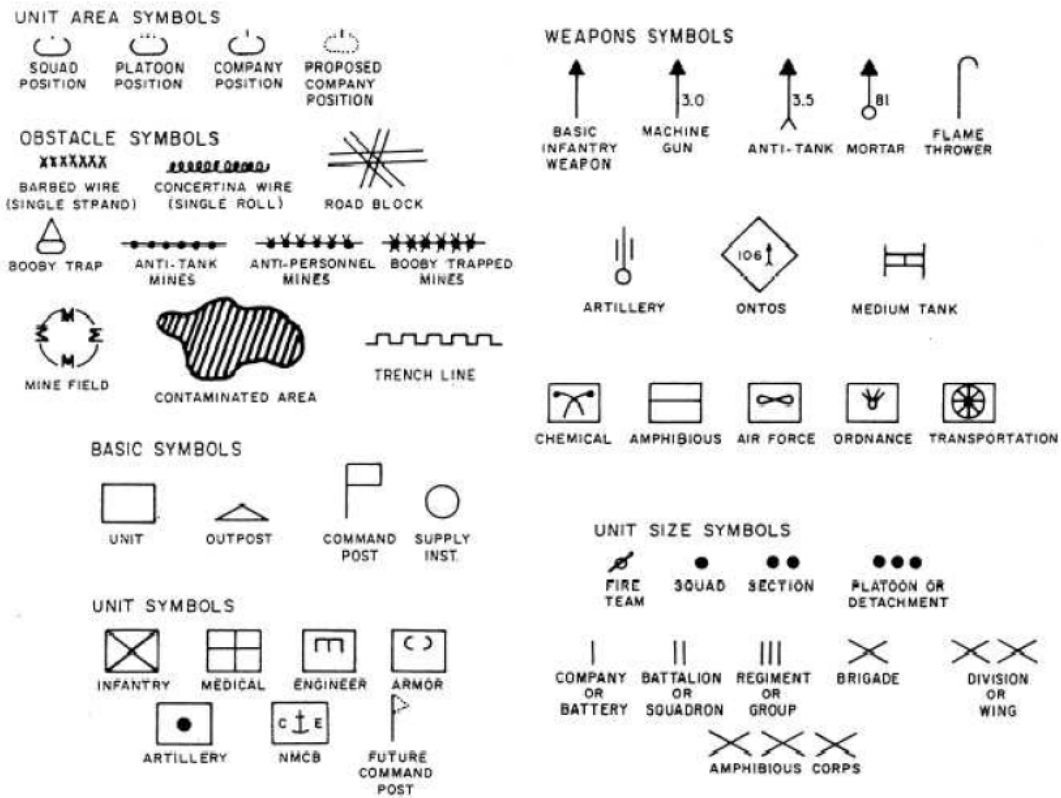


Figure 2 - Military Map Symbols



## 9.10 Appendix 10. UN International Search and Rescue Response Guidelines (INSARAG)

### SAR TEAM IDENTIFICATION, MARKING & SIGNALING GUIDELINES

#### 9.10.1 Victim Marking

- During the search function, it is necessary to identify the location of any known or potential victim.
- The amount and type of debris in the area may completely cover or obstruct the location of the known or potential victim.
- The victim location markings are made by the Search Team or other individuals conducting search and rescue operations whenever a known or potential victim is located and not immediately removed.
- The victim location markings should be made with florescent color.
- A large "V" is drawn near the location of the known or potential victim.
  - The letter "L" with a number will denote the number of live victims.
  - The letter "D" with a number will denote the number of dead victims.
- Draw an arrow beside the "V" when the location of a victim has been confirmed either visually, vocally or hearing specific sounds which would indicate a high probability of a victim.
  - This may be done when the victim is initially located or may need to be done later after some debris removal or use of specialized search equipment.
  - A canine alert will initially receive the "V" without an arrow to indicate a potential victim.
- A circle would be drawn around the "V" when the last live victim has been extricated from that location.
- Draw a horizontal line through the "V" to indicate only dead victim(s) remain.
  - A circle would be drawn around the "V" when all dead victims have been removed.

Potential Victim Location



Confirmed Victim Location



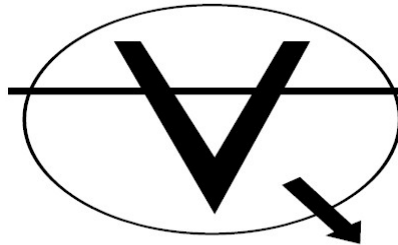
Dead Victim(s) Only Location



Extricated Live Victim(s)

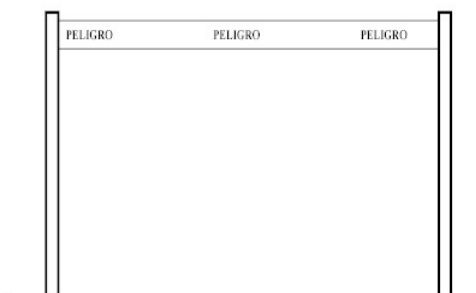


Extricated Dead Victim

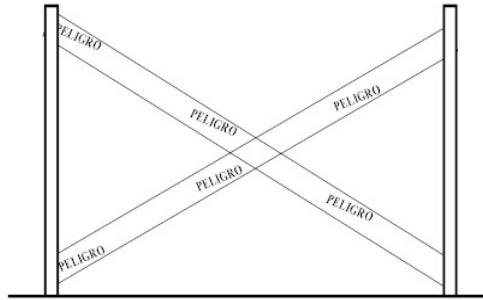


### 9.10.2 Other Marking

- General cordon markings (cordon banners, flagging, etc.) - to be used for small defined area. They can be enlarged to include other non-buildings (i.e., bridge, dangerous zones, NBC, security, etc.). Large areas may require barricades/fences/patrol/etc.
- Operational Work Zone



- Collapse/Hazard Zone



- Facility:
- Iconic flags, banners, balloons, etc. (must identify team identity, team medical facility, team CP).
- Vehicle:
- Vehicles must be marked with team name and function (flag, magnetic sign, etc.).
- Team and function:
- Response team identity (country and team name) by uniform, patch, etc.
- Personnel - the following positions must be color-coded and labeled in English plain text (vests, arm bands, helmet color, etc.)
  - Management position(s) - white
  - Medical position(s) - red cross/crescent
  - Safety/security position(s) - orange
- Symbols: (Plain text such as Team name would be denoted adjacent to the symbol.)

Facilities - circles



Zones - irregular shapes



Command function - box



Reference point - triangle



Time denoted -  
(local time)

22/11 0700 hrs  
23/11 1900 hrs

(with arrow pointing to

activity site

Sample symbols

Command Post (box w/  
CP) (local time)



EOC (box w/ EOC) (local  
time)



SAR Base of Ops (circle  
w/ BoO) (local time)



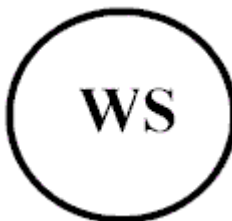
OSOCC (box w/ OSOCC )  
(local time)



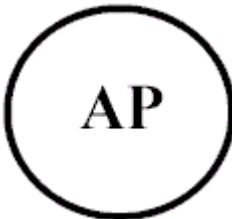
Reception Center (box w/  
OSOCC RECEPT) (local  
time)



Work Site (circle with WS)  
(local time)



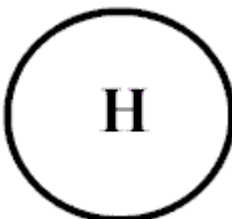
Airport (AP in circle) (local  
time)



LZ (circle w/ LZ) (local  
time)



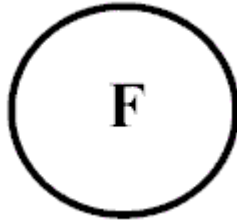
Hospital (circle w/ H) (local  
time)



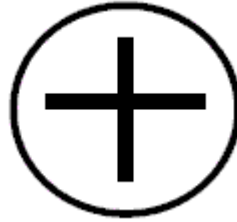
Hazards (write hazards and specify zone) (local time)

**GASES**

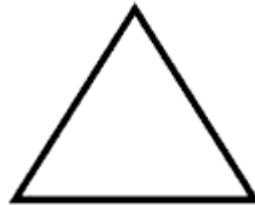
Fuel (circle w/ F) (local time)



Medical care (Red Cross/Crescent) (local time)



Reference point/landmark (triangle - include descriptor) (local time)



## 9.11 Appendix 11. Swedish Warning Symbols

