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Conventions in the Collection and Use of Human Performance Data

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FIRE SCIENCE & ENGINEERING

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Project No: 60NANB7D6146 Funded by the National Institute of Standards and Technology as part of their Fire Research Grants Program

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Dedication

This work is dedicated to Guylène Proulx.

Executive Summary

Over the last two years, NIST has funded a project (Project Number: 60NANB7D6146) as part of the Fire Research Grants Program to address key limitations with data relating to human performance, especially during fire scenarios. This project represented an attempt to develop tools, including a *Data Acquisition Matrix* and a *Data Template* that enable interested parties to reliably deposit, extract and interrogate data on human performance during fire. The key objective of this project was to provide a design for an accessible suite of tools – "a one-stop shop" – for fire personnel, researchers, model developers, fire safety engineers, and code developers, etc. These tools can then be used in the various fire engineering stages: data collection; theory development; model development; model validation; and model application. This work has been conducted to develop a suite of tools that would be required to implement an online *Data Portal* in order to provide the greatest access and convenience possible: allowing data to be uploaded, downloaded and interrogated according to the needs of the user. Critical to this process are the quality of the data itself and the completeness of the information provided. The tools provided therefore encourage data to be collected in context with the most comprehensive background information possible, and presented in as much detail as possible within a standardized format. This report describes the tools developed to aid in this process and the underlying assumptions behind them, and how these can be combined in the form of a *Data Portal* design.

1 Introduction

1.1 Motivation

The lifeblood of any field of study is data – data that bridges the gap between observation, understanding and application. The existence of such data allows for the development of theoretical understanding that can then support the tools employed in the field and inform practice. This project addresses the collection, representation and dissemination of data related to human performance, particularly in response to fire.

The analysis of human behavior in fire is a relatively young field, only existing for a matter of decades. Prior to this time, human response was assumed to be dominated by physical factors, to be panic-based, considered intractable, and/or was excluded from engineering practice entirely [1-5]. *Human behavior in fire has not been addressed to the same degree as other aspects of a fire event.*

For much of the recent past the field of human behavior in fire has been primarily used to support fire safety engineering, rather than as a research pursuit in its own right: to provide support for the assumptions used by engineers, designers and by regulators, rather than an end in itself. It included a simplistic (common-sense) and often optimistic representation of human performance (excluding behavioral elements that detracted from performance), rather than a comprehensive sophisticated attempt to represent research-based theory. This is understandable given the difficulties that existed in getting the importance of human performance accepted within the engineering process. *The approach to understanding human behavior in fire has been largely determined by the engineering process.*

Much of the early work in the field was conducted according to two principle objectives, both of which were tied to the practice of fire safety engineering: (1) the ability to establish the importance of human performance upon the results produced and (2) the provision of key supporting evidence for engineering practice. In both instances, the development of the field (and specifically the collection of data) was determined by engineering practice, rather than the generation of a comprehensive theory that helped to explain and predict phenomena*. Human behavior in fire is not adequately supported by theory.*

This evolution of the field has led to an incomplete, disorganized and disparate understanding of the subject matter: human performance in fire. This was due in part to the diverse background of those contributing to the field (e.g., engineers, social scientists, field researches and model developers). These varied approaches and immature understanding of human performance has led to a pragmatic bias across the field. This is reflected in the current set of data relating to human behavior in fire; much of which was required for the engineering process and therefore was not collected in order to objectively extend the subject knowledge or the development of subject theory. *Human behavior in fire is not adequately supported by data. The data-sets that are available are often not sufficient for the range of intended applications.*

Empirical data-sets are the foundation of engineering and are therefore a resource of enormous value. This is particular true of a new field where empirical data-sets are scarce, difficult to collect and difficult to interpret (i.e., human egress during fire). Since data-sets are precious and expensive to gather, the collection and application processes should be optimized. These data-sets are required in order to further our theoretical understanding of the phenomena involved and to develop and validate predictive techniques. *Data-sets on human performance are relatively scarce, difficult to collect, and difficult to interpret.*

The use of data in developing and validating predictive techniques will become more important as they become more widely used. Predictive techniques will be increasingly applied for a variety of reasons:

- the increased use of performance-based calculations;
- the increased novelty of structures making the application of prescriptive codes difficult;
- an inability to recreate realistic (and consequently more dangerous) conditions during trials;
- and the broadening of applications for the use of these techniques (e.g. examining procedural change).

Given the increased use of these techniques, it is essential that the underlying methods employed are appropriate to their respective application. Therefore these methods require the provision of detailed, unambiguous and accessible data in order for them to be appropriately configured and validated. This is not currently the case and therefore our theoretical understanding of human performance suffers because of it. The data-sets currently available are not sufficient for the field to progress, for the predictive models to be developed, or for models to be applied and understood with sufficient confidence. *The lack of data (and subsequently the lack of theory) will have an even greater impact in the future.*

Empirical data-sets addressing human performance are too scarce, not sufficiently detailed, dispersed, and are often employed without sufficient understanding of the context in which they were collected. The application of this data could be improved with better knowledge of the conditions of the event in question, the methods used before and after the event to collect and analyze the data, and a detailed representation of the data itself. Without this context, data can be misunderstood and misapplied. *The data-sets available are often not provided with sufficient context, detail or background information.*

In order to optimize the process of data collection and application, a tool is required that provides:

- assistance in the techniques applied in the collection of data;
- guidance on the formatting of the data and background information produced;
- a central repository to which interested parties may have access enabling data interrogation;
- and a structure enabling the sufficient and comprehensive description of the data.

This report describes the development of the key elements of such a tool.

1.2 Objectives

The major tasks involved in this project were conducted over a two year period and were funded by NIST (Project Number: 60NANB7D6146) as part of the Fire Research Grants Program. This report, and the project on which it is based, represents an attempt to strengthen the data collection process, the representation of this data, and the dissemination of this data to interested parties; i.e., to strengthen the study of human performance in fire. However, given the nature of the data available (i.e., it comes from a number of different areas), the complexity of subject matter (i.e., emergency responses can take a number of forms), and the application areas (i.e., data can be used in a number of different ways), the tools developed needed to be flexible enough to cope with data derived from an array of different situations. The key objective of this project is then to provide a detailed design for an accessible *Data Portal* – a one-stop shop – for fire personnel, researchers, model developers, fire safety engineers, and code developers alike. The *Data Portal* will be formed from two key developments:

- *the Data Acquisition Matrix – employed before and during the data collection process*
- *and the Data Template – employed to represent the data once collected.*

The *Data Acquisition Matrix* provides guidance on the entire data collection process, from conception to analysis; the *Data Template* provides a framework for presenting a data-set and the background information associated with it.

These developments are specifically designed to aid data collection and data representation. The full online implementation of the *Data Portal* will also address data dissemination. These developments enable interested parties to reliably deposit, interrogate and extract data on human egress during fire. This will benefit the field by supporting the development of more pertinent, comprehensive theories, producing more refined engineering tools and allowing for better informed engineering practices (i.e., it will help break the cycles shown in Figure 1).

The development of such a facility was recognized explicitly in the seminal paper by Fahy and Proulx:

"..it is essential that engineers, designers and building officials have available to them accurate information upon which to base any assumptions of occupant time to start and movement speed that will be used in the evaluation of an engineered building design. The engineering community needs a repository for this information, readily accessible by them and building officials. … The research community studying human behavior in fire needs to develop a process for collecting and distilling peer-reviewed pre-movement and travel speed data into an accessible database. A format for that database needs to be developed and agreed upon. A repository for the database needs to be found. Access, possibly via the internet, should be open to all users." [6]

In this work, the researchers initiated the process of collecting data to provide a data resource specifically for use within evacuation models. This data (specifically the time to start evacuating and movement speeds) would form a sub-set of the target for this project.

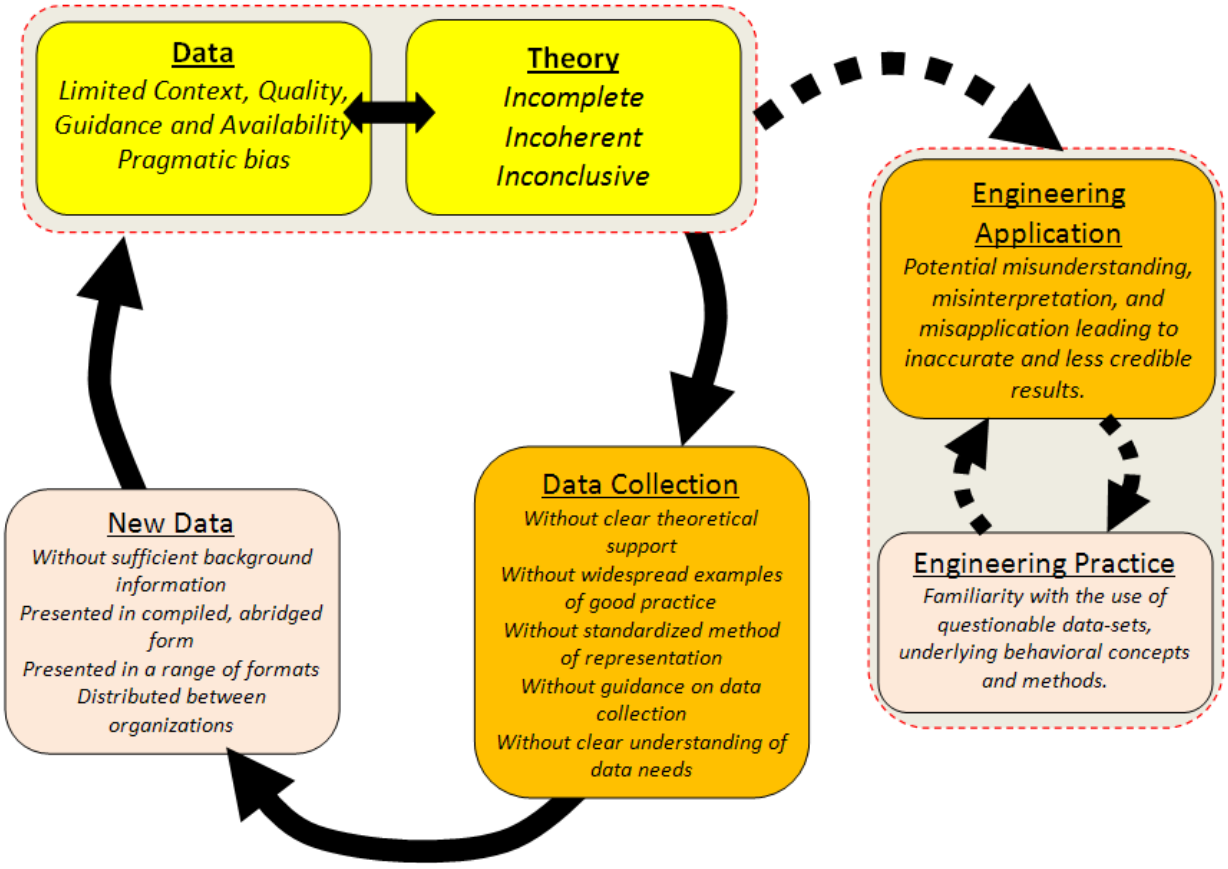


Figure 1: The current cycle of data and theory development.

If the *Data Portal* is fully implemented, in time, data collected from a variety of sources may have either been collected according to the guidance provided by the tool (involving collection techniques, terminology and format) or converted to be included within the data repository itself. This web-based tool will be accessible to legitimate interested parties, so that international users will potentially be able to interrogate the data for a variety of reasons including researching into human behavior in fires, model development, regulatory modification, and/or egress calculation. The tool will also be used to interrogate the numerical data provided and get an understanding of the events being represented through the associated descriptions depicting the events represented by the data (i.e., a more qualitative understanding). By aligning the format of the data and the descriptive terminology used, the user will be much more confident in their understanding of the nature and appropriateness of each data-set.

Similar attempts have been made at developing this type of facility by a range of organizations. These include systems developed by the National Transportation Safety Board (USA) [7], the Fire Safety Engineering Group [8], Federal Aviation Authority (USA) [9], the Aviation Accident Investigation Branch (UK) [10], and the Transport Safety Board of Canada [11]. However, in all of these cases, the facilities developed have either not been web-based, not been fully accessible, have been limited in the nature of the data included, or did not attempt to present the data in a

manner consistent with the aims of this project. Although these attempts help validate the need for the proposed system, the techniques employed are not sufficient or not relevant, and cannot therefore simply be adopted directly. By specifically designing a web-based portal based on a detailed assessment of the processes involved and the requirements of the field, the facility will act as a dedicated repository of data, a guidance tool for data collection and a focal point in which data collectors and users can engage.

The project required a number of sub-tasks to be completed in order for the *Data Portal* to be developed. This required the detailed review of the data sources currently available in order to understand the manner in which they are currently presented. This enabled the *Data Portal* requirements to be established and detailed designs to be produced for the key sub-components; i.e., the *Data Acquisition Matrix* and the *Data Template*.

1.3 Implementation and Impact

The design has been produced in such a way that it can be readily implemented by NIST personnel into their software network. By ending the project at the design phase developmental duplication is limited; i.e. a system fully developed outside of the NIST network environment would likely need to be modified, re-engineered and incorporated by NIST software engineers. By adopting the current approach, the tool can be implemented in the most efficient manner possible, according to in-house requirements and expertise. The work has been conducted such that, even if the full *Data Portal* is not implemented, the stand alone resources will still be of value to those in the field collecting, presenting or using data.

By implementing such a benchmark resource, it will *at the very minimum* set a standard of data collection requiring subsequent *alternative* data collection methods to be compared against it. It is anticipated that the influence of such a facility, held by (or associated with) NIST, would be far in excess of this and would instead directly shape future data collection efforts providing a methodology, a repository and a means of dissemination.

2 Data Variability: Why are human data-sets so complicated?

This section outlines the nature of the problem faced in some detail. It is critical to understand the underlying issues with data related to human behavior in fire in order to improve the quality and quantity of such data. This section identifies some of the key issues, how they influence the collection and use of the data, and provides insight into the manner in which these issues can be addressed.

The innate scope and complexity of the subject matter related to human behavior during emergencies poses a significant problem when collecting data, and when compiling and assessing relevant data-sets. Unlike other related subject areas, it is very difficult to compartmentalize constituent or influential factors. The difficulty is primarily due to the highly coupled nature of the factors influencing human behavior and the range of different application areas associated with the field. This influences data collection and the development of supporting theories, making both processes more difficult. The complexity of human egress data-sets largely occurs as

- The subject matter is highly interrelated (see Section 2.1);
- Data can be derived from a number of sources and in many ways (see Section 2.2);
- A number of tools are available to employ relevant data (see Section 2.3);
- A range of application types exist (see Section 2.4);
- Data can be misused (see Section 2.5).

2.1 The Coupled Nature of Behavioral and Procedural Factors

Key behavioral responses exhibited when an individual is interacting with a structure (e.g., their home, office, public space, etc.) are influenced by the previous experiences and recollections of the individuals involved and the conditions to which they are subjected during the event: how they used the structure in the past, previous experiences and training, and the conditions they face in the structure during the event. A structure can be seen as a people movement system that operates in different states. This movement system is formed from three phases: *ingress* (people enter the structure); *circulation* (people use the structure); and *egress* (people leave the structure). Therefore, for the structure to be used people have to arrive and enter it; during its use, people circulate around it; and, eventually, people leave the structure (see Figure 2). All of these uses are stored as experiences within an individual and will influence future activities. The phases are influenced by the procedures in place and stored in the experiences of the population. These three key phases are described by the **ICE** acronym (*ingress; circulation; egress*) [12].

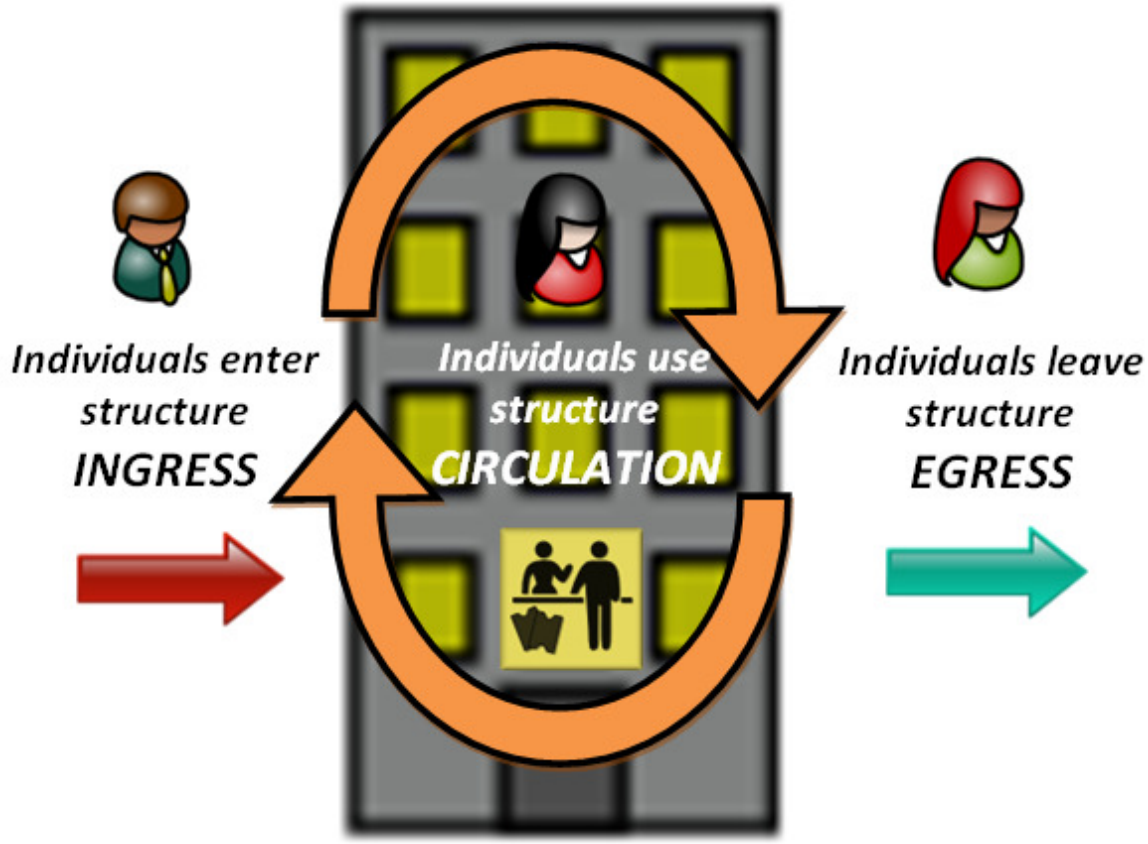


Figure 2: ICE: the three phases of people movement [12].

Given these phases, and the fact that they are highly coupled (i.e., they co-exist and interact with people using the space in a number of different ways simultaneously), it is beneficial to treat people movement as a single system that can exist in a number of states, rather than as a number of separate entities. To support our understanding of these interrelated phases, data would need to describe similarly interwoven processes.

As an individual is exposed to each different phase of use, the phases directly influence their experiences in relation to the structure and therefore influence the initial information to which they have access during an emergency (i.e., the information that they bring to the event). Notification and procedural measures represent attempts at expanding, improving and correcting this information [3,13]. For instance, a notification system might inform a population of the location of emergency exit doors, which might otherwise have been ignored in favor of the exit used to enter the structure (i.e., ingress influencing egress).

Table 1: Interaction between ICE and SOS.

(ICE)		Procedural Activities (SOS)		
		Safety (S) 	*Operation (O)* 	*Security (S)* 
Phase of Movement	*Ingress (I)* 	Fire Department Arrival	Ticketed Access	Ensuring appropriate exits are used for ingress
	Circulation (C) 	Crowd management	Providing information on facilities and services	Managing Access to areas within the structure
	Egress (E) 	Managing emergency evacuation	Leaving the building	Ensuring appropriate exits are used for egress

As people use a building according to the three **ICE** phases, they are constantly engaging in various procedures that influence (and often manage) this use. This occurs in both emergency and non-emergency scenarios. The different types of procedural activities include human-based (e.g., the staff engaged, training, etc.), technological (e.g., alarms or electronic signage), and/or architectural (e.g., the building is configured to allow for easy navigation), all of which are used to manage people movement. These procedures can indirectly influence performance (for example, where facilities are positioned in order to ensure that the space is used in a certain way), or directly manage performance (for example, where security measures are pre-planned, well-defined and require training). These procedures can broadly be categorized into those that address safety (S), those that address internal operations (O), and those that address security issues (S). These three key procedural activities are described by the **SOS** acronym (safety procedures; operational procedures; security procedures). Table 1 presents examples of how the **ICE** phases and the **SOS** activities combine.

Just as the population's experiences with a structure are governed by the manner in which they use it prior to the incident, the external conditions faced and the information available is influenced by the procedures being employed during the event. This in turn will influence the population's response. Therefore, any theory of human performance in this context will have to be sensitive to the procedures employed and the information available (current information or in the form of recollection). Given that people constantly process the information available to arrive at a decision (and adapt to the evolving scenario), it is important to understand their baseline information, the formal attempts at modifying this information (e.g., procedural

actions) and the informal information that is available in the surrounding environment (e.g., the actions of others, environmental cues, etc.). Given this, any description or understanding of human behavior during an emergency needs to cognizant of the **ICE** phases and the **SOS** procedural activities. These are just examples of the factors that influence human behavior, but exemplify the degree of spatial (i.e., different procedures will be active and different information available at different locations) and temporal (i.e., an individual gains experience and local expertise over a period of time) connectivity that underlies human response. Comprehensive theories are required to adequately describe these interactions; accurate and relevant data-sets are required to support the development of such theories.

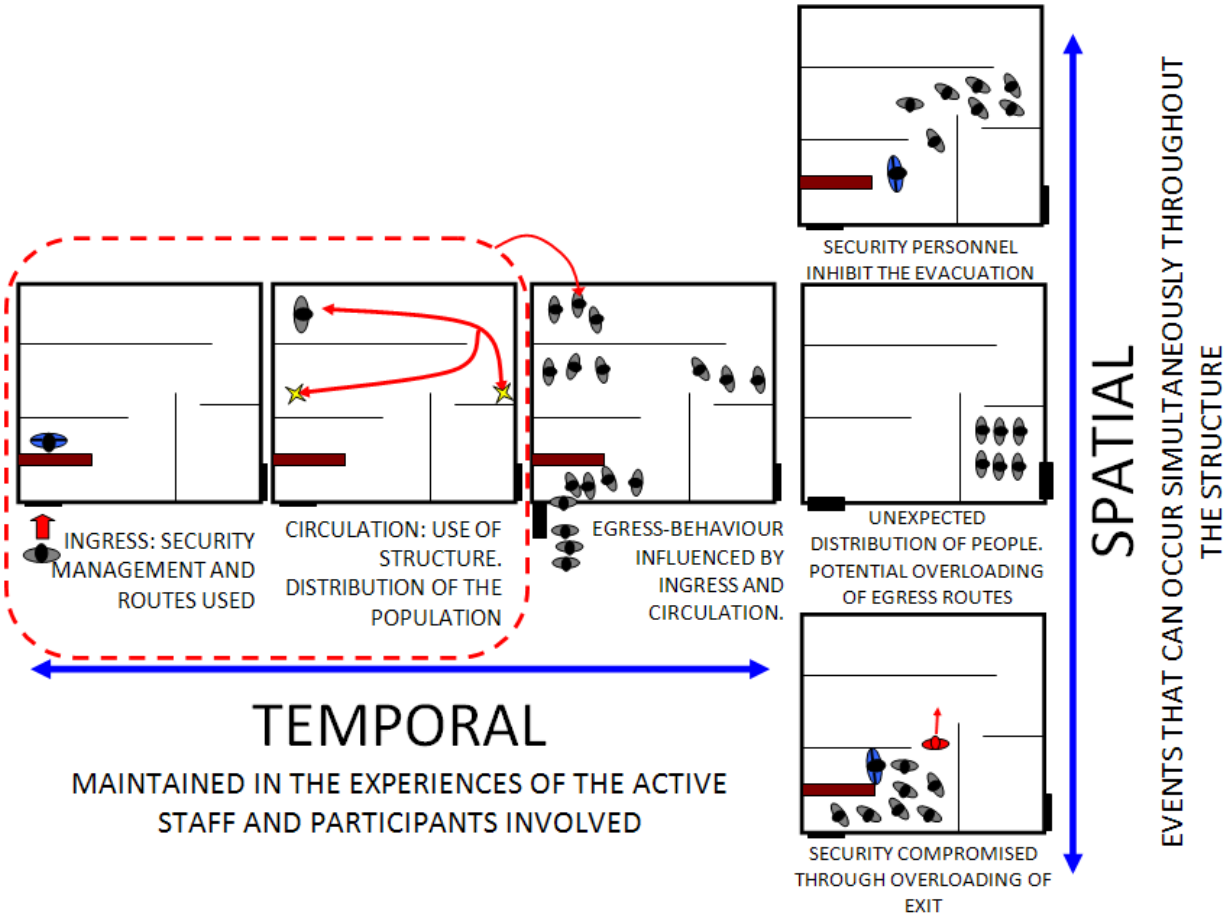


Figure 3: Example of how the use of the building and the procedures employed can interact.

The relevance of this discussion to data is fundamental. Human behavior is complex and multi-faceted – even just considering the two fairly simple components outlined here: that an individual experiences the structure according to a number of different phases and that the structure is subject to a number of different procedural activities at any one time. Human behavior is dependent on the recollection of activities performed along the historical timeline of the building. Human behavior is also dependent upon the surrounding conditions and upon influences beyond the range of their immediate surroundings; i.e., the procedures being employed simultaneously in the same space and elsewhere in the same building. These

temporal and spatial factors directly influence human response and should be accounted for in the development of theories. These factors should therefore be represented in the range of data-sets available to inform theory development. The individual (e.g., participant, evacuee, etc.) represents the key intersection between historical events and the developing event scenario (and the procedural attempts to deal with it). An example of how these two aspects may interact is shown in Figure 3.

We must be aware of the factors that influence human response when collecting data and developing theory. This has not always been the case and was reflected in the type of data collected and the theories developed. When viewing past data collection it is important to understand the assumptions made by the collectors. The collector's 'theoretical' assumptions would have influenced the methods employed and the data actually collected. Just as it is important when collecting data to understand the complexity of the underlying behavioral processes represented by the data, it is also important to understand the context of previous data collection efforts to adequately assess the quality of the data and determine its appropriateness to any future applications.

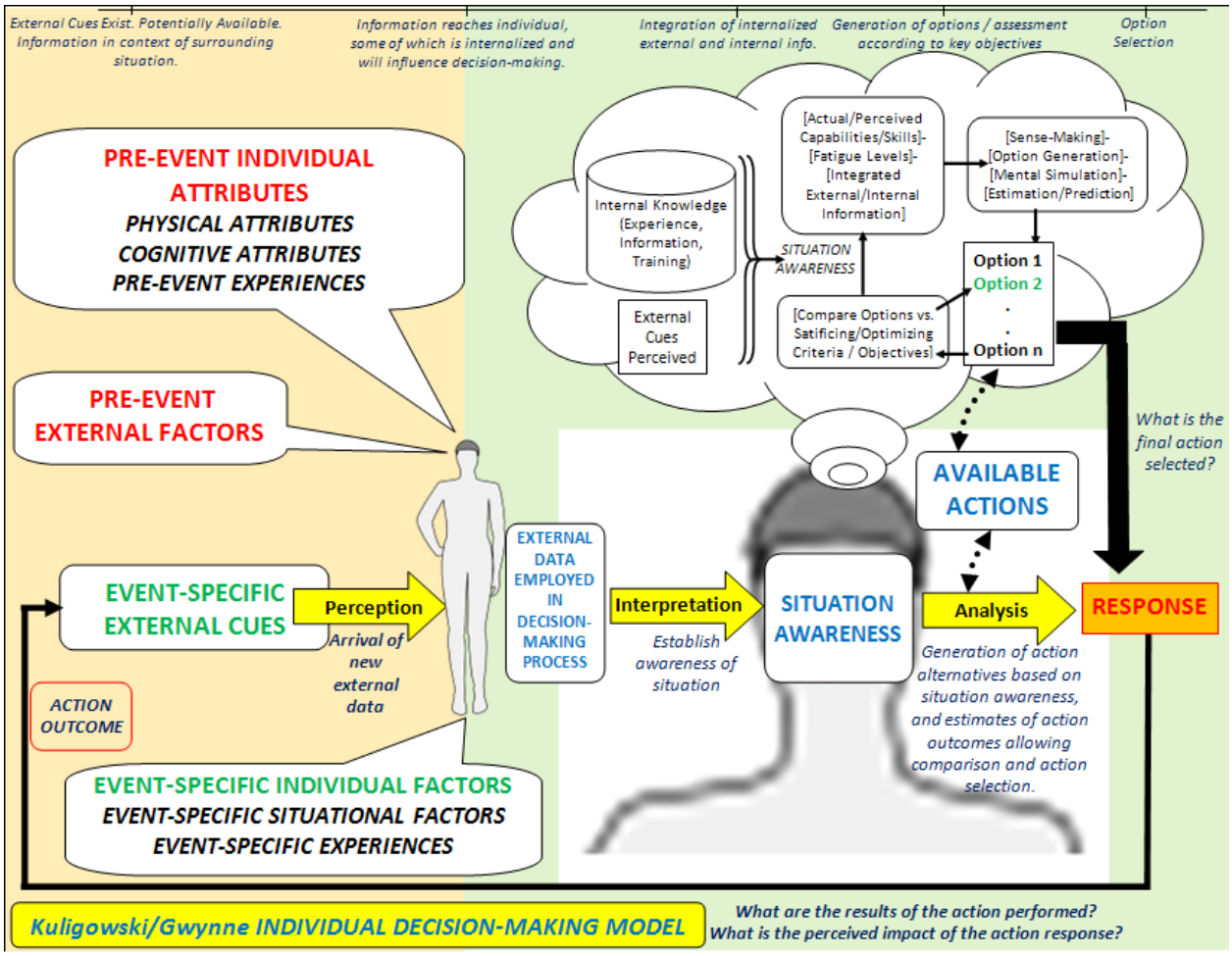


Figure 4: Internal decision-making process [14-17].

The human decision-making process is complex and influenced by a range of factors including those mentioned above. Figure 4 shows a simple descriptive representation of the decision-making process (discussed in more detail in Section 5.3). Although it is simple, this representation does demonstrate the number of factors that influence performance and the key processes through which an individual passes during an event. If any examination of the existing theories of human behavior in emergencies is made (especially in fire) then the discrepancy between the nature of those theories and the supporting data available becomes all the more apparent [14-17].

Data-sets need to cover the array of factors that influence behavior, or at least be consistent with the existence of these factors: *knowledge of the underlying assumptions on which the data is based (and the factors that are addressed) is critical to anyone employing the data.*

2.2 The Range of Data Sources and Means of Collection

Data can be derived from an array of different sources [5]. These sources directly influence the manner in which data-sets are collected, the underlying format, the veracity of the data, and the content. Therefore, understanding the source of the data is critical in determining how it can be used. Broadly speaking data can be derived from the following sources:

- CCTV/security video footage. This data source has the potential to accurately record behavior in both emergency and non-emergency situations. Given that the derived data-set typically represents routine operations/movement, the user of the data should be aware that, when considering this non-emergency behavior, there may be discrepancies between the scenario recorded and the scenario of interest.
- Full-scale experiments/trials; e.g., building evacuation drills. These may be announced or unannounced and typically focus on the performance of the structure, rather than the performance of the evacuating population. Depending on the nature of the experiment/trial, the population involved may have forewarning of the event, may not be exposed to deteriorating environmental conditions, and/or may become aware that the event is not real. All of these may influence the relevance of the results produced.
- Small-scale component tests; e.g. occupant performance on stairs. These tend to focus on a particular performance factor. The user of data produced by small-scale component tests should be aware of the primary performance factor being examined. This will allow them to establish the credibility of the claims made – especially regarding other secondary or peripheral factors derived from the data-set.
- Formal incident investigations performed in order to understand what happened during the incident and what factors contributed to it [18,19]. Such investigations primarily focus on establishing the chain of events and factors that contributed to the outcome; they tend not to produce quantitative estimates, because, unless they are supported by objective measuring (e.g., footage that has been captured by CCTV), much of the report will be based on subjective accounts. The user should therefore be cautious when presented with quantitative results derived from anecdotal reports.
- Surveys; e.g. data collected at fire incidents through questionnaires or interviews designed to gauge the opinion of a particular population, etc. The user should be aware

of the nature of the survey (e.g., whether it was open or closed), the content (e.g., what was actually being asked), and the details of the population consulted.

- Simulated data; e.g., the use of computational tools to explore performance under conditions that could not be explored directly, such as catastrophic fire conditions. The strength of this type of data is highly dependent upon the nature and sophistication of the model used. It may be one of the few options available to investigate performance under extreme conditions; however, the limitations of the model, the process and the data produced should be clearly understood.
- Research of existing material /secondary resources such as academic literature, journalistic sources, anecdotal evidence, and material from adjacent fields of research. The value of the source will be dependent on the appropriateness and credibility of the secondary source given the intended application. The ability to assess this appropriateness will largely be influenced by the background information provided by the original authors.

The observer of any data-set should be aware of the original data source as this influences the relevance of the data to any application. Similarly, the method employed to collect the data will influence the data that is eventually collected. There are a number of methods available to collect data:

- Video
    - Stationary camera: monitor behavior, velocity, flow rate, conditions at or passed selected point(s)
    - Moving camera: monitor behavior, velocity, flow rate of progressive conditions experienced by selected individuals or groups
        - *Allows a stream of information to be collected and then the focus of the analysis determined after collection. Extraction of data will be dependent on definitions being developed and consistently employed.*
- Still photograph
    - Density/spacing between people
    - Boundary layer around flow of people
        - *Allows a snapshot of an event to be established allowing the conditions evident to be recorded. Ability to accurately determine performance may be an issue.*
- Human observer
    - Make manual observations
        - *Allows numerical and descriptive information to be recorded.*
        - *Consistency and accuracy may be an issue.*
    - Conduct interviews
        - Interviewer surveys participants (either alone or in groups) according to a pre-defined script. This script may allow flexibility in developing the interview (or probing), or it may require strict adherence.
        - *The quality and nature of the data produced is highly dependent upon the design of the survey and the skill of the interviewer.*

- Electronic Sensor /Automated Measurement
  - Count number of people passing a selected point
  - Determine travel speed
  - Determine number of people in a space
  - Dependent upon the quality of the hardware/software involved. There is some difficulty in making measures in complex and/or high-density crowds.
    - *This may (potentially) record the arrival times of individuals at a specific location in an objective and consistent manner, although is highly dependent upon the equipment, the configuration and the success of the data extraction.*

Third-party users need to be aware of the data collection methods employed to better assess the underlying data source presented and the suitability of this data for their needs.

2.3 The Impact of Model Sophistication on Data Requirements

There are a range of different models that require the use of data [2]. The various types of models employ different techniques, cover different areas of the response process and operate at different levels of sophistication. As a consequence, models require data in different formats and to address different subject matter. Models can be broadly categorized into six different types, each with their own data needs:

- *Prescriptive Codes*: Pre-defined rules based on experience (i.e., expertise and lessons learned from real incidents), that are then codified into a framework of regulations. Data is used to support the development of these rules, rather than their application.
- *Full-scale evacuation demonstration*: The use of a representative population and scenario(s) to gain insight into performance of a structure under specific conditions. Data may be used to help inform expectations regarding performance and then organize the management and data-collection activities. The data-sets used are not then involved in the modeling process as such, only in the organization of the event.
- *Empirical correlation/analysis at the level of the Structure*: Data-sets are collected from the evacuation of structures and then analyzed to produce high-level functions to predict performance assuming similarities at the structural level. Data-sets are used directly in the production of the model and in the application.
- *Manual calculation at the level of the Component (Hydraulic models)*: Data-sets are collected from the evacuation of structures and then analyzed to produce low-level component-based functions to predict performance assuming similarities at the component level (e.g., doorway, corridor, stair, etc.). Data-sets are then used directly in the production of the model and in the application.
- *Theoretical Model/Expert analysis*: Data-sets are used to develop a theory describing some performance component. A set of theories are then employed as part of expert analysis/engineering judgment to assess some issue. This assessment may well use further data to support the analysis and make it more specific. This process is then highly dependent on the availability and use of data from the development of the theories to their application.

- *Computational Analysis*: Computer tools include the coding of the previous three bullets. These provide different levels of sophistication and have different data requirements. In addition, to them needing data in their development, each has their own data needs in their application; however, they will all need data in order to be appropriately applied at all.

Each of these different model types will employ different methods to produce a result [12]. Each model type also represents the key components (e.g., the structure, the population, behavior, procedural activities, environmental conditions, etc.) using different techniques and to a different degree of refinement. Depending on the sophistication of the model, they could be employed in a number of different application modes, each of which places a different onus on the user and on the data required:

- *Naïve* – estimates people movement patterns throughout the building prior to the population's experience and knowledge levels developing. The user would need to provide information on the location of the facilities, amenities, routes, information available, the building, and the population characteristics. For each of the physical and informational components, the user would need to establish their relative impact on the knowledge levels of the population. The user would then need to understand the behavioral response of the population to the physical and informational components and characterize this using the data available.
- *Operational* – assesses people movement patterns under routine conditions. The user requires an understanding of how people make use of the building in question, an understanding of non-emergency behavior to identify abnormal behaviors and an ability to characterize this with available data, and the ability to interpret the results produced.
- *Predictive* – predicts egress behavior from fundamental principles. The primary expertise required by the user to employ this mode is in the configuration of the scenario; i.e., defining the scenario and then supporting it with the data available. Once the model has been run, the user then has to determine whether the simulated behavioral responses are reasonable by comparison against available theory; and then the user must analyze the results produced.
- *Engineered* – answers key engineering questions using constrained behavioral assumptions. The user will need to provide a description of the initial scenario conditions, characterized by the data available – both generic and specific: population, building, procedure and environment.
- *Real-Time* – runs simulations during an event/incident to provide feedback during the application of a procedure. In *Real-Time* mode, the initial scenario conditions are determined by external sources, which are tasked with providing sufficient data on the surrounding environment to characterize the scenario in sufficient detail for the model to operate.
- *Interactive* – allows the user to interact with the simulation as it is running in order to influence the results produced. The user will have to initially configure the scenario conditions as he/she would have in *Engineered* mode.

The range of models available requires different types of data. The use of existing data-sets is dependent on sufficient contextual information being provided for model developers/users to reliably employ data.

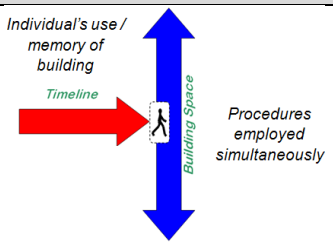
2.4 The Impact of Model Application on Data Requirements

The models described above can be applied to a number of application problems. As with the models themselves, each type of application places different demands on the user in terms of expertise (i.e., how much knowledge and experience is required of the user), and supporting data (i.e., how much information is required to develop the scenarios and configure the models being employ to address the application needs). Possible application areas include

- *Structural Design Assessment (e.g., RSET calculation for PBD, comparison of different structural design variants).* This requires the configuration of the model to assess structural performance (e.g., the time for the internal population to reach safety) under certain scenarios. Although the user is often required to provide their own data to configure the models, some guidance is provided on the scenarios and on the data to employ [2,20].
- *Procedural Design Assessment (e.g., modifying the alarm system, including more security staff, changing the location of a ticket machine, pedestrian analysis, etc.).* This requires the configuration of the model to assess performance (e.g., the time for the evacuating population to reach safety) assuming that specific procedures have been employed. Very little guidance is provided on how to conduct this type of analysis or on the data that should be used.
- *Forensic Analysis (e.g., examination of actual incident, such as that conducted by NIST for the Rhode Island and WTC incidents [18,19]).* This requires the configuration of the model to replicate the original conditions and variant of it in order to deduce influential factors. This requires a high degree of expertise in the use of the model and in the selection of the data. Very little guidance is provided on this type of application.
- *Regulatory Development.* This employs the model to support and inform the development of regulatory rules. The model would be configured to represent a situation of interest to demonstrate the validity of a particular piece of code (or code change). Very little guidance is provided on this or the data that should be used.
- *Third Party Analysis* – the model is employed to assess the use of modeling techniques by another practitioner. This may require the use of the exact same model (if the actions of practitioner are being assessed) or possibly different approach (should the outcome of the analysis be being assessed). There is some guidance on how to perform structural design assessment and on the third party analysis of this assessment; however, data selection in both cases is left to the discretion of the engineer to some degree.
- *Research* - In this case the model is employed to investigate an area of interest that may not otherwise be amenable to analysis. For instance, severe environmental conditions, movement of large numbers of people, etc. By definition, research is often novel requiring a great deal of expertise in the use of the models and the selection (and potentially the generation) of data.

Different application types require different data. However, in all cases it is critical that the relevant data-sets are available and that they are appropriately employed. The type of application along with the innate complexity of the subject matter, the range of collection methods, model types and application variability all place different requirements of the data-sets available and promote the collection of data with diverse formats, content, complexity and context (see Table 2).

Table 2: Summary of factors discussed.

Influences on performance	Data Sources	Data Collection Methods	Model Types	Model Application Modes and Types
	CCTV/security video footage Full-scale experiments/trials; Small-scale component tests; Formal incident investigations; Surveys; Simulated data;	Video Still photograph Human observer Electronic Sensor/ Measurement	Prescriptive Codes Full-scale evacuation demonstration Empirical correlation/analysis (Structure) Manual calculation (Component/ Hydraulic models) Theoretical Model/ Expert analysis Computational Analysis	Naïve Operational Predicted Engineered Real-Time Interactive Structural Design Assessment Procedural Design Assessment Forensic Analysis Regulatory Development Third Party Analysis Research

2.5 Potential Misuse of Existing Data: The Selective Process

Each of the factors discussed in the previous sections influence the data produced, the data collected and/or the data required to support the development and application of theories and the application of theory [2,5,12,14-17]. However, even if the appropriate data are available, it does not necessarily mean that data are automatically used. Data does not exist independently of the collection process; data are not collected in a vacuum. The data collection process requires decisions to be made at a number of stages, and these directly influence the scope and refinement of the data (see Table 3), and the applicability of this data. Given this, it is important to understand the process by which data are produced. In doing so, we can attempt to remedy any deficiencies in this process. In the context of this project, it is just as important to guide data collection as it is to guide data presentation.

Initially, a decision has to be made to acquire or seek out data: there is a reason behind the acquisition of the data based on a research or engineering need. The data acquisition process is therefore *selective*. Data are then collected. The methods used during this process will influence the nature of the data and the availability of contextual (background) information. The methods selected may be based on their appropriateness, but also based on less rational reasons: available expertise, cost, convenience, etc. The data are then extracted and analyzed.

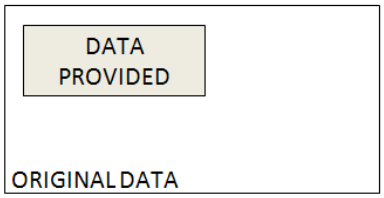
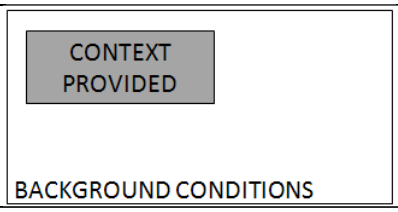
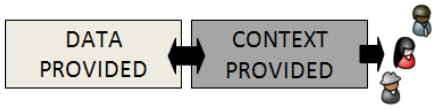
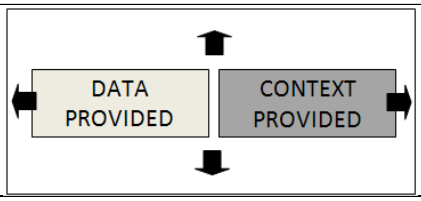
Table 3: Data Collection and Application Process

Activity	Description	Example
[1]SELECTION ↓	The subject of the data was deemed to be of sufficient interest for the data to be compiled.	Choosing to conduct an experiment, seek out CCTV footage, etc.
[2]COLLECTION ↓	The techniques employed influence the content of the data-set and the detail with which it is represented.	Video coverage, surveys, interviews, manual timings, sensors, etc.
[3]EXTRACTION/ ANALYSIS ↓	The reduction of the raw data down to a refined form can exclude (or excludes) certain information from the final data-set.	Sampling video footage into 30s periods, and analyzing these periods.
[4]DESCRIPTION ↓	The supporting background information provides context to the data-set.	Providing information on the event timeline, population, structure, etc.
[5]PRESENTATION ↓	The modified format in which the data-set is finally presented differs from its unrefined original raw state.	Providing the range and average of the data, and a frequency distribution.
[6]DISSEMINATION ↓	The collector then makes the decision to release the data-set freely or selectively.	Data are only available within an organization.
[7]COMPREHENSION ↓	The user may have little or no understanding of the data collection process and the data-set, and the effect of this on the data-set's use.	Background information aids with the application of the data.
[8]APPLICATION	The data-set is employed as part of research, regulatory activities, engineering practice or tool development.	Data are used to configure a computational tool for an engineering application.

The data and the derived understanding are then described and presented; i.e., distilled into a representative state from a raw form and summarized along with the background information that is available (according to the information collected) and deemed worthy of inclusion. The data-sets are then shared with an audience of interested third parties. This may range from immediate colleagues to the general public. These parties attempt to understand the data according to the distilled format and the associated background information. On this basis, the data are then applied. Third parties may not necessarily have access to the most appropriate data for their application, but instead make judgments based on those sources with which they are familiar or to which they have access; i.e., not only is data acquisition selective, but data use is also selective and not necessarily based on the appropriateness of the data itself. This is compounded by the limited background information associated with the data and the data being provided in a summarized form. In such circumstances, the likelihood of data being inappropriately employed is increased.

There are a number of opportunities within this process for the data to be misrepresented, misunderstood, and misapplied. Examples of this are shown in Table 4. In most instances, only a sub-set of the data collected is shared. It is shared in a reduced/distilled format, rather than in a complete format. Potentially more importantly, in the vast majority of cases only a limited amount of information is provided on the background conditions evident during the original event; i.e., the event described by the data. The reduced data-set and limited context requires a greater degree of interpretation by the third party. This increases the potential for the underlying causal factors being misunderstood, the results being misinterpreted, and the data-set being inappropriately applied.

Table 4: The impact of issues arising during the data collection and application process.

	Data / Information	Impact
COLLECTION		Sub-set of data is collected given limitations in expertise, data collection techniques and limitations of the event.
DESCRIPTION PRESENTATION		Sub-set of background conditions are collected given lack of expertise and general lack of recognition as to the importance of this information.
DISSEMINATION		Data sub-set and the limited context provided is sought out by interested parties
COMPREHENSION		Interested parties extrapolate from limited information to fit application requirements.

Not only does this type of error influence a particular application, but there is a high probability that it will propagate through a chain of different individuals. For instance, a researcher misusing third party data may then produce faulty theoretical understanding. This may then be embedded into a simulation tool. This tool may be validated against data inappropriately selected for comparison. The 'validated' model may then be used by an engineer who may select inappropriate data to configure the model for application. At this stage, a model that is based on a faulty theory, has been validated inappropriately, and is then applied incorrectly.

This discussion has been an attempt to outline the many factors that can detract from our understanding of human behavior in fire; understanding these factors can help mitigate against them. The development of the *Data Acquisition Matrix* and the *Data Template* is specifically designed to address points (1-5) and (7-8) in Table 3; the full online implementation of the *Data Portal* will go on to address point (4).

The next section discusses the manner in which these factors (and the impact that they have on data) have been addressed in this project; i.e., how myriad factors can be accounted for in the collection and presentation of data, and in the guidance provided to assist these processes.

3 Project Overview: What we are trying to achieve?

Data-sets, especially data describing human behavior in fire, have three key attributes: they represent a critical component in both theoretical and practical activities; they are scarce; and they are imperfect. Data-sets are incredibly important in any field of knowledge. Data underlie the development of ideas and the identification of influential factors related to the subject matter of interest; the development of these ideas into theories; the development of practical tools based on these theories; and the testing, validation and application of these tools in the real world. As such it is critical for the advancement of any field that there are sufficient, high quality data-sets to enable these activities to be conducted, and to increase credibility in the field, such that the findings produced are deemed valid and valuable.

Human egress data are scarce for a number of reasons. The immature nature of the field has meant that there has only been a relatively brief period where dedicated data-sets have been sought out. The nature of the data (i.e., related to human performance) means that the data-sets are technically difficult, ethically challenging and often expensive to collect. The scarcity of data has also led to the data itself becoming a precious commodity; therefore, there is an impetus for data collectors to hold on to already scarce data-sets and exploit them as much as possible for themselves. Also, the contents of the data-sets can be sensitive - the conclusions drawn from data-sets can have legal, financial, political and public relations consequences, often unforeseen when the data-sets are released. Therefore, there are impediments to organizations releasing their own data. This somewhat counteracts the potential for data sources to be collected on a more regular basis (e.g., through the increasing number of CCTV security cameras): as these resources have become available, so have the sensitivities to releasing the data, and the rise of privacy concerns. All of these issues then act to suppress the generation and dissemination of high quality data, both through legitimate and less justifiable concerns.

Finally, the limited data currently available are imperfect and our understanding of key performance components suffers because of this. This imperfection is caused by several issues: (1) many of the data-sets currently available were not originally intended to be used as they are; (2) some of the data-sets were collected by non-experts, and/or by people with different areas of expertise; (3) the data available are often presented in a reduced, distilled format preventing full analysis; (4) the data are presented without the necessary background information. These factors reduce the scope, refinement and appropriateness of the data available and increase the probability of misuse [1-3,5,12,14,16,17].

This project addresses these key limitations of human egress data by developing the components of an online *Data Portal*. Primary in these elements are the *Data Acquisition Matrix* and a *Data Template*. The *Data Acquisition Matrix* provides detailed guidance on the data collection process: what factors should be considered by the data collector before, during and after the data-set has been collected? The *Data Template* provides guidance on the presentation of the data and the associated background information that allows informed assessment: what data and supporting information need to be provided for the data-set to be

of use to a third party? These primary developments are described in the following sections and appendices, and are anticipated to be used in any of the three ways shown in Figure 5. These tools will enable interested parties to reliably deposit, extract and interrogate data on human performance during fire. The tools developed here can be used in the various fire engineering stages: theory development; model development; model validation; and model application.

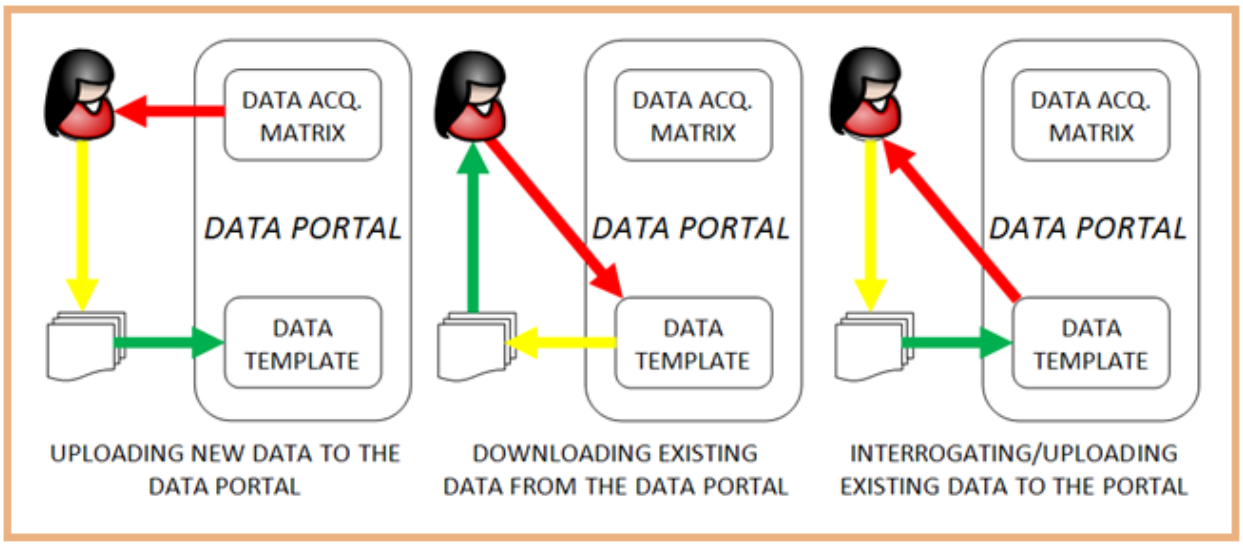


Figure 5: Three key uses of the *Data Portal*.

A third party may have an opportunity to collect data (see Figure 5). In order to collect a data-set that is sufficiently comprehensive to fill the *Data Template* the third party downloads the *Data Acquisition Matrix* to aid them in data collection activities. The data-set is then uploaded, populating the *Data Template*. Alternatively, the user may wish to access an existing data-set. Assuming that the *Data Portal* had been fully implemented and populated, the third party could then access the portal, select an appropriate data-set and then download the data formatted in a standardized manner according to the *Data Template*. Finally, the third party may already have a data-set and may wish to format it according to the *Data Template*. This could then be downloaded, the data configured and then the data uploaded for general use.

An obvious issue with the future success of the *Data Portal* is the willingness of people and organizations to share data. This can be addressed in several ways. Firstly, the host organization (potentially NIST) could actually implement the *Data Portal*. It is felt that implementation of *Data Portal* populated by existing, publically available data-sets will prove an invaluable tool to those in the field – a tool that will be used, will gain momentum and which will eventually be seen as valuable as a means of publicizing work in the field and disseminating data-sets for peer access and use. Secondly, the host organization could populate the implemented *Data Portal* with the data-sets that are currently publically available. This will demonstrate the value of the *Data Portal*, and will allow people access to the (already familiar) data-sets in a standardized format. Finally, the host organization could promote the *Data Portal*. This has been conducted, to some degree, during the life-time of the project through discussion groups, conference discussions, workshops, article generation, and information feedback (for instance,

the Egress Modeling Workshop held during the 9th IAFSS Symposium 2008, chaired by the author). The field should continue to be made aware of the existence of the documentary tools to increase their familiarity with the concept; this will be continued when the *Data Portal* is fully implemented by encouraging the use of the *Data Acquisition Matrix* and the *Data Template* in the collection and representation of data-sets, especially those with a high-profile.

The two primary developments in this project have been designed to stand alone. Should the full *Data Portal* not be implemented, the *Data Acquisition Matrix* and the *Data Template* will still be of value to the data collection process. Obviously, the full *Data Portal* provides a degree of functionality beyond the two documents: providing access to data. However, the two documentary tools provide detailed guidance on the collection and presentation of data. This is intentional to ensure that whether the *Data Portal* is fully implemented or not, that the project produced significant value to the field in general and in those collecting, disseminating or using data in particular.

4 Method and Key Tasks: How we are achieving our objectives?

The key task of this project was to develop a set of tools that could be used as part of an online *Data Portal*. Primary developments, as mentioned above, were the *Data Acquisition Matrix* and the *Data Template*. The *Data Template* itself required a number of secondary developments in order for it to have the desired functionality. These developments are described in Table 5.

Table 5: Project Developments.

(1) Primary Developments	
Data Acquisition Matrix:	A matrix describing the key elements of the data collection process.
Data Template:	A placeholder for providing a comprehensive description of the data, the data collection process and the background conditions evident during the event described by the data.
(2)Secondary Developments (of the Data Template)	
Narrative Timeline Notation:	A representation of the event described by the data-set in question.
Timeline Description:	A representation of the event at the individual and event level.
Keyword Equivalence Classes:	A categorization of the terms used to describe the data.

The tools described above have been developed to improve elements of the data collection, interrogation and application process, including the key issues highlighted in Table 4. This should provide tangible benefits in the quality, quantity and availability of human egress data. The relationship between these developments is more clearly shown in Figure 6. These tools are now described.

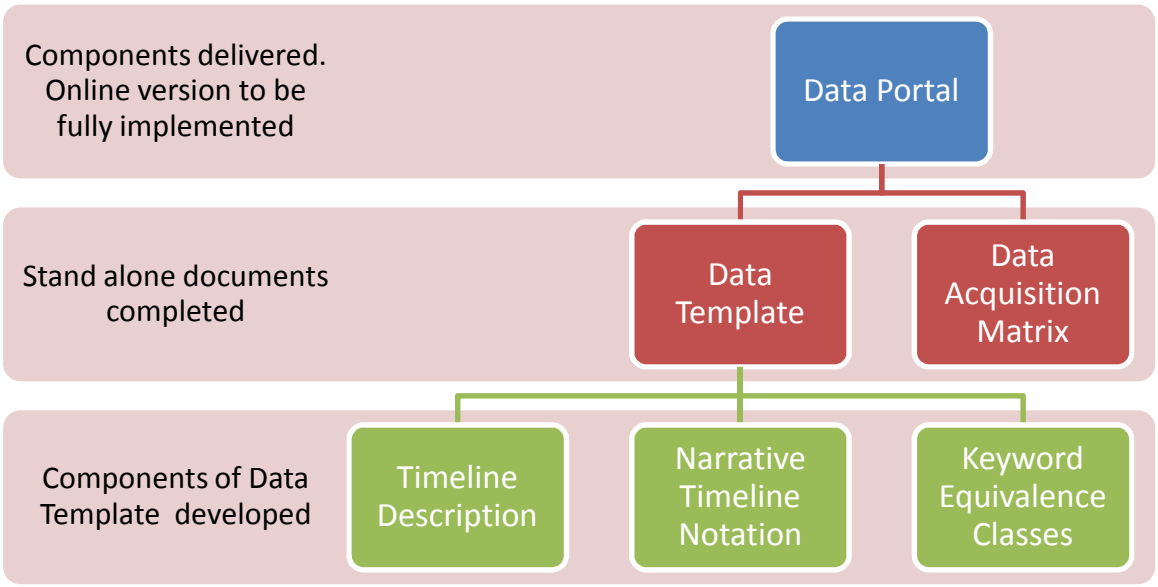


Figure 6: Relationship between developments.

These developments (collectively referred to as the *Data Portal* from this point onwards) required a number of preparatory subtasks to be completed. These included a review of available material, the iterative design of the *Data Template*, canvassing of expert opinion, the validation of this design, and then the design of the *Data Acquisition Matrix*. Critical among these tasks was an appreciation of the data publically available, the methods used to represent and describe the data, and the terminology employed (see Figure 7).

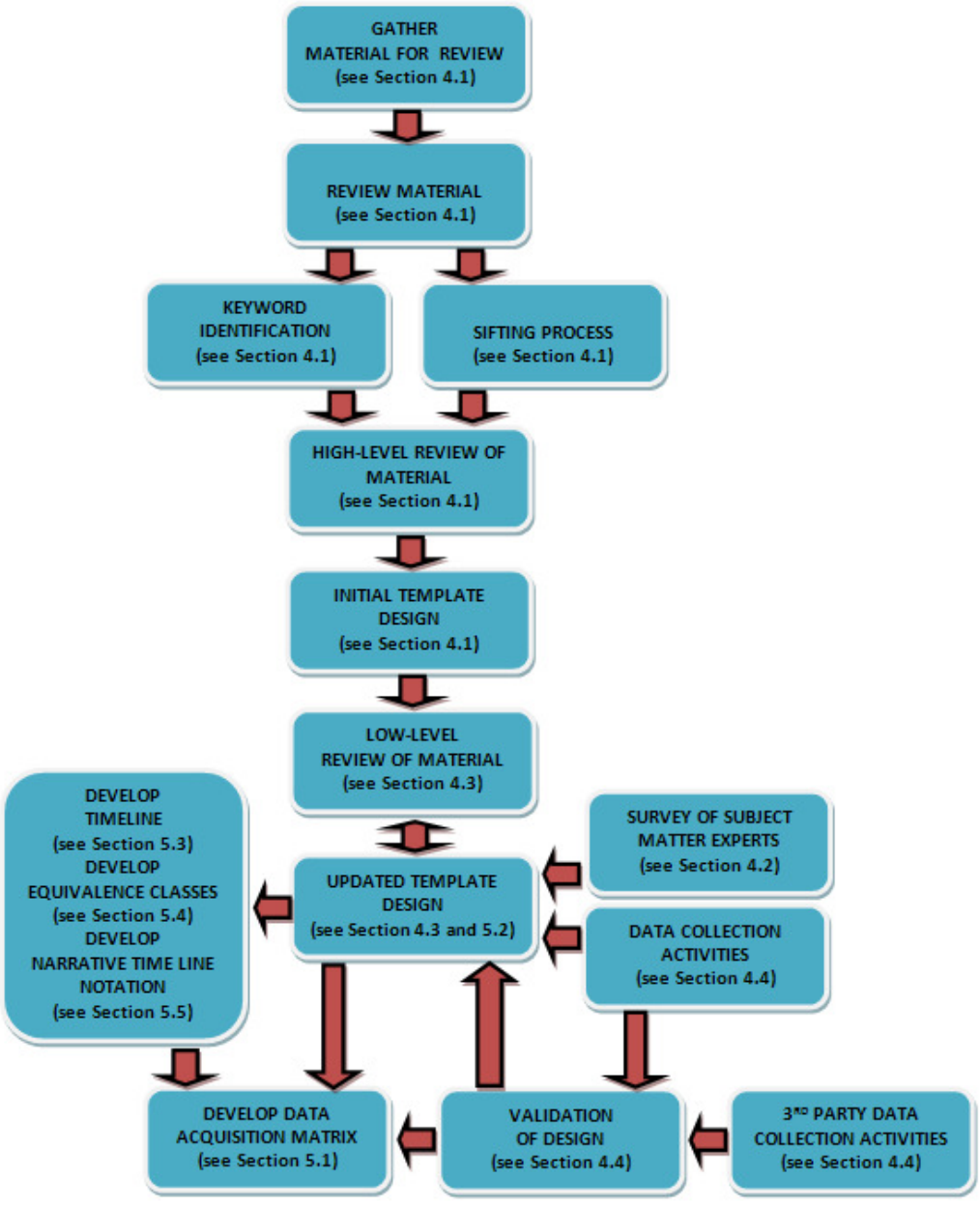
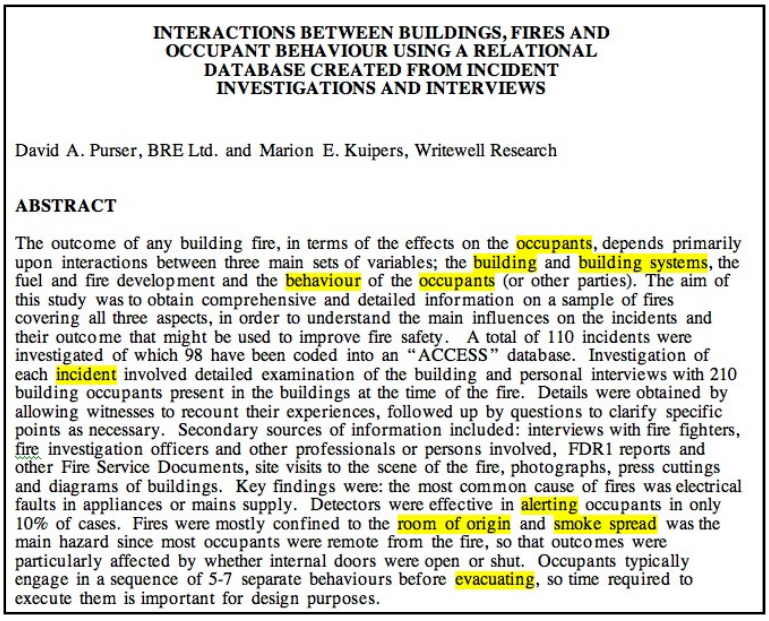


Figure 7: Project Tasks.

4.1 Informing the Design: Material Review

A broad review was conducted of material that was publically available that broadly related to human performance. Although much of this material focused on response to emergency situations (such as fires), other subject areas were also examined that included pedestrian and non-emergency conditions. This was to ensure that there was a sufficiently broad base to the source material and the subsequent *Data Template* design; i.e., that the issues raised in Sections 2.1-2.5 were represented to some degree. This review was conducted to better appreciate the data available, the background information provided, the formats used and the terminology employed (see Figure 8). Not all of material reviewed related directly to data, as it was important to understand how data might be collected, employed and represented in the field.

A broad search was conducted that included (although was not limited to) examining conference proceedings, books, journal publications, theses, trade magazines, reports and internet resources. This search produced approximately 1,200 sources of material. The sources were then categorized according to whether they described a general method (e.g., data collection, presentational, analysis, etc.), presented a theory (broadly related to human performance), presented data, or described some other aspect of the field. These three categories were considered to be of most interest to this project.



INTERACTIONS BETWEEN BUILDINGS, FIRES AND OCCUPANT BEHAVIOUR USING A RELATIONAL DATABASE CREATED FROM INCIDENT INVESTIGATIONS AND INTERVIEWS

David A. Purser, BRE Ltd. and Marion E. Kuipers, Writewell Research

ABSTRACT

The outcome of any building fire, in terms of the effects on the occupants, depends primarily upon interactions between three main sets of variables; the building and building systems, the fuel and fire development and the behaviour of the occupants (or other parties). The aim of this study was to obtain comprehensive and detailed information on a sample of fires covering all three aspects, in order to understand the main influences on the incidents and their outcome that might be used to improve fire safety. A total of 110 incidents were investigated of which 98 have been coded into an "ACCESS" database. Investigation of each incident involved detailed examination of the building and personal interviews with 210 building occupants present in the buildings at the time of the fire. Details were obtained by allowing witnesses to recount their experiences, followed up by questions to clarify specific points as necessary. Secondary sources of information included: interviews with fire fighters, fire investigation officers and other professionals or persons involved, FDR1 reports and other Fire Service Documents, site visits to the scene of the fire, photographs, press cuttings and diagrams of buildings. Key findings were: the most common cause of fires was electrical faults in appliances or mains supply. Detectors were effective in alerting occupants in only 10% of cases. Fires were mostly confined to the room of origin and smoke spread was the main hazard since most occupants were remote from the fire, so that outcomes were particularly affected by whether internal doors were open or shut. Occupants typically engage in a sequence of 5-7 separate behaviours before evacuating, so time required to execute them is important for design purposes.

Figure 8: Example of key word identification [p443,21].

Once collected, the material had to be sifted through to determine the content in more detail. The sifting process was employed in order to select the sources whose review would most benefit the developments associated with the *Data Portal*. This review also prompted new developments to be considered. This required the following steps:

1. Collecting the sources
2. Performing superficial scan of sources to establish content

3. Labeling sources according to their content using keywords
4. Searching through sources for certain keywords
5. Reading material in source
6. Reviewing material according to the template
7. Modifying the template according to omissions and inadequacies identified during review process.

This was a time-consuming process requiring sources to be collected, reviewed and assessed. Of the original 1,200 sources, a sample of approximately 400 sources was deemed to satisfy the criteria applied (i.e., fell into one of the three categories of interest), while the other sources were excluded from more detailed analysis. Although crude, this labeling process enabled the unwieldy number of sources to be reduced to a manageable number. These 400 sources were subject to a high-level review; e.g., documenting techniques employed, language used, data presented (if appropriate), conclusions drawn, etc. The primary objective of reading and reviewing this material was to inform the development of the *Data Template* and the associated sub-developments: the high-level review produced the initial design for the *Data Template*. The review was not conducted to produce an exhaustive database of material; although a valuable task, this falls beyond the scope of this project. At the end of this high-level review an initial design of the *Data Template* was developed.

A sample of over 100 diverse and representative data sources (including real incidents [e.g., 18,19,22-25], non-emergency events [e.g., 26-30],experiments [e.g., 31-37], drills [e.g., 3, 38-42], surveys [e.g., 43-45], sources on theory [e.g., 46-51] and general method [e.g., 52-56]) was then reviewed much more closely. Additionally, approximately 50 other sources were reviewed that were associated with computational models, engineering guidance and engineering calculations. These documents were a sample of those publically available and those provided on request or purchased. This included documentation associated with a range of computational evacuation models including buildingEXODUS, Simulex, EGRESS, GridFlow, Evacnet4, Exit89, EVI and FDS_Evac [e.g.,57-65] and from model reviews [e.g.,66-69]; guidance documentation including ISO, BSI and IMO [e.g.,70-72]; and engineering calculations including guidance such as those provided by SFPE and the NFPA [e.g.,20, 73]. The analysis of the models was primarily to examine the consistency of the terminology employed, the associated data, and the manner in the data was used with the model. These 150 sources were subject to much greater scrutiny, being categorized and interrogated using either the *Data Template* or a companion method of categorization used to examine the evacuation models. In effect, the high-level review of the 400 sources of material available provided the initial design of the data template; the low-level review of the 150 data sources employed each template iteration and suggested refinements to the design. The development of the *Data Acquisition Matrix* followed on from this development in an attempt to ensure that adequate data could be provided to the *Data Template*; i.e., to encourage new data with sufficient background information to populate the *Data Template* more completely.

4.2 Design Validation Process: Canvassing Expert Opinion

The reviewing process highlighted above, by definition, looked at events that had occurred in the past; i.e., they were derived from existing documentary sources. A small group of experts was surveyed in order to get a more current view of the data employed, general practices and the terminology used by some of the most influential people in the field. Given their influence and expertise, it is assumed that their attitudes and practices will be well known and have some influence. However, that is not to say that their opinions are representative of the field. This brief, informal survey is presented in Appendix A.

This survey was developed to gather the opinions of nine key people in the field. These were selected from five nations, and come from a number of different backgrounds: model developer, fire scientist, fire engineer, researcher, teacher and data collector. This relatively small sample size was imposed by regulatory constraints. These experts were questioned on their activities, the data that they employ, the terminology that they use, and the data that they would most like to see available. In addition, comments were sought on the type of functionality that they would find useful in the development of the *Data Portal* and its components. A section of the findings are shown in Table 6 and Table 7.

Table 6: Data-sets employed.

Data-Sets Employed	Example Use(s)	Key activity
Fruin [27]	Level of service concept	*Model Developer/Fire Scientist/ Fire Engineer/Teacher/Researcher*
Ando [74]	Flow density relationships	*Fire Scientist / Fire Engineer*
SFPE (Purser, Nelson and Maclennan, Pauls/Proulx) [e.g. 75]	Flow density relationships, speeds, boundary calculations	*Model Developer / Fire Scientist / Fire Engineer/ Teacher/Researcher*
Weidmann [76]	Flow density relationships Exit flow rates	*Model Developer*
Tubbs, J. [77]	References to US regulations (especially US)	*Model Developer*
Shields / Boyce [e.g. 78]	Impaired physical ability	*Fire Scientist / Fire Engineer/ Teacher/Researcher*
Predtechenskii and Milinskii [79]	Flow density relations, hand calculations	*Model Developer/Data Collector*
Technical Guides (BS 7964-6 / ISO TR16738/RiMea) [e.g., 71]	Key parameters and relation between them	*Fire Scientist / Fire Engineer/ Model Developer/ Teacher*
Thompson, P.A. [80]	Trajectory	*Fire Scientist / Fire Engineer*
Proulx [e.g., 81]	Stair speeds	*Teacher/Researcher*

The survey findings can be broadly summarized as follows:

- A core set of data-sets are employed. These include the data-sets produced by Fruin, Ando, Predtechenskii and Milinskii, Shields, Pauls, Thompson, Purser and the data provided in the SFPE Handbook [27, 71, 74-81].
- A wide range of terms are used. Even at the highest levels in the field, there is little consensus on the language used to describe phenomena related to the field.
- The experts identified that some basic data-sets are still required to support their work. These data-sets include pre-response times (referred to as PTAT, response times, etc.), travel speeds, the impact of impairments on travel speeds, the relationship between population densities and travel speed, the range of flow constraints, and the trajectories that individuals adopted when interacting with each other during movement.

This information was useful both in the development of the *Data Template*, providing design suggestions and key validation data. It also, to some degree, prompted the development of the *Data Acquisition Matrix*.

Table 7: Data-sets desired.

Description of Data-Set	Resolution	Preferred Format	Key activity
Occupant Response Time / PTAT (Pre-Travel Activity Time) distributions	*At the individual level*	*Raw numerical data*	*Model Developer / Teacher/Researcher / Data Collector*
		Distribution	*Fire Scientist / Fire Engineer*
Exit Flow	*At the component level*	*Average [range]*	*Model Developer*
Impact of Devices on Travel Speed	*Population – those using walking frames*	*Modifier*	*Model Developer*
General impairment			*Data Collector / Model Developer*
Individual trajectories	*Individual level*	*Raw data*	*Model Developer*
Occupant densities during evacuation and merging ratios			*Fire Scientist / Fire Engineer*
Time from detection to warning			*Fire Scientist / Fire Engineer*
Flows		*Raw data, average, distribution*	*Fire Scientist / Fire Engineer/ Teacher/Researcher*

4.3 Design Validation Process: Data Template Evolution

The *Data Template* is a key component of the *Data Portal* and also directly influenced the development of the *Data Acquisition Matrix*. It is a generic framework to represent specific instances of human egress data; i.e., each data source examined is represented in a separate record as indicated by the template. This includes a description of the data presented (e.g., travel speeds descending stairs, behaviors exhibited, etc.), the conditions under which the data-set was collected (e.g., high-density crowds, presence of smoke, real incident, etc.), the data collection methods employed (e.g., video recording) and related events/issues. The *Data Template* is intended to provide placeholders for the information presented in the data sources; i.e., both a guide to prospective collectors as to what should be collected, and a record of what has been collected.

The *Data Template* passed through over a hundred design iterations. The iterative design process was deemed necessary to avoid a preconceived idea of what the *Data Template should* be, rather than what it *needed* to be.

The initial design was relatively simple and open, and formed the first estimate of the information that should be included for it to be used by a third party. As more sources were examined, so the *Data Template* was modified, evolving to cater for the scope and detail of the different sources examined. This process continued until further template development was not required. Given the range of data sources reviewed, the scope of the *Data Template* is much more comprehensive than the contents of any single instance of data; therefore, when completing the template, it was often the case that there were a large number of omissions where information was missing or not applicable. This is useful in defining the scope of a data-set, clearing demonstrating to a third party what is included and excluded from a data-set.

Although the analysis of existing material provided a strong basis for the *Data Template* design, further analysis was required. To gain new insight into the requirements of the template design, several data collection activities were conducted. These involved the design, management and performance of data collection activities and the subsequent analysis of the data collected. This provided invaluable insight into the requirements of the data collector, the analyst and the background information that is required to make use of the data. It also informed the development of additional tools to be provided as part of the *Data Portal* that directly inform the data collection process.

4.4 Data Collection / Design Validation

Several data collection case studies were conducted in North America during 2007-2009 by the author and by third-parties [13,82]. Although the majority of these were conducted as part of other projects, the studies were conceived, design and conducted with the sole intention of collecting human egress performance data; i.e., these activities were designed to produce the type of data for which the *Data Portal* has been produced. It became apparent during these activities that key steps are required *during* the data collection process that directly influence the appropriateness, clarity and completeness of the data collected, presented and eventually

applied. These key steps need to be performed during the planning, design and execution stages of the data collection process. If these key steps are not addressed during the data collection process itself then it becomes very difficult, if not impossible, to compensate for their absence later on; i.e., when the data-set is represented or employed. Therefore, the development of a companion tool became a necessity (the *Data Acquisition Matrix*), to be used in conjunction with the *Data Template*: a matrix of checklists and guidance to aid the data collector - to ensure that key steps in the data collection process are performed and that the data collected is as detailed and comprehensive as possible, and supported by sufficient contextual data. This is designed to complement the *Data Template*; i.e., to fill the maximum number of placeholders within the template that is reasonable for a particular data source to fill. In addition, a more flexible means of describing the unfolding event and the numerous activities performed in conjunction with each other. This led to the development of the *Narrative Timeline Notation* described later in this document.

An example of these case studies is presented below (see Figure 9). This shows the type of information that was collected and the type of data that was produced. The reader is referred elsewhere for more detail on this and similar efforts [13,83].

The building involved in this trial was part of an administrative office complex located in North America. This complex consisted of a fourteen-story tower (including a basement level and unoccupied top floor) and an adjoining three storey low-rise structure. Each floor of the tower occupied approximately 1,940m2 (21,000ft^2). The tower had two stairs that ran throughout the evacuated floors. Each of the stairs was approximately 0.91m (3 feet) in width, allowing a single lane of pedestrian traffic. This behavior was also observed during the evacuation exercise.

At the time of the exercise (i.e., mid-morning), the complex was occupied by 825 people. This was established by examining CCTV footage. These were distributed throughout the structure, with 713 people (approximately 90%) of the population in the tower, while the rest were in the low-rise structure. The population was made up of administrative and engineering staff.

The facility management conducted emergency fire and earthquake exercises several times a year. These exercises were unannounced. The observed evacuation exercise required a full building evacuation. The procedure initially required the immediate evacuation of the three floors deemed to be most at risk from the incident followed by the rest of the building. During the exercise the fire floor was selected at random. Neither staff members nor occupants were aware of the exercise of the located of the simulated incident.

All floors of the structure had a pair of wardens whose responsibility was to ensure the population evacuated in accordance with the emergency procedure. In addition, building management identified a pair of additional wardens for each floor, in case the original wardens were injured or absent. On hearing the alarm, the wardens swept their floor to alert the population and eventually ensured that it was clear. On leaving the floor a warden picked up a register. The arrival of the evacuees at the assembly point was then recorded by wardens.

The primary objective of this research was to collect data relating to the pre-response phase – the time between the alarm being sounded and the population initiating purposive response. However, in order to support this activity, a range of other information was required. This provided the context in which the exercise took place, background information, and the conditions that developed during the event. Data was therefore collected on the pre-response and response phases of the evacuation using a range of techniques (see below). This provided a numerical estimate of the evacuation, but also some description of the conditions that arose. A description of the data-collection techniques employed is now provided.

Data collection techniques employed.

	Pre-Evacuation	*Evacuation*
Video Cameras	*X*	*X*
Manual Observations	*X*	
Survey	*X*	*X*

It was important that the anonymity of the evacuees was maintained during the data collection process. Video cameras were used, but were deliberately positioned so as not to focus on the faces of those concerned. This was achieved by laying the video cameras on the floor and then focusing them on the feet of the evacuees.

The authors established a simple set of guidelines in order to enable consistent and efficient manual data collection. It was apparent from the analysis of previous egress data that it would be impossible to record data for each individual given the number of arrivals that might occur in a short period of time. Each data collector was given this scheme and applied it during the trials. The collector recorded the time for the first and last person to arrive in the first group of evacuees. For subsequent groups, the observer recorded the time of the last arrival along with the number of people in the group. This was the minimum information recorded; it was often possible for the data collectors to record more information than this. The pre-response time of the last person in a group was taken as a conservative estimate of the pre-response time of the group. This method provided a conservative estimate of the arrival/pre-response times for each individual.

The four video cameras captured 132 pre-response times (representing 16% of the evacuating population).

Observers collected approximately 150 pre- response times, not captured on camera, representing 18% of the evacuating population. In combination they represented 34% of the overall population. Only this sample could be collected given the constraints placed on the data collection process; e.g. the level of access, preservation of anonymity, etc. All pre-response times were calculated from the beginning of the alarm message. The authors also conducted a post-incident survey. The population was able to respond via e-mail or on hard-copy. These responses were collected within 24 hours of the evacuation taking place to ensure that the events were still fresh in the minds of the evacuees. 103 responses were received (representing 12% of the evacuating population).

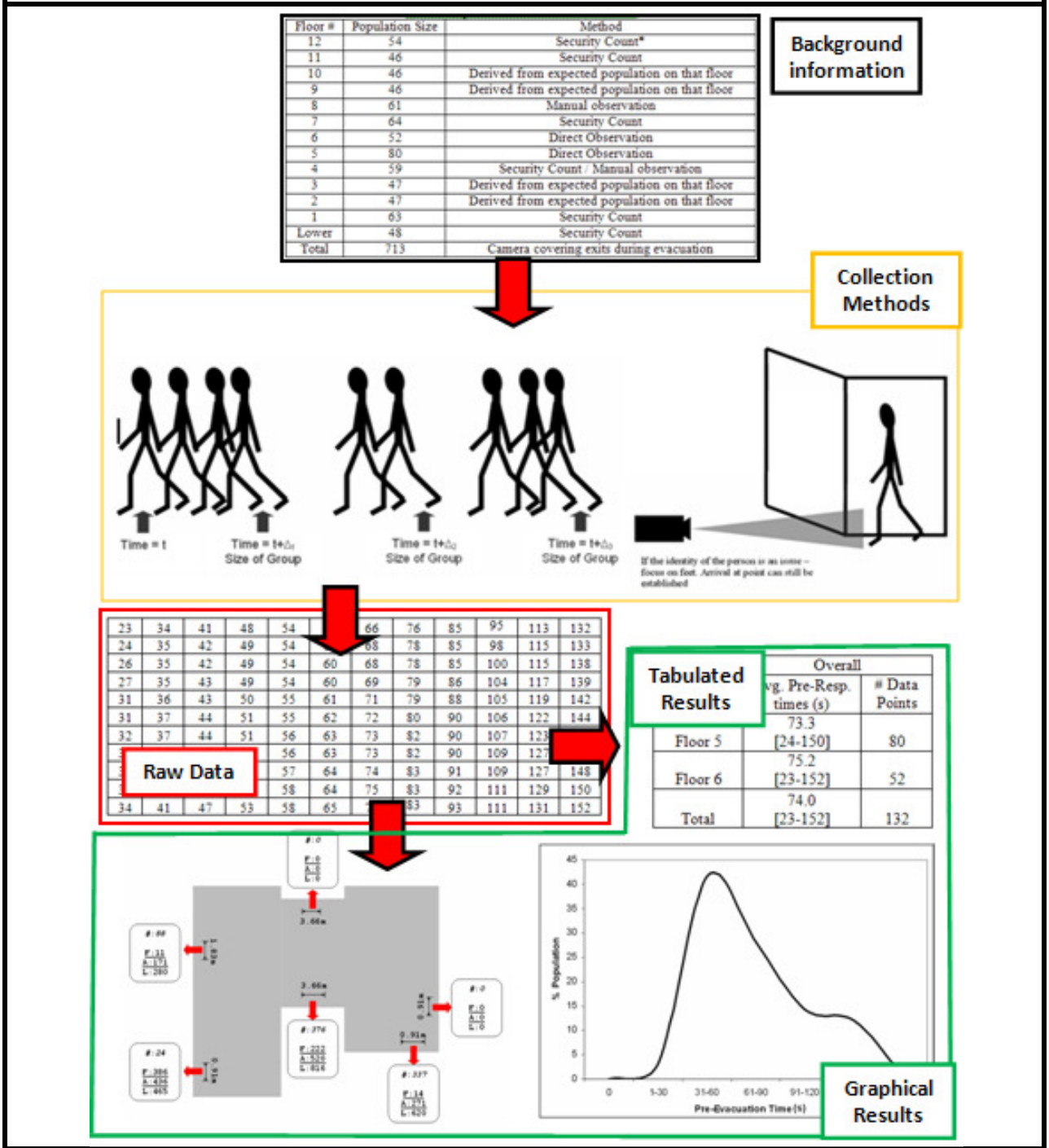


Figure 9: CASE STUDY – North American Data Collection Exercise [83].

The data collection case studies reinforced the importance of documenting the background conditions of the event and the manner in which these might influence the results. In addition, the collection methods employed not only influenced the raw data that was collected but the manner in which this data could eventually be presented to third parties. Again, this clearly established a need for a number of tools that could help in the data collection process and in the representation of the information/data collected.

The compilation of material (from existing sources, expert opinion, and from data collection exercises) provided a foundation for the development of the key *Data Portal* components. These are now described.

5 Developments

The developments produced during this project to enable the implementation of the *Data Portal* are now presented. The primary developments are the *Data Acquisition Matrix* (see Section 5.1) and the *Data Template* (see Section 5.2). The *Data Template* required a number of secondary developments in order for it to function (e.g., the *Timeline*, *Keyword Equivalence Classes*, *Narrative Timeline Notation)*. Several of these secondary developments may have value in and of themselves and so are also briefly described in Sections 5.3-5.5.

5.1 Development 1: Data Acquisition Matrix

Objective: Produce guidance to help ensure that future data collection efforts can populate the Data Template as comprehensively as possible.

A critical part in representing the data in an unambiguous manner is having access to as complete a data-set as possible. As Proulx stated,

> *"It is important to use a sound methodology to study evacuation drills to be confident later in interpreting and generalizing the results" [56]*

This completeness relates both to the data, the data collection methods employed, and the context under which the data-set was collected. This completeness depends on the data collection process itself, and cannot therefore be ensured purely by improved representation and access; i.e., purely through the use of *Data Template* (and eventually the *Data Portal*) alone. A key component of the *Data Portal* is therefore providing guidance on the data collection process to ensure that future data-sets are as complete and comprehensive as possible.

Guidance has been developed, in the form of a *Data Acquisition Matrix*, to aid in the data collection process: to provide key reminders as to the elements of the event in question that should be documented. The guidance provided in the *Data Acquisition Matrix* ranges from the initial concept phases of the data collection process to the collection and analysis of the data. It is categorized according the stage of the data collection process and the component of the event being examined (a simplified version of this is shown in Table 8, with the full matrix shown in Appendix B). Each cell in the matrix leads to a resource (e.g., a set of documents), describing the component in question. Depending on the particular aspect of interest, this matrix leads to questions for the researcher to address, checklists, and/or guidance documents to refer to during the entire data collection process. This design was produced with potential online applications in mind.

Table 8: Simplified version of the *Data Acquisition Matrix*.

SCOPE / TIMELINE	Procedure **Pr**	Response **Re**	Organization **Or**	Population **Po**	Objectives **Ob**	Structure **St**	Environment **En**	Data Acq. **Da**
Blueprint **B**	LINK TO QUESTIONS	LINK TO QUESTIONS	LINK TO QUESTIONS (See Table 9)	LINK TO QUESTIONS	LINK TO QUESTIONS	LINK TO QUESTIONS	LINK TO QUESTIONS	LINK TO QUESTIONS
Investigation **I**	LINK TO CHECKLIST	LINK TO CHECKLIST	LINK TO CHECKLIST	LINK TO CHECKLIST	LINK TO CHECKLIST	LINK TO CHECKLIST (See Table 10)	LINK TO CHECKLIST	LINK TO CHECKLIST
Preparation **P**	LINK TO DESCRIPTION OF ROLES	LINK TO DESCRIPTION OF ROLES	LINK TO DESCRIPTION OF ROLES	LINK TO DESCRIPTION OF ROLES	LINK TO DESCRIPTION OF ROLES	LINK TO DESCRIPTION OF ROLES	LINK TO DESCRIPTION OF ROLES	LINK TO DESCRIPTION OF ROLES
Execution **E**	LINK TO DESCRIPTION OF ROLES	LINK TO DESCRIPTION OF ROLES	LINK TO DESCRIPTION OF ROLES	LINK TO DESCRIPTION OF ROLES	LINK TO DESCRIPTION OF ROLES	LINK TO DESCRIPTION OF ROLES	LINK TO DESCRIPTION OF ROLES	LINK TO DESCRIPTION OF ROLES
Data D_a^e	LINK TO DESCRIPTION OF ROLES	LINK TO DESCRIPTION OF ROLES	LINK TO DESCRIPTION OF ROLES	LINK TO DESCRIPTION OF ROLES	LINK TO DESCRIPTION OF ROLES	LINK TO DESCRIPTION OF ROLES	LINK TO DESCRIPTION OF ROLES	LINK TO DESCRIPTION OF ROLES

Two acronyms have been developed to describe the scope of the guidance provided (PROPOSED) and the data collection timeline (BIPED). It is hoped that these acronyms will act as simple reminders of the key data acquisition components to be addressed at various points in time. The scope of the data collection is categorized as follows: Procedure; Response; Organization; Population; Objectives; Structure; Environment; and Data acquisition. The timeline is categorized as follows: Blueprint (planning what to do); Investigation (establishing specifically how to do it); Preparation (configuring the data acquisition elements); Execution (collecting the data); and Data (manipulating the data). The permutations of these two sets of factors (PROPOSED and BIPED) combine to address the key components of data acquisition.

The nature of the guidance provided is sensitive to the stage of the data collection process (BIPED) and the factor being addressed (PROPOSED). For instance, early on in the process (during the planning stages), questions are provided to prompt the user on issues that should be considered; later in the process (where an event has been decided upon) checklists are provided to remind the user of issues that need to be addressed as they prepare and collect the data; in the final (preparatory and execution) stages, guidance is provided on the roles that need to be adopted for these stages to be completed, and the activities associated with these roles. The matrix and the associated guidance are almost 60 pages in length. A full description of this tool is provided in Appendix B. In addition, some instructive examples of the guidance provided are shown below. For instance, the cell *[Organization, Blueprint]* leads to a resource that includes guidance (in the form of questions) on organizational issues that need consideration when planning a data collection exercise (examples of these questions is shown in Table 9).

Table 9: Organizational considerations when planning data collection.

- *What organization enables the procedure of interest to be employed?*
  - *Commercial, federal, academic, military, etc?*
  - *What are their primary activities?*
  - *What are their sensitivities?*
  - *Has this type of organization been exposed to similar incident or events recently?*
- *Does the preferred organization introduce limitations into the data collection process?*
  - *Are there administrative, political, financial or legal limitations?*
- *What are the benefits of the data acquisition process to the organization? Why would they allow the data collection process to take place?*
  - *Financial,*
  - *Public relation,*
  - *Knowledge*
  - *Safety (training, procedure, systems, staffing, etc.)*
  - *Performance (operations, security, etc.)*
  - *Training, etc.*
- *What problems might the data acquisition cause for the organization?*
  - *Disruption of service*
  - *Loss of human resources*
  - *Security issues*
  - *Public relations*
  - *Safety*
- *Does the organization allow/provide for funding opportunities to be explored?*
- *Who are the key personnel/contact points within the organization?*
  - *Who would you need to contact in the host organization in order to understand the procedure employed?*
  - *Are you the appropriate person to make this contact? If not, who within your organization should?*
  - *Do you need to introduce other organizations into the project to mediate/negotiate?*
- *If difficulties are encountered, are there alternative organizations?*
- *What benefits does this organization bring to the project that others lack?*
- *Does the organization require specific reassurance regarding the safety and validity of the event?*
  - *Is an ethics review required? If so, does the organization have an internal process?*
  - *Does your organization have the ability to meet this need?*
  - *Who else would be able to do this?*
- *What are the administrative issues that need to be addressed?*
  - *Medical coverage/support*
  - *Financial issues*
  - *Waiver issues*
  - *Insurance*
  - *Loss of time/earnings for the organization/compensation*
  - *Anonymity of the organization/occupants, etc.*
- *Are active staff members (e.g., people that will employ the procedure) required or will they be provided by the organization?*
  - *If so, advertising, contracts, job descriptions, costing, and possible training is required.*

The cell *[Structure, Investigation]* leads to a set of checklists describing the attributes of the structural components that need to be considered. An example of the escalator checklist is shown in Table 10. This guidance is accessed through hyperlinks from the original master *Data Acquisition Matrix* (see Table 8). This matrix representation has been selected as it is compatible with web-based design (e.g., hyperlinks can be used to link to more detailed guidance), and the matrix can also be used as an overview document in the field.

Table 10: Escalator attributes that may need to be recorded.

Factor	Attributes	Questions	X
Label			
Type		Scissor / enclosed , etc.	
Connecting floors			
Location		Internal location, external, etc.	
Speed			
Direction			
Angle			
Clear Width			
Steps			
	Length of approach	Distance from start of escalator to first step	
	Length of run-off	Distance from last step to end of escalator	
	# steps		
	Rise height / tread depth		
	Nosing		
	Edge of steps		
	Consistency		
	Condition	Debris / damage / etc.	
	Material		
	Diagonal length		
	Occupiable area		
	End notification		
Handrail			
	Projection		
	Material used		
	Height from the step		
Clear head room		Step to the bottom of stair above	
Condition			
Lighting			
	Normal		
	Emergency levels		
Access			
Sign / guidance		Presence / illumination levels, etc.	

The *Data Acquisition Matrix* is designed to inform the collection of new data. It is a companion tool to the *Data Template* described (along with its component parts) in the following sections. It provides general guidance to those engaged in data collection across the range of activities and stages involved in the data collection process. As such, it should help manage the collection of data, and help the collector produce more complete and well documented data-sets; i.e., data-sets that can populate the *Data Template* more completely than might otherwise be the case.

Outcome: Standalone guidance that assists the data collector in their design, collection and interrogation of the target data/information.

5.2 Development 2: Data Template

Objective: Produce a structure that enables data-sets to be represented in detail alongside the data collection methods and background conditions.

The *Data Template* is a key component of the *Data Portal*. It describes the information required for each of the data-sets provided to the portal – the data-set itself, the data acquisition methods and the associated description of the background event conditions. The *Data Template* evolved in response to the source material review and through the lessons learned during data collection activities and the various feedback exercises conducted. Given the range of data sources examined, the scope of the general *Data Template* is well beyond the requirements of any specific data-set. The template is designed to capture as broad a range of information as possible. It is recognized that some data-sets will be more complete than others and that different methods of representing the data may be required. Therefore, the template is as flexible as possible, allowing information to be provided in summary form, in detail and in a range of numerical/graphical/descriptive formats. It is likely that in most cases the *Data Template* will be sparsely populated.

The template will be the basis of a searchable database of data-sets, but also as a placeholder (prompting the provider) for the data-set and associated information that is required. It is intended that the comprehensive nature of the template will act as a resource, providing sufficient context and detail of the data, and a motivating force during the data collection process encouraging collectors to gather the range of information necessary – to act in conjunction with the *Data Acquisition Matrix*.

The *Data Template* and the *Data Acquisition Matrix* have been designed to complement each other: the guidance provided in the *Data Acquisition Matrix* will allow the data collector to populate the template more completely. Similar assumptions and terminology are used throughout to reduce ambiguity. The goal is therefore to allow new data to be uploaded in the most complete form and for existing data-sets to be interrogated and employed in the most unambiguous and refined manner possible.

The full *Data Template* is approximately 20 pages in length in its documentary form. A full description of this tool is provided in Appendix C. Each template instance within the database describes a single data source. The key sections of the *Data Template* can be seen in Table 11. Section A of the template provides the user with background and summary information on the data collection process, allowing an initial judgment to be made of the data-set's relevance and credibility. The factors examined/represented within the data-set and the relationship between them is shown in Section B-1. As part of the template, keywords/terms related to the data-set are presented (Section B-2 in Table 11). These keywords/terms are intended to provide the user with a quick overview of the source content. However, given the range of terms used in the original sources, the *Keyword Equivalence Class* tool has been developed to reduce potential confusion (see Section 5.4). The content of Section B should allow the viewer to get an overview of the key issues examined and the relationships explored.

Table 11: Section headings of the *Data Template*.

OVERVIEW: *Overview of behavioral components addressed and nature of the findings*
A. BACKGROUND INFORMATION – *Overview of data source*
A-1. Reference – *High-level description of data source/source material, allowing reader to establish the location of the source material.* **A-2. Organizations Involved In Data Collection -** *Background information on nature of organizations involved, allowing reader to establish credibility and appropriateness of those involved.* **A-3. Date of Data Collection -** *Overview of age of data, allowing reader to determine whether the data-set is current enough for the intended application.* **A-4. Reviewed Material Accompanying Data-Set -** *Description of supporting material presented by authors, allowing reader to identify other key related reference material.* **A-5. Original Purpose of Data Collection -** *Description of objectives behind data collection, allowing reader to establish whether original application purpose is sufficiently similar to current application.*
B.SUMMARY INFORMATION: *Overview of data content*
B-1. Factors/Variables Being Examined - *Examination of influential factors (e.g., independent variables, IV) and outcomes (i.e., dependent variables, DV) related to the data collection process. May be non-linear, multivariate, etc. May be that many IV lead to single DV, or single IV leads to many DV. This is simply to provide high-level guidance on the factors of interest. This allows reader to gain an overview of the key factors examined.* **B-2. Key Terminology Employed -** *Description of the (1) keywords stated by authors (i.e., identified in key word section of article); (2)significant terms manually derived from review of material; (3) parent terms associated with analysis of (1) and (2) using equivalence classes. Allows reader to understand the terms used and determine whether there are discrepancies and conflicts with their own terminology.*
C. PROCEDURE: *Description of nature of event and procedure employed to manage response of target population*
C-1. Nature of Event - *Description of the event from which data was collected, allowing the reader to establish similarities/differences with intended application.* **C-2. Procedure Employed -** *Detailed understanding of the procedure employed to manage the event, allowing reader to establish similarities/differences with intended application.* **C-3. Preparation for Procedure -** *Description of the preparations made prior to the event, allowing the reader to understand the preparations made as part of the data collection exercise.* **C-4. Technological Resources Employed within Procedure -** *Description of the equipment used to enable the procedure to be employed. Provides the reader with information on a key procedural component.* **C-5. Human Resources Employed within Procedure -** *Description of staff required to facilitate the procedure. Provides the reader with information on a key procedural component.*
D.STRUCTURE: *The physical space in which the event took place*
D-1. Structure/Space Characteristics - *Detailed information on physical space in which the event took place, allowing the reader to more clearly understand the structural environment*
E.POPULATION: *Description of those subject to the procedure*
E-1 Population Characteristics – *Detailed information on target population, allowing the reader to understand the nature of the population involved in the event.*

F.ENVIRONMENTAL CONDITIONS: *Environmental conditions in which the event took place*
F-1. Environmental Conditions - *Detailed information on the environmental conditions, allowing the reader to assess similarities/differences between the original and target environmental conditions.*
G. DATA PROCESSING: *Description of the collection, extraction and analysis processes and the resources involved*
G-1. Data Collection Methods - *Information on the data collection techniques employed, allowing the reader to assess the sophistication and appropriateness of the techniques used.*
G-2. Methods/Tools Used to Extract Data - *Description of extraction/sampling techniques employed, allowing the reader to assess the sophistication and appropriateness of the techniques used.*
G-3. Methods/Tools Used to Analyze Data - *Description of the data analysis techniques employed, allowing the reader to assess the sophistication and appropriateness of the techniques used.*
G-4. Description of Data Presented - *Description of the data-set format and content, allowing the reader to quickly understand the nature of the data provided without delving too deeply into the data-set itself.*
H. EVENT TIMELINE: *Description of event evolution*
H-1. Narrative Timeline Notation - *Description of the event timelines of the various event components allowing direct comparison, allowing the reader to gain insight into the unfolding events.*
I. RESULTS: *Data collected*
I-1. Reported Results - *Details of the numerical/descriptive results reported, providing the reader with a broad understanding of the data produced.*
I-2. Quotations from Text - *Key comments from the original authors/data collectors, allowing the reader to establish what the original authors thought were key occurrences.*
I-3. Conclusions Drawn - *Key conclusions drawn by the original authors/data collectors, allowing the reader to understand what the original authors thought was significant.*
I-4. Theory Development - *Summary of key relationships between the variables identified and the strength of these relationships (e.g., anecdotal, statistical, etc.), allowing the reader to clearly see what the general findings were.*

Section C provides information on the procedure(s) employed to manage the response of the target population. This information relates to the nature of the procedure itself and the human and technological resources employed. This will enable the user to determine whether the practices involved reflect those of the intended application. Section D provides a description of the structure involved in the event. This description relates to the configuration and the key components that may influence performance. Section E similarly describes the target population involved: the population that is responding to the event, as opposed to those managing the event.

Section F describes the environmental conditions that were present during the event. Section G gives some background information on the methods used to collect, extract and analyze the data-set. Section H provides a detailed representation of the event's development using the *Narrative Timeline Notation* (see Section 5.5). This will provide the user with a clearer understanding of the how the key event components evolved in parallel before examining the

results in detail in Section I. These results include the data, conclusions drawn and any higher level theoretical issues developed (likely related to the factors and variables examined, described in Section B-1).

The *Data Template* represents a superficially simple representation of a data-set. However, the design has proved relatively robust against the range of data-set test cases to which it has been exposed. Undoubtedly, data-sets will arise in the future that will have elements that fall outside of the template. As with other elements described in this document, the *Data Template* is a provisional attempt at describing data-sets in a relatively comprehensive manner. It is hoped and expected that the limitations of the template will be demonstrated and that its design will rapidly evolve to cope.

Outcome: A framework has been developed that allows data to be described in a standardized format in conjunction with the conditions evident during the associated event, the data acquisition methods and other key event components.

In the following sections several of the secondary developments required to facilitate the *Data Template* are described.

5.3 Development 2a: Event-Level Timeline /Individual Descriptive Model

Objective: Produce a basic description of low-level and high-level events to aid in the categorization of terms and the development of the Data Template.

In order to clearly define the scope of an event, and therefore the components that need to be supported by data, two descriptive 'models' have been developed: to describe the processes and events involved: at the event level and at the individual level. These provide benchmarks indicating data requirements and also a marker against which other tools (such as key elements in the *Data Template* and *Data Acquisition Matrix,* and in the other secondary developments) can be employed. These developments are not intended to be definitive representations of the timelines in question: only a descriptive schematic of the processes and/or or the phases involved.

Numerous timeline examples have been collected (see Figure 10 - Figure 12) [e.g., 1,71,72]. None of the examples examined adequately describe the process for this project, although, several contributed useful ideas. Several issues with the existing timelines can be identified: (1) the terminologies employed are different from that suggested here; (2) they combine information at the individual and event level; (3) the components represented conflict with those suggested; (4) their intended uses are different from those suggested here.

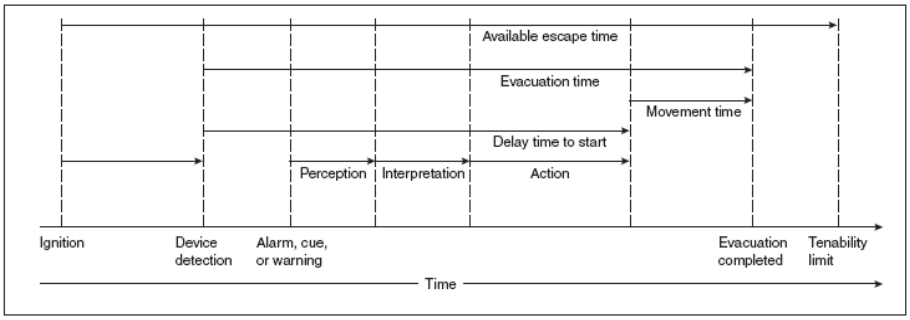


Figure 3-13.3. ***Sequence of occupant response to fire.***

Figure 10: Example timeline produced by Proulx [p3-347,1].

FIRE / CUE INITIATION OR DEVELOPMENT	Cue Validation Process……and Continuing process			
	Receiving Cues	Recognizing Cues	Interpreting Cues	Receiving, recognizing, interpreting (RRI)… RRI…RRI…
		Decision Making Period		
		Premovement Decisions		Transmovement Decisions
				Movement / Refuge Time

Figure 11: Example timeline produced by SFPE Guide [p2,72].

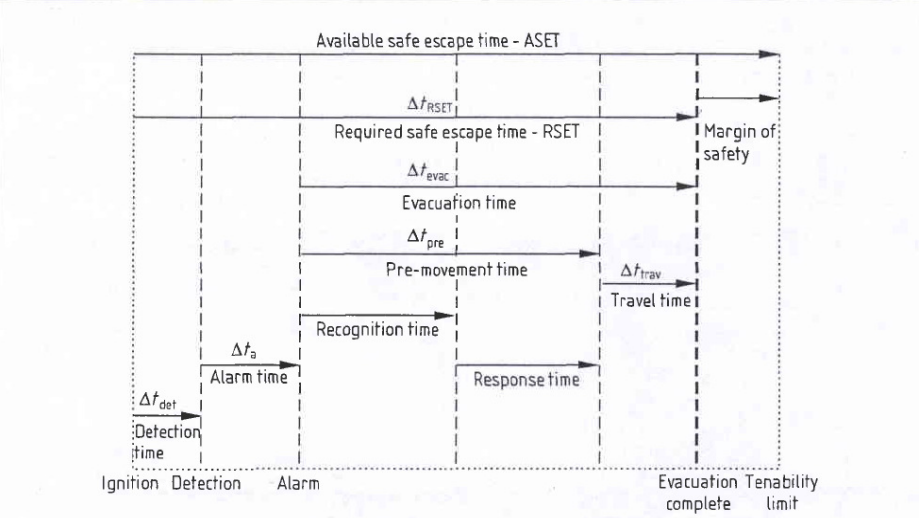


Figure 1 — Simplified schematic of processes involved in escape time compared to available safe escape time

Figure 12: Example timeline produced by Purser [p6,71].

A 'timeline' representation can be established on (at least) two distinct levels: on an individual level and on an event level. The individual and event level representations provide entirely different perspectives of the event require different terminologies and also require different sets of data to support them. The representations parallel the different approaches that are adopted to understand and quantify behavioral performance. The individual descriptive model (this term is used instead of an individual timeline given the cyclical nature of the processes involved) is informed by the individual experience and decision-making process (see Figure 13), while the event level timeline is, by definition, a composite of all the individual activities and the scenario conditions to which the individuals are exposed. The individual model therefore

outlines the key processes through which an individual passes during the decision-making process (i.e., the event from their perspective) and therefore the data that might ideally be expected to be available to represent this process (assuming that each of the processes required supporting data). This understanding is particularly useful to the development of low-level models, along with theoretical research, and in this case the development of *Equivalence Classes* discussed in Section 5.4. In contrast, the high-level event timeline is more relevant to engineering calculations where a less detailed analysis is often required. In effect, the low-level and high-level cater for different types of data users: those developing/applying models, those developing/applying engineering calculations, and those supporting these activities through data collection activities.

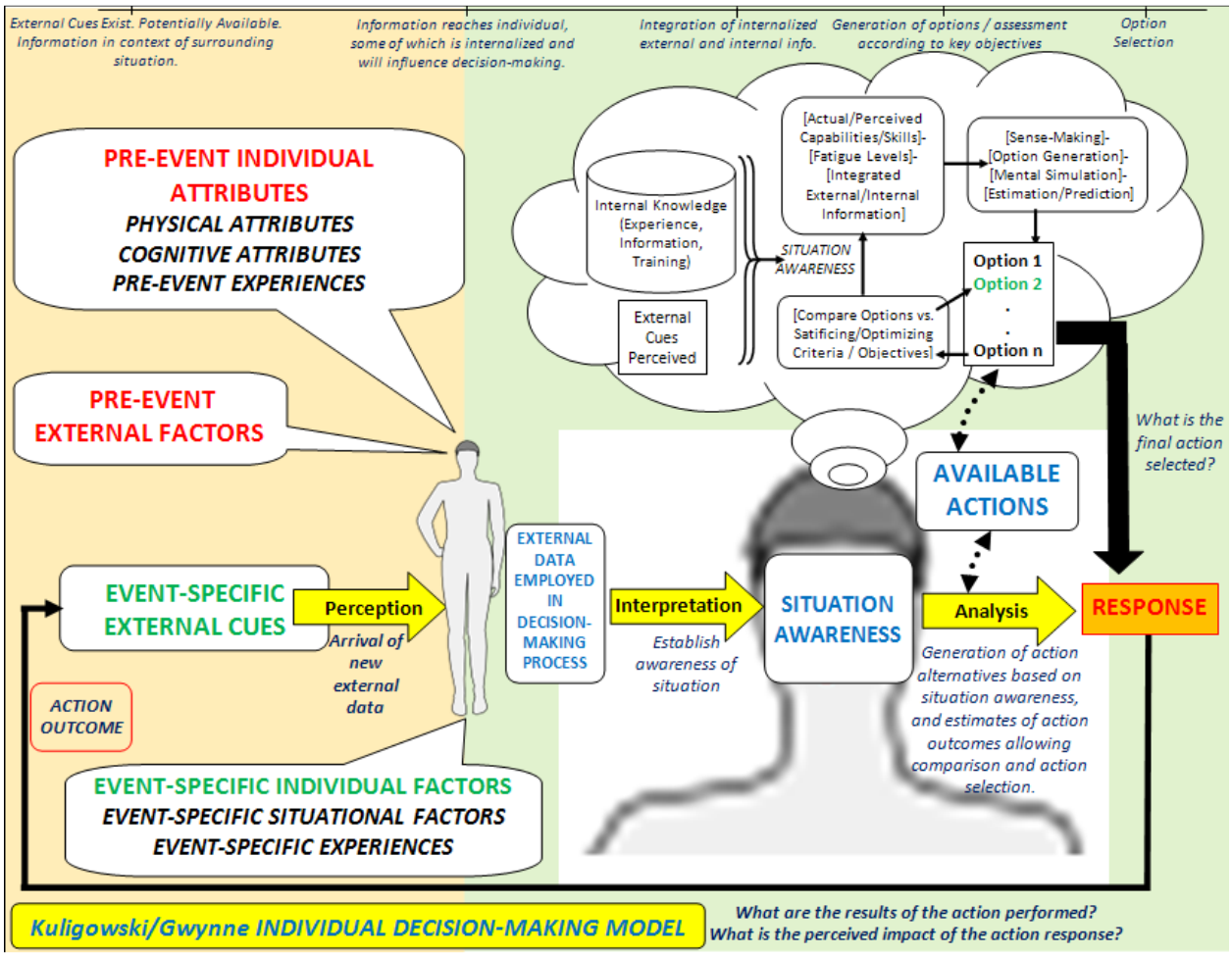


Figure 13: Schematic of individual experience and decision-making model [14-17].

The individual level descriptive model is shown in Figure 13. It was developed jointly from the literature review identified earlier and from the research currently being conducted by Kuligowski [14-17]. Kuligowski is developing a more detailed behavioral model to describe human response, focusing particularly on the period up to when an evacuee initiates evacuation response. The Kuligowski model is derived from survivor accounts from the World Trade Center Incident, and also on other extensive literature reviews [14-17]. Although a

considerable simplification, the model presented in Figure 13 is broadly consistent with her approach. It should be remembered that the approach described here is only intended to be descriptive – primarily used to identify key phases and associated data/terminology, rather than to operate as a fully functioning model.

The individual is initially exposed to external cues (that may be related to the event or pre-exist the event); the individual perceives these cues, and internalizes a sub-set of the information held in the cues; this information is then interpreted and combined with existing internal information, which is then used during the analysis of the situation and the generation of responses; finally, a response is selected and acted upon, which may then influence the external conditions, closing the cycle. The key definitions from this process are shown in Table 12. The primary value of these terms (and indeed the model itself), is in understanding the decision-making processes involved and providing a framework for the *Equivalence Classes* described in Section 5.4.

Table 12: Key definitions employed in the individual decision-making model.

Component	Sub-Component	Description	Example
Event-Specific External Cues *External cues that are currently in the surrounding environment that are related to the event and which exist as a result of the event.*			Presence of smoke Alarm signal
Pre-Event External Factors *External factors that are currently in the surrounding environment, but which existed prior to the event.*			Background noise Security desk / arrangement
Event-Specific Individual Factors *Individual factors that arise during the event.*	Event-Specific Situational Factors	Temporary factors specific to the current situation.	Location Alertness
	Event-Specific Experiences	Recollections of previous pertinent situations during the current event.	Perceived time constraints
Pre-Event Individual Attributes *Attributes that the individual has prior to the event*	Physical Attributes	Individual attributes that directly influence their physical response.	Age / Gender Presence of an impairment
	Cognitive Attributes	Individual attributes that influence their decision-making process.	Visual impairment Basic cognitive skills
	Pre-Event Experiences	Historical recollections of pre-event activities and information. Their relevance	Habituation Familiarity

		to the current situation will depend on the nature of the event and the individual's response. These may also evolve during the current event.	
Decision-Making Process *The process by which an individual employs the information available to understand and respond to a situation*	Perception	The process by which external information is sensed by the individual and then internalized.	Seeing smoke, recognizing it as being unusual, establishing that it might pose a real hazard, establishing responses, selecting and then enacting a response.
	Interpretation	The process by which internalized information is assessed and integrated with existing internal information to produce the individual's situation awareness.	
	Analysis	The process by which alternative actions / responses are generated, compared/assessed and then selected.	
	Response	The enactment of the action selected.	
	Outcome	The impact the action response has on the surrounding conditions.	

A general event level timeline has been produced that ties in with the individual approach adopted to simplify and structure the vocabulary employed (see Section 5.4). This uses high-level, generic language. This is intended to be able to represent the range of different events and situations that may arise (see Figure 14).

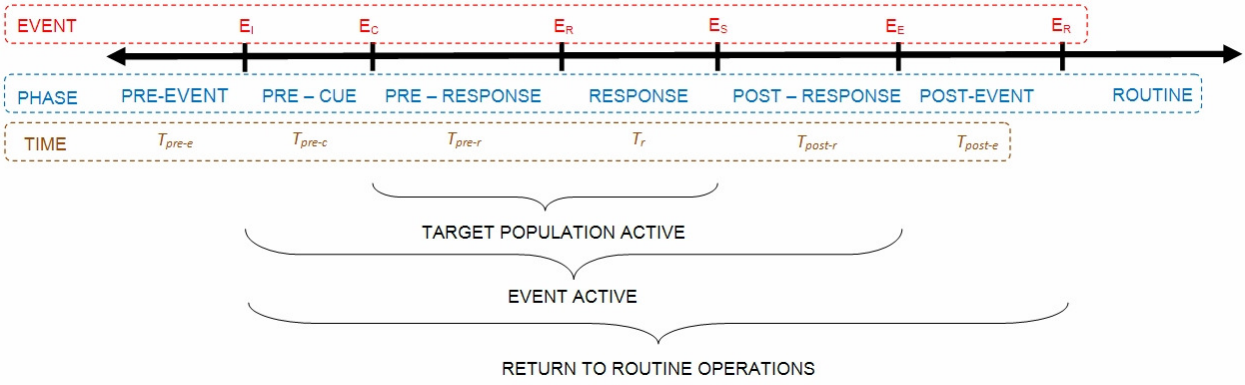


Figure 14: Event Level Timeline

For the majority of the time, the structure will be used in a routine, non-emergency manner; an emergency situation only occupies a relatively tiny amount of time. Therefore, the language used in the timeline should be mindful of the flexibility required. Although the original focus of this project related to emergency response to fire, it should still cater for other facets of movement and also for the various responses that may be employed in response to fire; i.e., *not all fires require evacuation and not all evacuations involve fire*. This also reflects the ICE and SOS concepts discussed at the beginning of this report; i.e., *that the performance during an event is related to the performance before the event, and that factors not directly related to the event also influence performance*. The event level timeline is a composite of the collection of individual experiences and actions (see Figure 15).

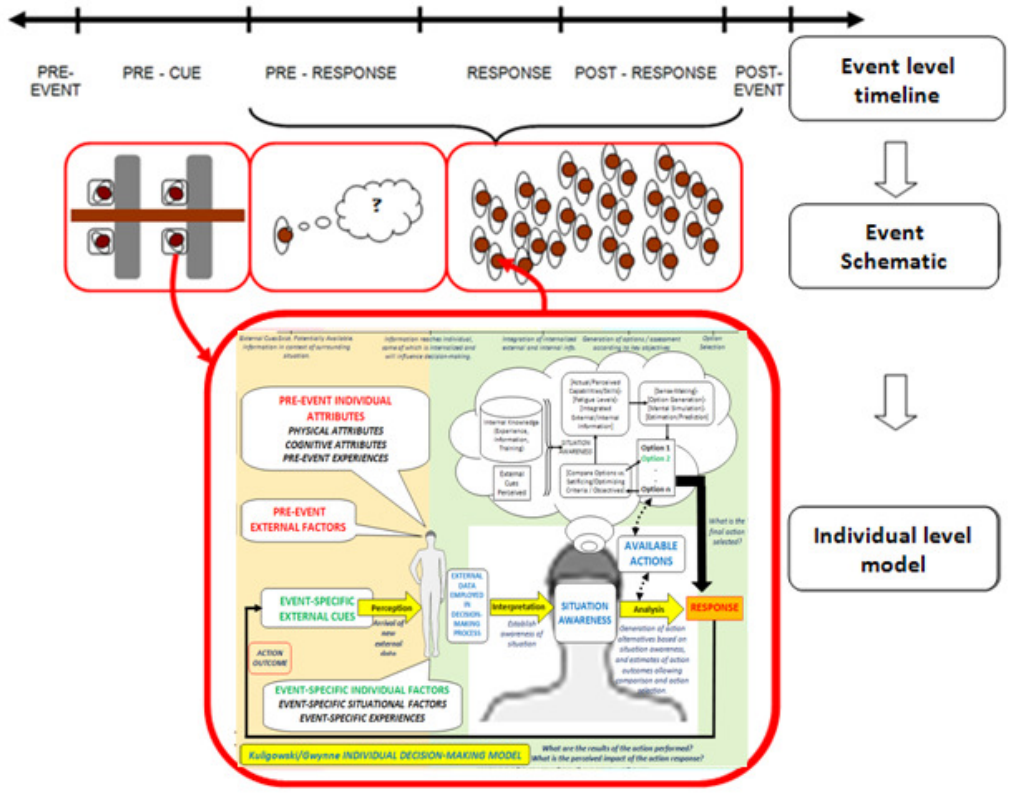


Figure 15: Relationship between individual experience and event timeline.

Seven basic timeline phases are included (see Figure 14). Although specifically designed to be comprehensive and flexible, it is expected that four of these phases will be of primary interest: *PRE-CUE* - the time from the initiation of the event, to cues being available to the population; *PRE-RESPONSE* - the time from when cues are available to the population, to the commencement of a purposive response by the population; *RESPONSE* - the time from initiation to completion of this purposive response; and *POST-REPONSE* - the time from the completion of the purposive response to the event being declared over. In reality, these phases are ambiguous, indistinct and overlapping. However, here the purpose of this timeline is to represent the phases that might be present during an event, benchmark terminology and data,

and help anchor some of the other developments made as part of the *Data Acquisition Matrix* and the *Data Template*, rather than definitively represent the event process itself.

The events, phases and time components are described in Table 13. Here the phases are defined (and separated) by two bounding events that, ideally, could be measured during an event.

Table 13: Description of events, phases and time components.

Phase	Initial Event	End Event	Time Component	Definition / Description
Pre-Event [Pre-E]	E_0 – Structure in service	E_I – Event initiated	T_{Pre-E}	Routine period between the initial use of the structure and the beginning of an event (if appropriate).
Pre-Cue time [Pre-C]	E_I – Event initiated	E_C – Cue(s) Available to Target Population	T_{Pre-C}	Time between the beginning of an event and the presence of the first cues that may indicate the existence of the event. For instance, presence of smoke, alarm initiation, staff activities, etc.
Pre-Response [Pre-R]	E_C – Cue(s) Available to Target Population	E_R – Initiation of purpose response by target population	T_{Pre-R}	Time between receiving cue(s) and initiating purposive action to reach a point of safety.
Response time [R]	E_R – Initiation of purposive response by target population	E_S –Objective reached by population	T_R	Time spent performing purposive actions to reach objective. For instance, evacuating the building, reaching a shelter, reaching an assembly point, etc.
Post-Response [Post-R]	E_S –Objective reached by population	E_E –All event related activities are over	T_{Post-R}	Time from objective being reached to active procedures being stopped; i.e., time for the event to be declared over once safety has been reached by the population.
Post-Event time [Post-E]	E_E –All event related activities are over	E_R –Structure returns to routine activities	T_{Post-E}	Time from the event being declared over to the structure returning to routine use (if appropriate).
Routine [Ro]	**After E_R** – Structure returns to routine activities		T_{RO}	Time after the structure has returned to routine activities.

Given that the specifics of the event (i.e., incident, experiment, drill, etc.) are unknown and the response to it are not specified, the term 'response' is used rather than something more specific, such as 'evacuation,' or some other response-specific term. This term is deliberately general, in order to cater for the range of situations and the range of responses (e.g., evacuate, defend-in-place, etc.). This approach is maintained in the development of the *Equivalence Classes*, where umbrella terms are used to represent a number of lower level terms. This is described in more detail in the next section.

Outcome: Simple representation of event-level and individual-level progression.

5.4 Development 2b: Keyword Equivalence Classes

Objective: Produce a means to improve the searching and querying of templates by including less ambiguous keywords and aid in the development of the Data Template.

The original purpose in examining the terminology employed was to ensure that the data description within the template was as unambiguous as possible. However, in doing so it became apparent that a facility to clarify, or at least organize, the terminology used in the field would be of some use. It is acknowledged that any attempt to standardize the terms in a single step – by providing a definitive set of terms - may at best be counterproductive and at worst seen as hugely presumptuous. Another approach has therefore been adopted to initiate this process.

It should be stressed that the *Keyword Equivalence Class* development represents an initial step (from a relatively narrow perspective) at gathering together the terms that would be involved in any query or search capability within the *Data Portal*. This is intended to be modified, restructured and developed. The *Keyword Equivalence Class* is therefore an initial pass at collecting together key terms, identify useful grouping terms and categorizing them accordingly. It should also be noted that this set of terms is only a sub-set of those actually collected during the review of the original source material. The full collection and categorization of these terms was beyond the scope of this project; indeed, it would form a worthwhile project in and of its own right.

It has been established that many different terms are currently employed for the same behavioral (or related) components. The range of terms used is due to a number of factors: the background of the researchers, collection date, intended application area, native language, natural variation in the use of language, etc. This variation can promote ambiguity in the nature and subject of the data collected. *Equivalence Classes* have been developed that collect together terms into sets that have the same or similar meaning, or where they are used as if they have the same meaning. For each of the *Equivalence Classes*, a parent term is suggested; that is, a term that is deemed most representative, transparent, and descriptive of the equivalence class in question and the family of terms within it. In some instances, these parent terms are not suggested as terms to be used in the field; they are instead placeholders to allow similar terms to be grouped together. Below parent terms are child terms that represent components that fall within the parent class of terms. These represent lower-level terms related to an attribute of the parent term, a member of the set described by the parent term, a process, a specific type, or a related adjective.

For each data-set that populates the *Data Template*, the user provides the keywords/terms that are associated with it – derived from or suggested by the original material. These may, for instance, be the keywords associated with a journal article, and/or terms derived from reviewing the material. The intention is that once provided to the *Data Template* (once fully implemented as part of the *Data Portal*), the keywords will be automatically examined by the *Data Portal* and compared against the set of *Equivalence Classes* to establish a match. This

comparison will determine whether a more suitable equivalent term exists (e.g., a low-level 'child' term describing the same attribute or component), and whether a parent term exists (i.e., an umbrella term describing a higher level entity). Depending on the nature of the class in question, several child/parent terms may be generated, according to the depth and complexity of the hierarchy represented. The presence of these keywords should help the viewer more reliably identify the content of the data-set and the associated material. For instance, the term **Age** might be inserted as a child term, along with **Physical Attribute** and the parent term **Individual**. These terms will then be inserted into the template (in Section B-2) to provide a clear indication of exactly what is addressed in a consistent manner, in addition to the terms employed within the specific data-set. The full list of equivalency classes generated is presented in Appendix D. The exact method of keyword insertion is, of course, to be determined and will be dependent upon the design of the implementation. However, the development of the *Equivalency Classes* should at least help inform this process.

An example (hypothetical) *Equivalence Class* is presented (see Figure 16). The terms presented broadly describe the time period between a cue being received (e.g., an alarm signal or smoke) and an individual initiating purposive evacuation behavior. These terms are derived from three different sources: model developers (top box in Figure 16), data collectors (middle box in Figure 16), and theoreticians (bottom box in Figure 16). Although there is some overlap, there are some differences between the terms derived from the different sources.

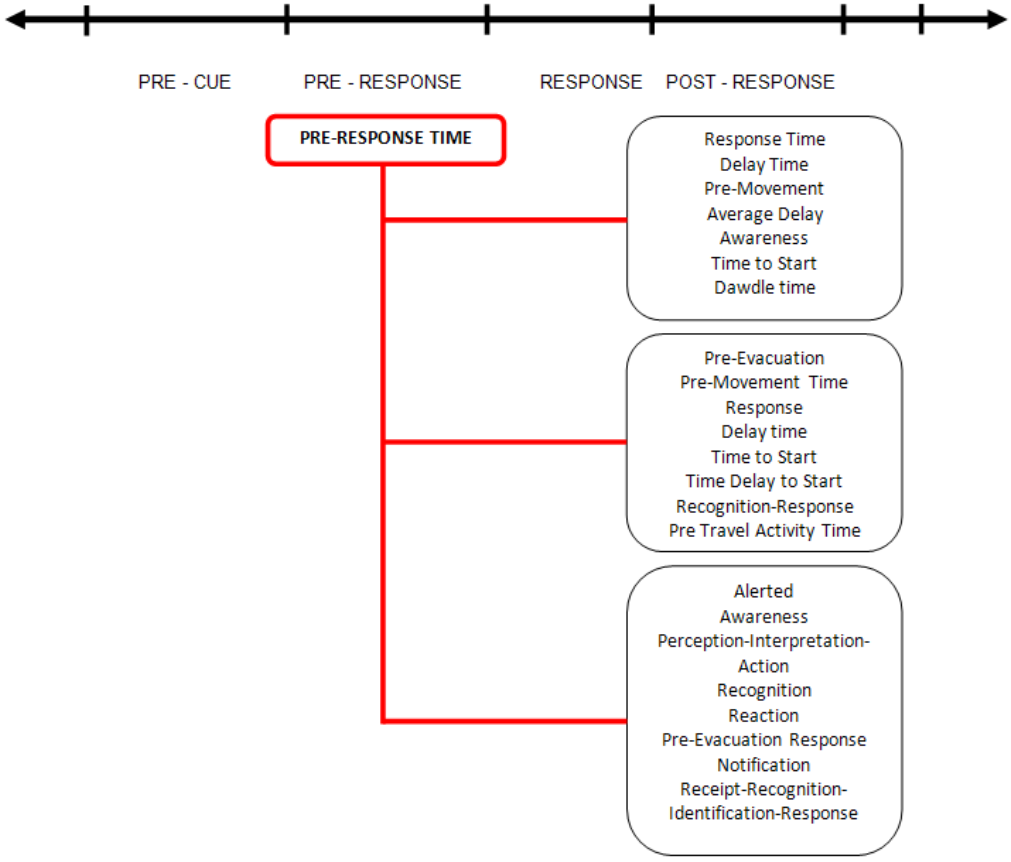


Figure 16: Hypothetical *Equivalence Class* for pre-response time.

Given the *Equivalence class* shown in Figure 16, any of the terms found during a search (e.g., delay time), will be associated with the parent term (e.g., pre-response time). This parent term will be inserted into the keywords associated with the data-set. This will ensure some consistency between the terms used to describe the different data collected addressing the same topic; i.e., that different data-sets addressing the same egress component will be linked through at least one common keyword. This is particularly useful where an existing keyword (such as delay time) might reasonably refer to a number of different behavioral components.

The focus of the list is to help categorize the numerous terms that might be used to represent human behavior in fire or in associated events. A brief overview of the key terms is now provided. Terms in bold are suggested keywords; i.e., these are suggested to be used in the query/search engine as parent or child terms. Terms underlined are tentative keyword suggestions. Terms on the same line have a similar meaning or address a related subject (i.e., equivalent terms). Terms indented and below another term (i.e., child terms) are either member objects, attributes, adjectives or other terms directly related to the parent term.

Event Timeline:
- [**Pre-Event**]
- [**Pre-Cue**]
- [**Pre-Response**]
- [**Response**]
- [**Post-Response**]
- [**Post-Event**]

[**Population**]:
- [**Size**] / [**Distribution**] / [**Nature**] / [**Group**]

[**Individual**]:
- [Characteristics]
- [**Physical Attributes**]
  - [**Age**]/[**Gender**]/[Physical Condition]/[**Height**]/[**Weight**]/[**Speed** (**Horizontal** | **Ascending** |**Descending**)]
  - [([**Sensory**]|[**Visual**]|[**Hearing**]|[**Mobility**]) **Impairment**]
- [Cognitive Attributes]
  - ([Cognitive]) Impairment] / ([Cognitive]) [Skills]
- [Experience]/[**Familiarity**]/[**Training**]/[**Role**] [Social Attributes]/[Cultural Attributes]
- [**State**]/[**Location**]/[**Activity**]/[**Engagement**]/[**Commitment**]/[Encumbrance]/Injury/
- [**Fatality**]
- Decision-Making Process:
  - [**Perception**]/[**Cue**]
  - [**Analysis**]
  - [**Interpretation**]
  - [**Response**]/[**Action**]

Individual responses to an event are represented by the following generic (model friendly) 'placeholder' terms:

- ([**Assess**] |[**Commence**]|[**End**]| [**Modify**]|[**Maintain**]) [**Action**]
- ([**Modify**]|[**Maintain**])[**Objective**]
- ([**Emit**]|[**Receive**]|[**Update**]|[**Process**]|[**Interpret**]|[**Seek**])[**Information**]
- ([**Give**]|[**Receive**])[**Aid**]/[**Aid Self**]
- ([**Collect**]|[**Deposit**]|[**Use**])[**Object**]

[**Structure**]

- [Structural Characteristics]
  - [**Type**]
  - [**Height**][Number Of Floors][**Area**]
  - Configuration

Structural Component

- [**Floor**]
- [**Elevator**]
  - [**Type**]/[Maximum Load]/[Door (Effective) Width]/[Speed]
- [**Stair**]
  - [**Type**]/[**Direction**]/(**Effective) Width**]/[**Riser Height**]/[**Tread Depth**]/[**Step**]/[**Handrail**]/ [**Landing**]
- [**Escalator**]
  - [**Speed]/[Width]/[Direction]/[Riser Height]/[Tread Depth]/[Step**]/[Handrail]
  - [Horizontal Component]
- [**Ramp**]
  - Incline
- [Horizontal Component]
  - (Occupiable |Usable) [Area]
  - (Effective)[Width]| [Height]
- [Travelator]
  - (Effective)[Width]| [Length]
  - [Direction]
  - [Capacity]
  - **[Speed]**
- [**Doorway**]
  - [Door Operation]/[**Type**]/[**State**]/[**Use**]/[**Height**]/**(Effective)**[**Width**]
- [**Refuge**]
- [**Seat**]
- [Assembly Point]
  - [Capacity]

[**Environment**]

- **[Ambient]/**[**Smoke]/[Gas]/[Visibility]/[Fire**]/[**Temperature**]

[**Procedure**]

- **[Type]**
- **[Preparation]**

[Documentation]
[Human Resources]
[Management]
[Technological Resources]
[Notification] / [**Signage]/[Sign]**

[**Event-Specific External Cues**]
[**Event Specific Individual Factors**] (**Situational Factors** | **Experiences**]
[**Pre-Event External Factors**]
[**Pre-Event Individual Attributes**]
Event Level Components
Basic Engineering Terms
[**Specific**]/[**Flow**]
[**Route Use**]
[**Speed**]
(**Population**) [**Density**]
[**Time**][Outcome]
[**Population Size]**
(Occupiable | Usable)**[Area]**
[**Distance]**
(**Physical** | **Effective**) [**Width** | **Height** | **Depth**]
[**Emergent Condition**]
[**Flow Characteristics]/[Queue]/[Congestion]**
(Level|Experienced)**/[Merging]/[Branching]/** [Bidirectional Flow]/ [Counter Flow] / [Contraflow]/[Upstream]/[Downstream]/
[**Model**]
[Background]
[Availability]
[Requirements]
[Application Area]
[Use]
[Environmental (Representation)]
[Population (Representation)]
[Response (Representation)]
[Structural (Representation)]
[General Approach]
[Testing]
[Output]
[Scope]
[**Data**]
[Acquisition]
(Acquisition | Collection) [Device]
[Source]
[**Format**]

The list of terms that form the *Keyword Equivalence Classes* is a sub-component of the *Data Template*. It is designed to enable the set of keywords provided to be augmented through the provision of additional, more generic and less ambiguous terms. However, it is felt that the list itself may also have some limited value in understanding the range of terms used in the field.

Outcome: A preliminary categorization of keywords has been developed.

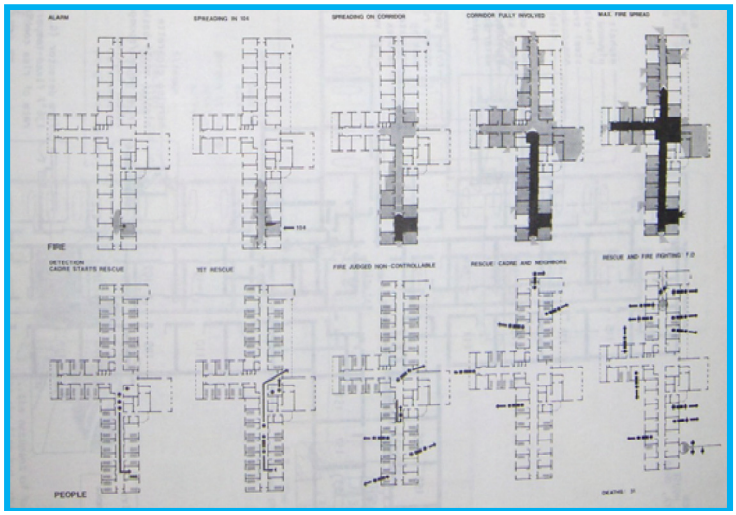
5.5 Development 2c: Narrative Timeline Notation

Objective: Produce a method of representing the evolving event conditions enabling the user to represent the event in more detail and aid in the development of the Data Template.

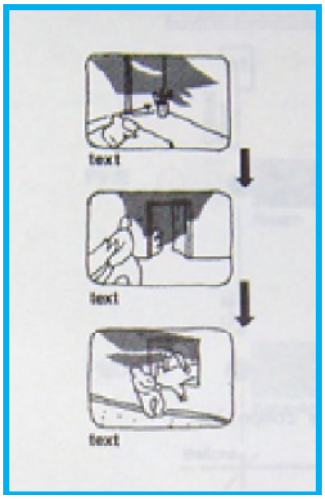
It is important for the user to be familiar with the background conditions associated with the data-set (e.g., influential factors, actions, events and data collection issues), in order for them to fully understand the data-set in question. However, it is often just as important to understand how these factors interacted and evolved during the event: their influence may not have been static, consistent or independent of the other factors present. This understanding may then allow third parties to better understand the chain of events leading to the results produced – both in terms of the event and the data collection process - and how the various factors evolved in conjunction with each other.

A key component of the *Data Template* was the development of the *Narrative Timeline Notation*. This effectively allows the description of the data acquisition 'event', irrespective of whether it was an experiment, a drill, circulation movement or a real incident. It was designed such that a broad range of factors could be described in a manner consistent with the other tools provided, and also allowed for these factors to evolve during the course of the event. This was felt useful in providing a more detailed context of the data acquisition process.

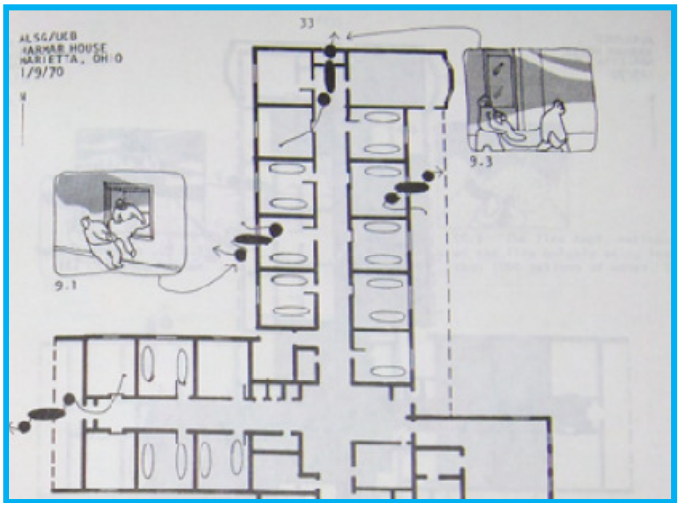
To support this effort, a number of graphical techniques to describe the unfolding of an event have been examined. These have been derived from within the behavioral and investigative sciences including the notations developed by Lerup, NTSB, de Haan, Finland, amongst many others [84-87]. Examples of these are shown in Figure 17 and Figure 18.



Plan view [p25, 84].



Storyboard [p17,84].



Combination view [p33,84].

Figure 17: Composite of Lerup timelines employed to represent hospital/care home evacuation procedures [84].

The Lerup approach (originally designed for hospital evacuations) is felt to provide the greatest degree of flexibility of the techniques examined while providing the richest description of the event (see Figure 17). It is also an approach that has been adopted (albeit in a simpler form) by NIST [18] during their analysis of the Rhode Island incident (see Figure 18).

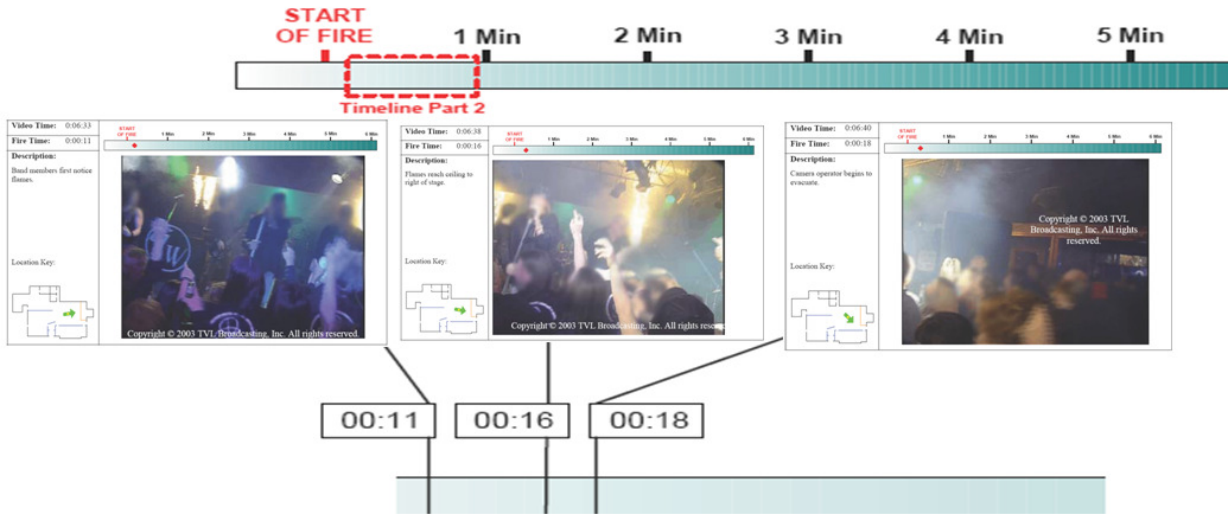


Figure 18: Composite of NIST timeline employed to represent the Rhode Island incident [p2-4,pA-4,pA-5, 18].

A hybrid version of the notation has been developed. This combined a simple tabular format with peripheral graphics and was consistent with the terminology used in the *Event Level Timeline* and the *Data Acquisition Matrix*; i.e., allowing the reader/user/portal to make direct comparisons between the *Data Acquisition Matrix* and the *Data Template*. This was felt to improve the intuitive understanding of the information presented. This simple notation allows the user to represent the unfolding events, identifying changes in the status of key elements. This was developed through examining a range of existing methods used to represent event activities (storyboards, schematics, notation systems, etc.), and testing them against the types of data-sets available in the field, the desired data/associated information, and hypothesizing as to the elements of most value to the range of expected interested parties. The timeline notation concept that has been developed is shown in Figure 19.

The derived tool provides a simple placeholder format to represent information regarding the development of key components (e.g., the procedure, the response of the population, the data acquisition process, etc.) and overlay them such that direct comparisons can be made. These comparisons can be made between different event components at any particular time, or within the same event component as time progresses. The concept allows for data, files, stills, links or footage to be uploaded allowing the user to gain as detailed an understanding as possible of the unfolding events. When the template is implemented online, it can be redesigned to exploit the presentational and graphical libraries available. For instance, rollover features may allow the user to influence the visibility of information of interest by positioning the pointer, etc.

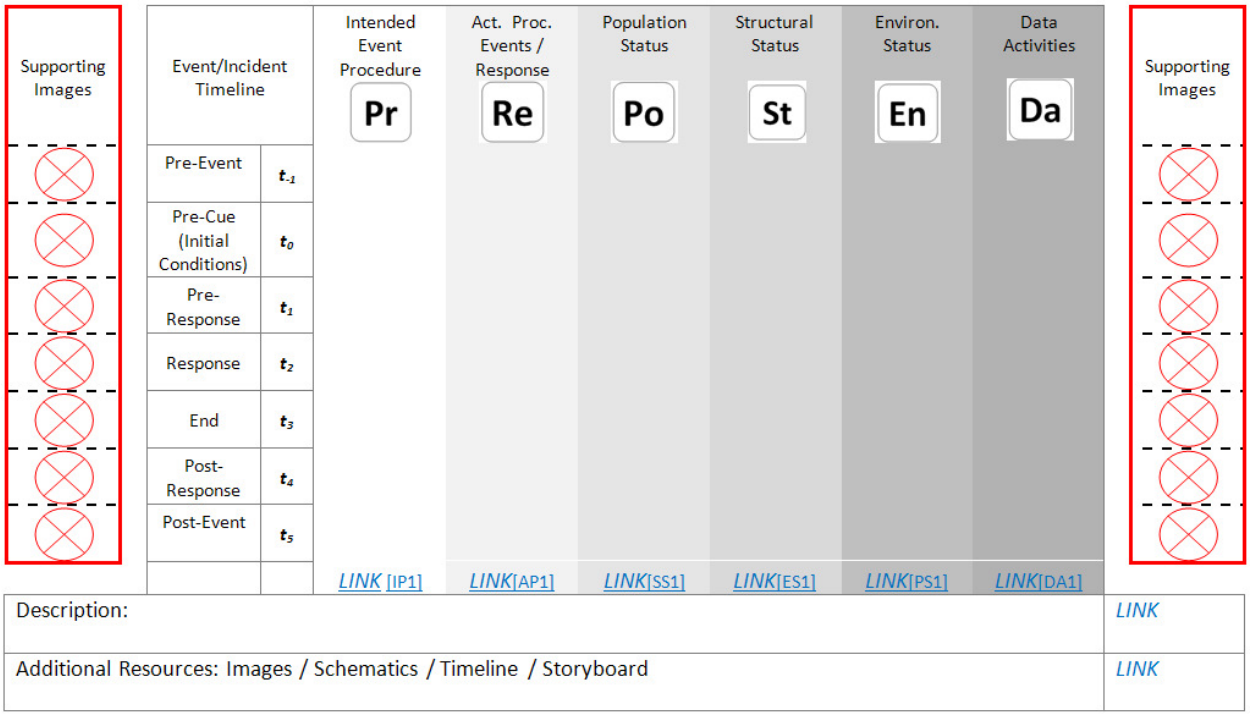


Figure 19: Event timeline notation.

A number of parallel timelines are provided. These include the data acquisition activities, the procedures employed, the response of the population, and the status of the structure/ environment/population at key moments in the event. By placing these situations in parallel timelines, the third party viewer/user should get a much clearer understanding of how the event evolved (see Figure 19), and how these elements developed and may have influenced each other.

The user of this facility will be able to provide information directly to the template, and upload (and associate) diagrams in support of these timelines. These can be used to provide emphasis on key events and/or provide additional explanation. It is expected that still images would be directly associated with specific events in the timelines, although the ability to upload streamed footage should certainly be available should the *Data Portal* is fully functional. An example of the use of an earlier version of this timeline is shown in Figure 20. This was produced in conjunction with one of the data collection activities described in Section 4.4 [83].

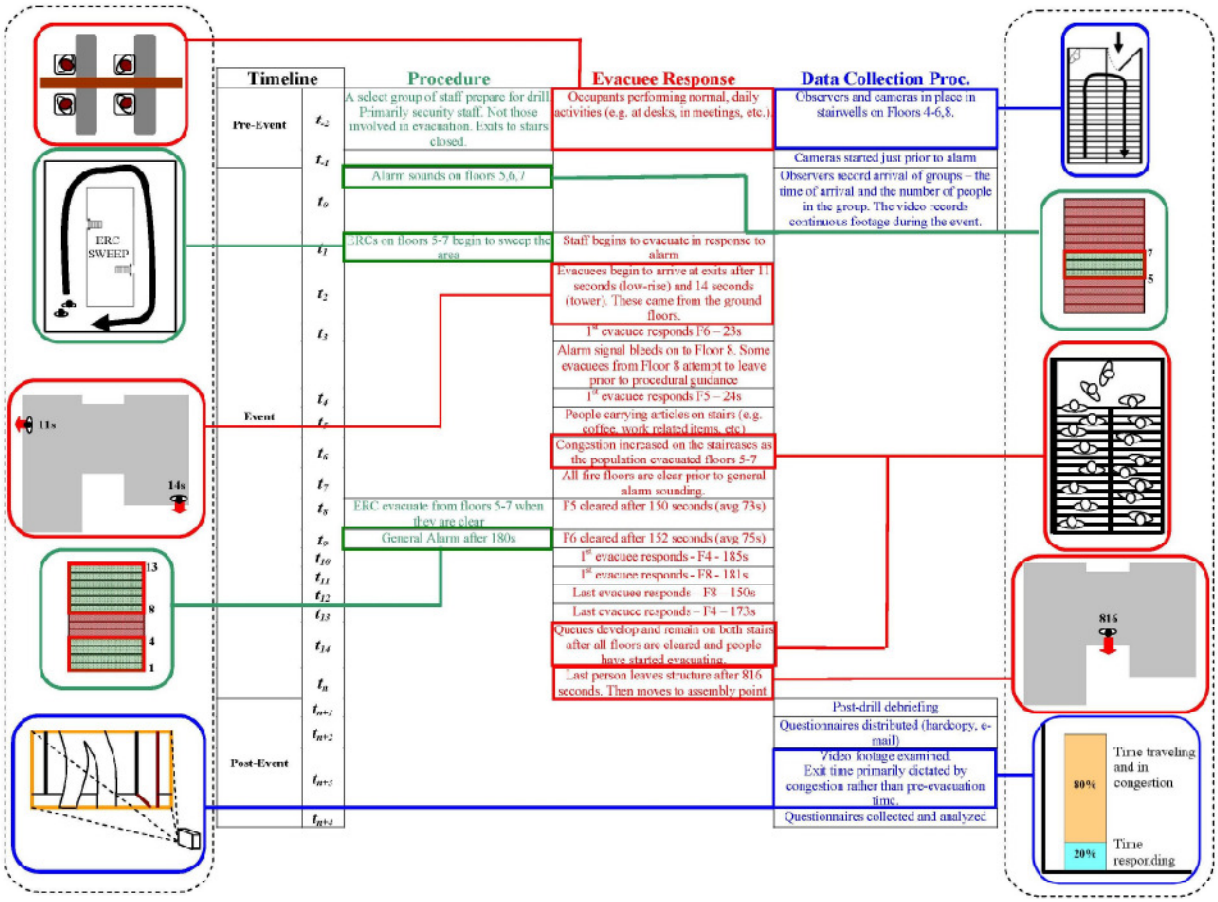


Figure 20: Earlier example of timeline notation reflecting results of data collection activity [83].

Although slightly cumbersome (given the early design iteration), it is apparent that a range of different data types can be associated with the parallel timelines adding richness and context to the description; allowing the user to focus on specific details, while placing them in context with other events and activities. A description of the data types that might be available, and that can therefore be uploaded to the *Narrative Timeline Notation* is presented in Appendix E. These types are defined according to a number of criteria: format, scale, dimension, focus, progress, timeline component.

The purpose behind this development was to provide the user with a detailed understanding of how events unfolded and how different event components developed in relation to each other. This should allow a richer understanding of the event and allow the data to be more clearly interpreted. The design is intended to be consistent with other aspects of the *Data Template* and the *Data Matrix*, allowing the information provided to be cross-referenced, further enhancing the user's understanding of the event from which the data was collected.

Outcome: A simple method has been developed to represent the development of key event components in parallel with each other.

6 Future Work: Data Portal Implementation

The current status of the *Data Portal* is that a set of standalone documentary tools have been produced (shown in Appendices B and C). These tools provide guidance to three different groups of people:

- *Data Collectors*: the tools provide guidance on what factors should be considered when collecting data and the breadth of information required when presenting the data.
- *Data Presenters*: the tools outline the information that needs to be provided to third parties and provides facilities and formats to do so.
- *Data Users*: the tools describe what information should (and can) be provided and therefore forewarns the data users of the omissions present in the data available and on the associated background information.

The nature of the project required that these tools had to be of current value and also to help inform the future design and implementation of the *Data Portal*. The eventual design, implementation and maintenance of the *Data Portal* was never guaranteed and so it was important for the value of the project that an intermediate position could be maintained, while not compromising the long-term value to the *Data Portal* itself. It is felt that this has been achieved.

Currently, the tools are connected in a fairly linear, documentary format. The documentary tools already developed do not take advantage of the capabilities provided by a basic web-based interface, database functionality, more comprehensive navigation, streaming, etc. Critically, these tools do not have the key advantage of an online implementation: the dissemination of data-sets. Some effort has been made to introduce a simple hyperlink structure in the current (MS WORD version of the) documents to demonstrate connectivity between related tool components. Elsewhere, naming conventions have introduced informal connections between components (e.g., between the *Data Acquisition Matrix*/*Data Template* components, the various timelines produced, and to provide additional linkage in the PDF version of this document where the hyperlinks are not active). However, this is rudimentary and does not replicate the flexibility of even the most basic online database facility.

The implementation of the online *Data Portal* will need to provide a simple interface that allows the user to select between the key tools: *Data Acquisition Matrix* and the *Data Template*. There are numerous ways in which this could be implemented. The *Data Acquisition Matrix* could remain in documentary form (e.g., be downloaded for field workers to gain easy access on site), be accessed directly online (e.g. to allow information to be entered and then converted such that it populates sections a new *Data Template* record), and/or downloaded in the form of a local application (e.g., a small application that allows the *Data Acquisition Matrix* to be populated directly onsite, with data stored in an appropriate format, and then uploaded later at the user's convenience). Similarly, the online *Data Template* will present three equivalent functions: standalone guidance on how to represent data (e.g., documentary form, online instructions, etc.), a local application (allowing users in the field to enter data or information in the appropriate format locally and then upload this information at a later convenient time), and the format of each data record within the *Data Portal* itself (i.e., the

online format by which data-sets are entered directly into the *Data Portal*). These tools act on two separate levels: as guidance, and as facilities to collect and store data (see Figure 21).

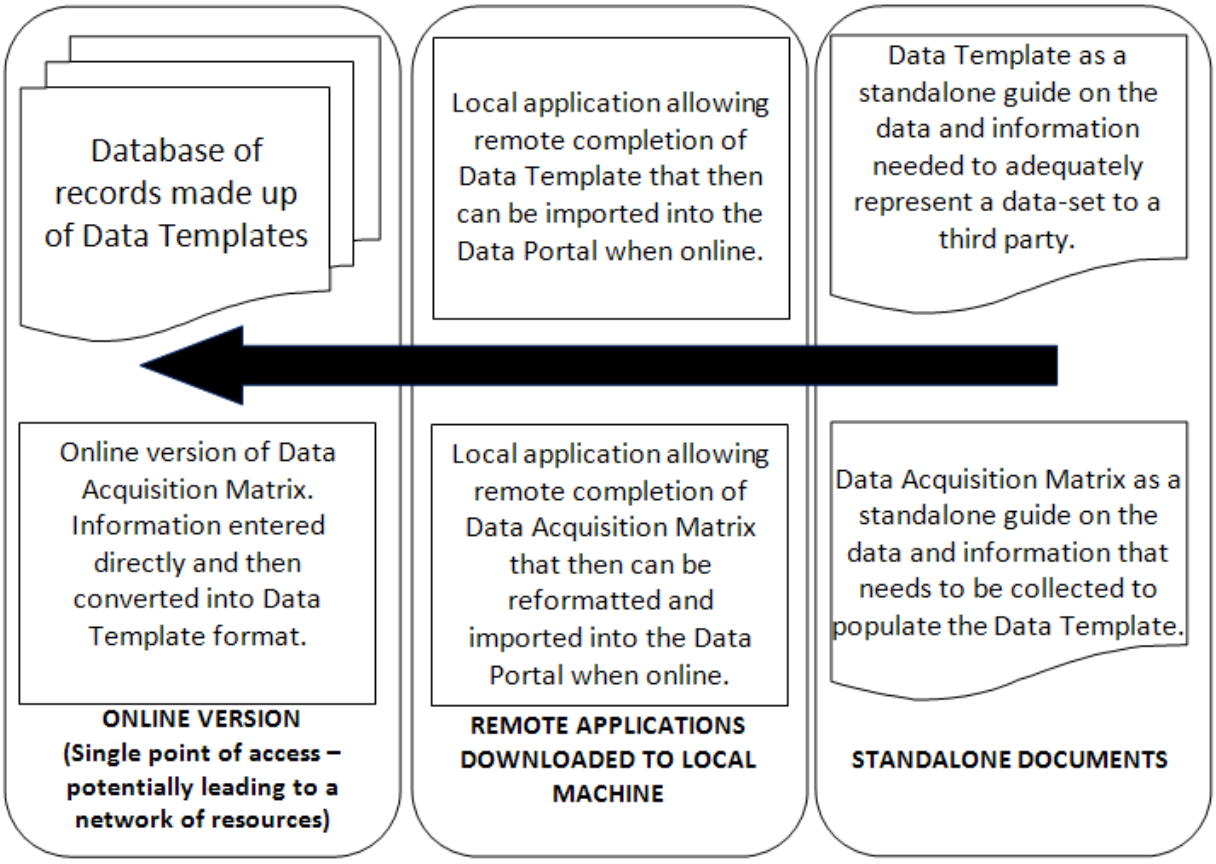


Figure 21: One example of an implemented *Data Portal*.

At its most basic level, the implementation of the online *Data Portal* will need the tools to be converted into an online facility; for instance, instead of it being a single flat layer of information, it will be constructed from a hierarchy of pages/sites that are connected in as intuitive a manner as possible, with much more attention given to the user experience; i.e., the user interface, how each tool is presented and navigation between the tools. Even a traditional online facility has access to a much more complex hierarchical structure and rich content (and context), enabling the user to be more active and engaged in their search of the *Data Portal*, their interrogation of the data and also the potential for them to share/gather new data. This will allow the data to be represented with richer content, allow the user to investigate the data more efficiently, and allow the experience to be far more interactive. *Importantly, the information will be available from an identifiable location and allow it to be distributed more effectively to those who need it.* However, it is felt that even this development does not exploit the full potential of the *Data Portal*.

One of the original goals of this project was to develop a central repository of information for the field – a place where data could be shared. It also represented an opportunity to share and encourage good practice and expertise. Current technological developments allow the

separation of host and user to be blurred to the point where a community of people can develop around a facility; a community that has some investment in its development and upkeep. Examples of this type of community include Wikipedia, Linux, etc. [88,89] For this to occur, the portal facility would need to attract people to it, allow people to have some influence over it, allow people to communicate and collaborate, and then provide them with some value.

The intent of the *Data Portal* was to support the development of the field by improving the availability of data and the quality of data representation. Conversely, through this support (i.e., by influencing and guiding the field) it is hoped that the underlying quality of future data collection will also improve. It was not possible and would not have been appropriate for this report to dictate definitive standards, terminology and formats. Although general principles have been set and guidelines provided (primarily in the form of the *Data Acquisition Matrix* and the *Data Template*), they are in no way intended to represent the final answer – only a current view on the type of information that is deemed useful and the practices that may help acquire this data. The tools provided are therefore a start; a set of live documents that will hopefully promote debate, improve practice, and advance and encourage future developments. Current technology allows for the original concept of the *Data Portal* to be expanded in order to encourage this progress.

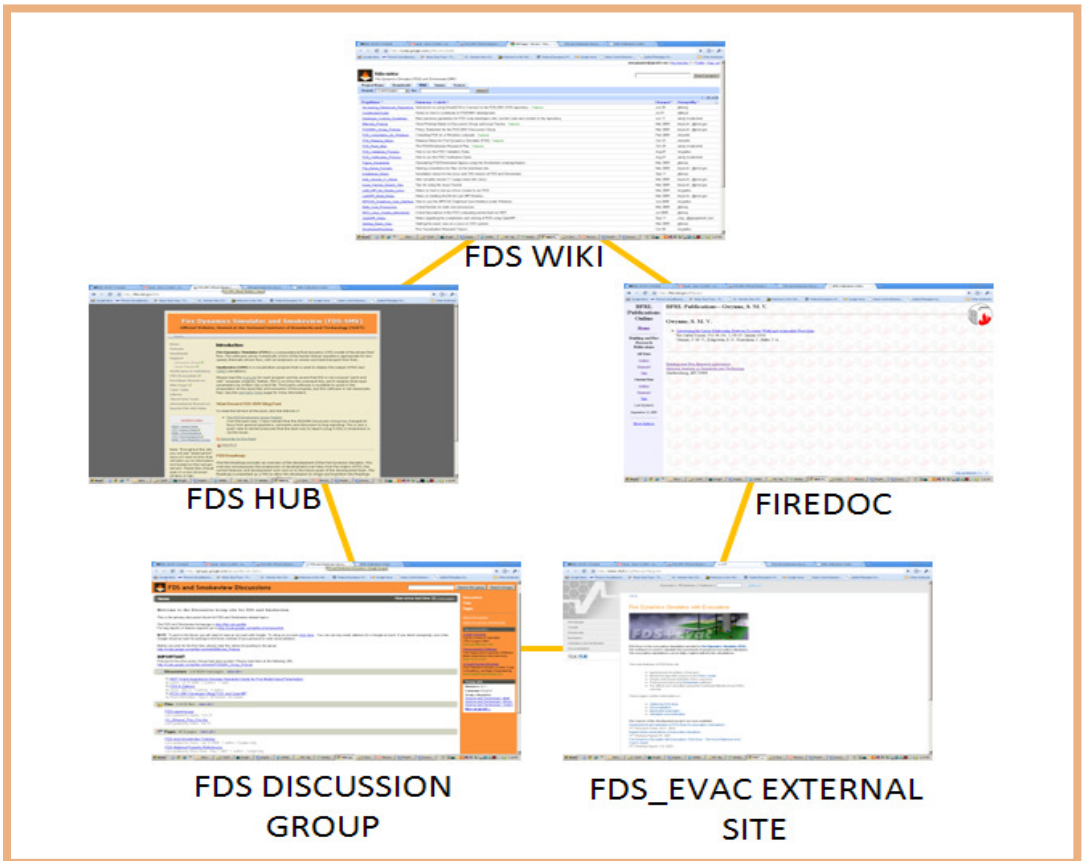


Figure 22: Examples of current NIST capabilities [90].

NIST (the funding organization behind this project) already hosts a range of facilities that encourage the online management and sharing of information for software products, article libraries, discussion groups and the interactive production of wiki-style rich content (see Figure 22). These provide opportunities for interested parties to seek and gain guidance, information and expertise; collaborate on new tasks; connect to external resources; and share ideas. Given that these facilities already exist within the NIST organization and within the field of fire science, it seems credible that a comparable facility (or set of facilities) for human behavior in fire could also be developed, ideally in conjunction with the facilities already available, to produce an integrated knowledge system.

As well as providing a network of information that incorporates another key fire safety element (i.e., human response), it would also allow some of the external factors that influence human performance to be represented in an appropriate level of detail and then be linked to relevant behavioral data-sets. For instance, data-sets describing the development of a fire could be linked to data describing the impact of fire and smoke cues upon the perception of an incident.

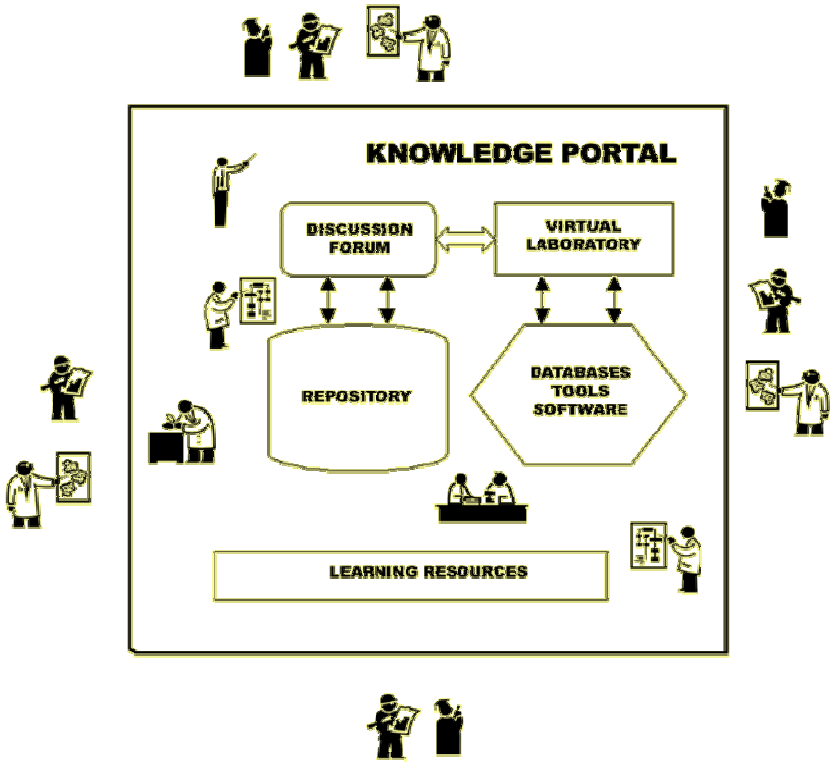


Figure 23: Knowledge Portal described by Kondratova and Goldfarb [Page 2, 91].

The type of approach required (and the functionality needed) is eloquently described by Kondratova and Goldfarb [91] in their 2004 NRC Report, and then by Robbins [92] in her 2009 BRANZ report (see Figure 23). In these works the authors discuss the clear value of having a more active knowledge portal where a repository of information is available that can be interrogated, but that this repository should also be coupled with other facilities, such as discussion forums, communication tools, training material, more extended guidance material,

and a range of interactive tools. In addition, although this process may be initiated (and fronted) by one authoritative organization, it may physically be based across a network of servers/locations to cope with computational demands and to exploit the convenience of available computational resources and potential data ownership issues.

It is somewhat redundant to go through the specific technologies required to enable such a knowledge portal [91,92]. This technology will likely have advanced significantly during the development of this report, let alone the life time of the project. Suggestions made here will therefore be out of date and cumbersome within a very short space of time. What is felt more useful is to identify some of the key attributes of such a portal and then give examples of some of the current technologies and approaches that might facilitate these attributes. At least in this way the objectives will still be relevant in the near future. Some of these key attributes desired of such a system are listed in Table 14.

Table 14: Desirable attributes of a knowledge portal [91,92].

Attribute	Description	Portal Functionality
Access	The portal is available to those who need it.	Online, documentary version, mobile versions, offline versions (e.g., technology that allows requests/data-sets to be completed offline, then uploaded when access is available), etc.
Contemporaneous	Data provided should be included as quickly as possible.	Version control allowing provisional data to be provided, distributed hosting to ensure robust and speedy storage, intuitive interface design, providence of the system, etc.
Communication / Collaboration	Access to peers. Provide access point to others in the field (senior, junior or peers). Allow those in the field to work together through the portal.	Discussion groups, ability to develop informal/formal agreements in private areas, newsletters, web-conferencing activity histories maintained, etc. Separate work spaces, project management tools, shared areas.
Stable	Needs to be assumed that the system will have longevity.	Needs to be initially operated/fronted by large, stable (probably non-profit) organization and then hosted across a range of systems/servers shared between organizations.
Credible	Data is trustworthy, represented accurately and described fully.	Moderation. Communication between moderator and those providing information. Discussion groups/chat facilities allowing direct feedback.
Representative	Meet the needs of users and the field.	Data Template/Acquisition Matrix evolves as more data is collected, practices change and the needs of field evolve. Version control, feedback, online surveys/polls, benchmarking.
Amendable	Constantly evolving through interaction	User access to design – wiki approach, open source elements, web documents, wave development, etc. Online, live documents with tracking, version control and peer-review.
Moderated	Quality control	Host moderators or host-appointed moderators
Flexible	Can be modified to suit the individual user.	Database capacity for searching, querying and compiling results according to the user's interests.

		Results provided in different formats – text, file, etc. Canned/customizable interface to suit.
Detailed	Covers the material in sufficient detail	Multi-format / rich content representation, including files uploads, streaming, etc. Ideally may allow live information, live guidance/participation, and online surveying/data collection tools.
Searchable	Users are able to locate key information.	Keyword / attribute / format / content / author, etc. search.
Interactive	Ability of users to swap ideas/information with each other and with the host. Allow people to disseminate research /project activities. Ability of the host to make general announcements.	Forums, blogs, discussion groups, shared spaces, network capabilities, online polls, messaging, etc.
Connected	Ability of the system to interact with other systems	Online, compatible, accessible.
Secure	Means of safeguarding authorship of data	Method of tracking use history, development authorship, version control.

In addition to the enormous increase in functionality and value provided by the expansion of the *Data Portal* to include the attributes in Table 14, there are other less tangible benefits. The extension of the *Data Portal* to incorporate these knowledge management attributes (i.e., to be extended to follow the Knowledge Portal concept highlighted in Figure 23) will significantly increase the functionality and reach of the portal. It will then be a facility that people visit not just to utilize data, but also to develop ideas, solve problems and gain assistance with the work in the field through the community that develops around it. On the most basic level:

The extended functionality is more likely to attract people;
These people will become increasingly familiar with, comfortable with and eventually reliant upon the facility;
It will provide them with greater access to the material, to tools and to each other;
It will allow visitors to adopt a more active role, allowing them to participate in the development of the facility and on user-defined tasks;
This participation will encourage visitors to gain a sense of investment and ownership of the facility;
It will get the more frequent/familiar visitors communicating with each other, with those hosting the facility and with those who are in the field, but not yet acquainted with the facility.

These developments will all add to the use, value, influence and impact of the *Data Portal*.

As mentioned several times, the tools outlined in this report represent an initial step. The tools will undoubtedly require modification and improvement. This report has focused on the content of these tools (i.e., the data and associated information held within them); for the full implementation, additional work will be also required on the design and presentation of the tools themselves to improve the user experience and aid their understanding [93,94]. The author will continue to develop and modify the concepts presented and welcomes any feedback or suggestions for collaborative efforts to continue the work.

7 Concluding Remarks

Over the last two years, NIST has funded a project (Project Number: 60NANB7D6146) as part of the Fire Research Grants Program to address key limitations of human egress data.
The work produced tools that will enable a *Data Portal* to be implemented: a facility to allow interested parties to upload, download and interrogate data-sets related to human performance in fire. In order to cater for new and existing data-sets, the *Data Portal* will provide two key tools: the *Data Acquisition Matrix* and the *Data Template*. The matrix informs the data collection process, ensuring that as comprehensive and refined a data-set as possible is collected. The template provides a range of placeholders, encouraging the data to be as completely represented as possible. This will present the extent of the information available for the existing data-set, but also the key omissions. Currently, the tools are in documentary form. The next step is to convert them into web objects, exploiting the additional functionality and flexibility available. In doing so, the tools can be further tested, with feedback being sought from outside parties on the value and design of the tools provided. To maximize its value, the portal will need to be populated with existing, publically available data-sets and also with newly collected data-sets. It is believed that once the *Data Portal* is fully implemented and is in use, it will provide both an invaluable resource to those working with current data-sets, but also will inform future data collection – making it more reliable, better documented, and more suitable for a range of applications.

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Appendix A: Survey for Experts in the Field

Any comments that you make here will be treated in the strictest confidence. A digest of these comments will be produced for analysis, but at no stage will your name be associated with these comments in a public forum, unless specifically directed otherwise.
Thanks for your time.
Steven Gwynne

I hope that the Data Portal will be of value to as wide a group of practitioners as possible. Given this, it is useful to collect some background information in order to understand the requirements of different sections of our community.

Question 1
What are your key areas of expertise? For instance, can you list your key educational qualifications and previous employment experience?

Question 2
What are your primary activities in the field? For instance, do you collect data, assess designs/egress assessments, design procedures, develop models, develop theories, employ egress models/hand-calculations, teach/train/mentor, etc.

Question 3
How many years have you been active in the field?

Question 4

We often rely on imperfect, incomplete, and inappropriate data-sets. Can you list the data-sets that you most frequently refer to and employ? This can be in the form of a description, a reference, a link or any other approach that can clearly identify the data-set, your use of it and any comments that you have regarding it. If appropriate, you may certainly indicate data that you have collected data-sets (along with a brief description).

Data-Set	Use(s)	Comments

Question 5

Given your typical activities in the field, what data-sets would you *like* to be available and in what format should they be presented? These could relate to evacuation events/factors that you currently include in your work (or your model), or events/factors that you currently exclude due to a lack of data, but would like to include. Several pieces of information are required: a description of the data-set itself including a general term (e.g. the data you are describing and the label you would associate with it); the resolution at which the data should apply (e.g. for an individual, a population, an egress component, a structure, etc.); the preferred format (e.g. the original raw data, a range, a maximum, an average, a statistical measure, a frequency distribution, in form of a modifier, graphical, descriptive text, original video, etc.); and the associated unit of measurement where relevant.

Description of Data-Set	**Resolution**	**Preferred Format**	**Associated Unit**	**Comment**

Question 6

You are asked to perform an analysis of egress performance by a client/third party. Please describe the factors and variables that would influence your analysis and the types of results that you might produce?

Question 7

Would you make use of the Data Portal described in the attached e-mail? If so, how would you most likely use it?

Question 8

Are they any tools or functionality that you would like to see provided by the Data Portal?

Question 9

What are the major issues that you foresee with the development of the portal?

Question 10

Do you have any further comments?

Thanks for your time. Once these answers have been compiled I will provide feedback to all contributors. A broader analysis will appear in freely available NIST reports.

Steven Gwynne, Ph.D. Hughes Associates, Inc.
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Appendix B: DATA ACQUISITION MATRIX - Level 1 Document

This tool is intended to be used during the various phases required to collect human performance data. A matrix is presented to provide an overview for the user. This highlights the scope of the data collection process (i.e., the elements that need to be addressed during the process), and the timeline during which the process passes. These are categorized and presented in order to produce two simple acronyms: PROPOSED (elements); BIPED (stages of the timeline). It is hoped that these acronyms will act as a simple reminder to the researcher of the key data collection components to be addressed. The scope of the data collection is categorized as follows: Procedure; Response; Organization; Population; Objectives; Structure; Environment; and Data acquisition. The timeline is categorized as follows: Blueprint (planning what to do); Investigation (establishing specifically how to do it); Preparation (configuring the data collection elements); Execution (collecting the data); and Data (manipulating the data). The intersection between these categories determines the specific guidance provided.

The cells in the master matrix (labeled as a Level 1 document) represent an element of the data acquisition process at a particular stage in the timeline. Where indicated, a link is provided in the resultant cell that takes the user to guidance relevant to that particular intersection of scope and timeline (labeled as a Level 2 document). (If read in PDF form, the link label matches up with the appropriate appendix heading; e.g., [B,Pr].) The nature of this guidance changes according to the stage of the timeline – moving from questions to prompt the user during the early stages, to a checklist, to guidance on the activities of team members. The relevance of this information will differ according to the nature of event being observed; however, it is still useful for the user to go through the process of addressing or disregarding the guidance provided in order to better frame their approach.

In reality, the user may not need to address all of the elements to the same degree of detail during each of the phases; indeed, many of the guidance may not be relevant in some scenarios. However, it is important that the user is aware of all of the elements and the phases of data acquisition in order to assess whether close scrutiny is required and assess whether elements of the suggested data collection components can be disregarded. In addition, there may be some repetition within the matrix. This is intentional as the user may approach the matrix from different perspectives and/or may omit sections entirely; limited repetition therefore introduces some redundancy in an attempt to prevent vital guidance being overlooked.

The matrix is geared to observing human performance as part of the collection of new data. This may involve manual observations, video, photography, supporting surveys, etc. It is not suited for post-incident interviews, where survivors of a previous real-life incident are involved. Although, the basic elements of the matrix would be the same and the high-level guidance would certainly be useful, the low level guidance does not address the specific factors, planning, and implementation issues that the interview of survivors would require. This would require more specific guidance on the sensitivities involved, interview planning, ethical issues and interview techniques that are not covered here.

Data Acquisition Timeline		***KEY ELEMENTS***								
		Procedure **Pr**	**Response** **Re**	**Organization** **Or**	**Population** **Po**	**Objectives** **Ob**	**Structure** **St**	**Environment** **En**	**Data Acq.** **Da**	
		Procedure employed to manage response of target population	**The response of the target population**	**The organizational / administrative issues related to the event**	**The population involved in the event**	**The objectives of the data acquisition exercise.**	**The structure(s) involved in the event**	**The environmental conditions present during the event**	**Data acquisition resources employed during the event.**	
What do you want to investigate?	**Blueprint** **B**	*What procedure do you want the population to follow?* [B,Pr]	*How might the target population respond during the event?* [B,Re]	*What administrative actions might the event require?* [B,Or]	*What target population is of interest?* [B,Po]	*What do you want out of this event?* [B,Ob]	*What type of structure is of interest?* [B,St]	*What environmental conditions may influence your results?* [B,En]	*Given the other BLUEPRINT factors, what resources do you need?* [B,Da]	***PRE-EVENT***
How do you get what you want?	**Investigation** **I**	*Examine procedural issues* [I,Pr]	*Establish behavioral factors.* [I,Re]	*Negotiate access and complete documentation* [I,Or]	*Determine the population characteristics* [I,Po]	*Establish how key objectives can be met* [I,Ob]	*Confirm pertinent structural details* [I,St]	*Document conditions and management response.* [I,En]	*Get resources and confirm acquisition plan.* [I,Da]	
How do you implement your plan?	**Preparation** **P**	*Actions to ensure procedure is executed* [P,Pr]	*Enable comparison between actual /expected response* [P,Re]	*Ensure organization and acquisition is integrated.* [P,Or]	*Confirm that population is as expected.* [P,Po]	*Ensure that objectives are met by procedure.* [P,Ob]	*Determine status of structure during event.* [P,St]	*Determine/ manage environment during event.* [P,En]	*Install/ implement acquisition tools / methods* [P,Da]	**DAY OF EVENT** ***PRE-CUE***
How do you get your data?	**Execution** **E**	*Apply procedure of interest.* [E,Pr]	*Monitor / manage response* [E,Re]	*Liaise with organization personnel.* [E,Or]	*Observe changes in population* [E,Po]	*Ensure acquisition meets objectives* [E,Ob]	*Monitor structural components.* [E,St]	*Monitor changes in environment.* [E,En]	*Acquire Data* [E,Da]	**DAY OF EVENT** ***PRE-RESPONSE RESPONSE***
How do you understand your data?	**Data (Extraction and Analysis)** D_a^e	*Be mindful of event conditions during data extraction. Ensure that data is extracted in context with the background conditions.*							*Extract Data / Remove acquisition resources* [D_E,Da]	**DAY OF EVENT** ***POST-EVENT***
									Analyze data [D_A,Da]	***POST-EVENT***

DATA ACQUISITION MATRIX: Level 2 Documents

B **BLUEPRINT-** ***Questions are provided to prompt the user to consider particular aspects of the preparation process.***

TERMINOLOGY:

TARGET POPULATION [TP]: THOSE INDIVIDUALS SUBJECT TO THE PROCEDURE IN PLACE (E.G., AN EVACUEE, A PARTICIPANT);

ACTIVE STAFF [AS]: THOSE INDIVIDUALS EMPLOYING THE PROCEDURE IN PLACE (E.G., A FIRE WARDEN).

Appendix: [B,Pr]: What procedure do you want the target population to follow and the active staff to implement?

Useful References	
Example Material	

- *What type of procedure leads to the behaviors of interest?*
  - Experimental? Managed? Phased? Horizontal? Defend in place? Examine *[B,Ob]*
  - Will it involve the involvement of the entire population, a section, or none at all?
- *Does a procedure need to be developed, or will a structure be selected that has this procedure in place?*
- *Are there documented examples of such procedures?*
  - Previous incidents? Current occupancies? Research Literature?
- *Are there regulatory issues that constrain the use of these procedures? What are they?*
- *What other procedures might influence the procedure of interest?*
  - For instance, are there non-emergency procedures (security, operational, etc.) that influence the emergency procedure of interest?
- *What are the key elements of this type of procedure? For instance, expected staff actions, human resource requirements and occupant response.*
- *What technological resources (e.g., notification systems, CCTV, etc.), does this procedure require when implemented?*
- *Do the key behavioral objectives [B,Ob] require a dedicated emergency or non-emergency procedure?*
  - Will it require access to a structure, an experimental rig, or new equipment?
- *Does the incident need to be unannounced, quasi-announced, or announced?*
  - How might this be achieved?
  - What mechanisms would be required to inform the population before, during, and after the event?
  - If it is to be covert, who are the essential individuals that need to know and can be trusted?
- *Are there limitations regarding the data collection process for certain procedures?*
  - For instance, in a full evacuation, would it be possible to monitor the entire population?
- *What do you want people (active staff and the target population) to be doing during the event?*

DOCUMENTED FACTOR - PROCEDURAL REQUIREMENTS

Sketch/Notes:

Appendix: [B,Re]: How might the target population behave during the event?

Useful References	
Example Material	

- *Do you have information on similar events/incidents outlining the response of the target population? This may also guide your expectations in [B,Pr].*
- *Is there specific information on the target population under comparable scenarios?*
- *What behavioral factors are you interested in?*
  - *Pre-cue, Pre-response, response, post-response, movement, actions, decisions, influences, etc?*
- *What performance aspects are you interested in? [B,Ac]*
  - *The time taken to perform? Quantitative measures?*
  - *The effectiveness/outcome of the performance, conditions experienced, etc? Qualitative factors?*
  - *The factors that influence performance?*
- *What relevant factors/events might lead to people not responding in accordance with the procedure? [B,Pr]*
  - *Other procedural issues?*
  - *Pre-Event issues: use of the building? Security / access issues?*
  - *Actions of others, other events?*

DOCUMENTED FACTOR - POSSIBLE PARTICIPANT BEHAVIORS; REVIEW OF EXPECTED RESPONSE
Sketch/Notes:

Appendix: [B,Or]: What administrative actions might the event entail given the partner organization?

Useful References	
Example Material	

- *What organization enables the procedure of interest to be employed?*
  - *Commercial, federal, academic, military, etc?*
  - *What are their primary activities?*
  - *What are their sensitivities?*
  - *Has this type of organization been exposed to similar incident or events recently?*
- *Does the preferred organization introduce limitations into the data collection process?*
  - *Are there administrative, political, financial or legal limitations?*
- *What are the benefits of the data acquisition process to the organization? Why would they allow the data collection process to take place?*
  - *Financial,*
  - *Public relation,*
  - *Knowledge*
  - *Safety (training, procedure, systems, staffing, etc.)*
  - *Performance (operations, security, etc.)*
  - *Training, etc.*
- *What problems might the data acquisition cause for the organization?*
  - *Disruption of service*
  - *Loss of human resources*
  - *Security issues*
  - *Public relations*
  - *Safety*
- *Does the organization allow/provide for funding opportunities to be explored?*
- *Who are the key personnel/contact points within the organization?*
  - *Who would you need to contact in the host organization in order to understand the procedure employed?*
  - *Are you the appropriate person to make this contact? If not, who within your organization should?*
  - *Do you need to introduce other organizations into the project to mediate/negotiate?*
  - *Who is responsible for the safety of those involved?*
- *If difficulties are encountered, are there alternative organizations, or different locations within the same organization?*
- *What benefits does this organization bring to the project that others lack?*
- *Does the organization require specific reassurance regarding the safety and validity of the event?*
  - *Is an ethics review required? If so, does the organization have an internal process?*
  - *Does your organization have the ability to meet this need?*
  - *Who else would be able to do this?*
- *What are the administrative issues that need to be addressed?*
  - *Medical coverage/support*
  - *Financial issues*
  - *Waiver issues*
  - *Insurance*
  - *Loss of time/earnings for the organization/compensation*
  - *Anonymity of the organization/occupants, etc.*
- *Are active staff members (e.g., people that will employ the procedure) required or will they be provided by the organization?*
  - *If so, advertising, contracts, job descriptions, costing, and possible training is required.*

DOCUMENTED FACTOR – ORGANIZATIONAL ISSUES AND ACTIONS

Sketch/Notes:

Appendix: [B,Po]: What is the target population of interest?

Useful References	
Example Material	

- *What is the target population? Why?*
- *What attributes does the population need to have for the data objectives to be met?*
  - *Number*
  - *Attributes / Demographics [age/health/ dimensions/gender/education/culture/language issues/background/education, etc.]*
  - *Location*
  - *Impairments*
  - *Activities*
  - *Information/experience*
  - *Training*
  - *State*
  - *Skills/experience*
  - *Distribution*
  - *Roles*
  - *Familiarity /Frequency of building use*
  - *Exposure to procedural / environmental / structural / organizational factors.*
- *Are there special considerations required, or can the objectives be met through the general population?*
- *If these requirements are not met, is it possible to introduce a new target population?*
  - *How would this population be obtained?*
- *Is it possible to focus on a sub-population? What portion of the population will be involved in the event?*

DOCUMENTED FACTOR – SET OF POPULATION ATTRIBUTES OF INTEREST
Sketch/Notes:

Appendix: [B,Ob]: What do you want out of this event?

Useful References	
Example Material	

- *What data is required and why?*
- *How is this data-set normally produced and presented?*
  - *Expected format?*
  - *Level of detail? Refinement?*
  - *Normal scope of data? What factors are addressed?*
  - *Do you have other examples of this data?*
  - *Why are the previous examples of this data not adequate?*
- *How will it be used?*
  - *Theory?*
  - *Engineering calculation?*
  - *Model development?*
  - *Model validation?*
  - *Model application?*
- *What do you want out of the data?*
  - *Increased knowledge / theory development*
  - *Fulfill an application/project requirements*
  - *Publicity*
  - *Proposal development*
  - *Establish relationship*
- *What other parties will be interested in it? Who are the stakeholders?*
  - *Can these parties help improve / facilitate the event?*
- *What analytical techniques will be used to draw meaning from the data?*
  - *What level of confidence is required in the data? Statistical? Anecdotal? Etc?*
- *How is the data to be stored?*
- *How is the data to be presented?*
  - *In what arena / medium?*

DOCUMENTED FACTOR - LIST OF OBJECTIVES
Sketch/Notes:

Appendix: [B,St]: What type of structure is of interest?

Useful References	
Example Material	

- *What occupancy type or structural components are of interest?*
- *What examples of these*
  - *are Local*
  - *are Accessible*
  - *Belong to organizations with whom you have a relationship*
  - *are Available*
  - *can be Constructed.*
- *Are there dimensional requirements?*
  - *No. of floors*
  - *Footprint / Dimensions*
  - *Height of structure*
  - *Height of floor space*
- *Are there use/occupancy requirements?*
  - *Access limitations? Refer to [B, Or]*
  - *Presence of amenities?*
  - *Presence of specific terrain?*
- *Are there component requirements?*
  - *E.g., certain types of doors, elevators, etc.*
- *Are the location requirements?*
- *Are there structural requirements?*

DOCUMENTED FACTOR - SET OF STRUCTURAL COMPONENTS OF INTEREST
Sketch/Notes:

Appendix: [B,En]: What environmental conditions may influence your results?

Useful References	
Example Material	

- *Are there specific environmental conditions of interest that need to be present, or excluded from the scenario?*
  - *For instance, smoke, temperature, narcotic gases, irritant gases, debris, water, weather conditions, etc?*
- *Are these environmental conditions potentially harmful? Does this harm need to be managed?*
- *Are these environmental conditions inside of the structure, outside or both?*
- *What season will it be when the observations are made? Is it relevant?*
- *What is the desired weather for the event in question?*
- *What environmental conditions do you want to influence performance?*
  - *Are these desirable?*
  - *Can these be controlled?*
  - *Do they require access or equipment to control them?*
  - *Who has this access or equipment?*
- *Are you responsible for managing/generating the environmental conditions? If so, what equipment does this require?*
- *Are you interested in the physiological, behavioral, physical, sociological, or procedural impact of the environmental conditions?*
- *Does the target population normally take measures to address these environmental conditions?*
  - *Winter clothing, umbrellas, etc.*
- *Do the environmental conditions interact/interfere with the data collection / procedural activities?*
- *What are the ambient/desired lighting levels?*
- *How do you return the environmental conditions back to normal after the event?*

DOCUMENTED FACTOR - SET OF ENVIRONMENTAL ATTRIBUTES OF INTEREST
Sketch/Notes:

Appendix: [B,Da]: Given the other BLUEPRINT factors, what data collection resources do you need?

Useful References	
Example Material	

- *What is the best approach to collecting data that meets the objectives?[B,Ob]*
  - *Reliable*
  - *Credible*
  - *Cost-effective*
  - *Ethical*
- *What background information is required for the data to be meaningful? For instance, what context needs to be provided in order for the data to be understood?*
- *What data collection methods/tools are needed?*
  - *During the event: video, camera, audio, manual, RFID, participant observer, etc.*
  - *Survey [postal, on site, web-based] , interview, etc.*
  - *Why should these be selected?*
  - *Rooming, technical equipment, etc.*
  - *Are these available given the findings of [B,Or]?*
- *Are there existing means by which to collect the data, or do new technologies need to be introduced in the structure?*
- *Can this equipment be purchased? How much does this equipment cost?*
- *Can it be constructed?*
- *Given the procedural expectations/requirements outlined in [B,Pr], can the results of this procedure be captured using the data collection method selected*?
  - If not, is it possible to gain a representative sample of the entire procedure? For instance, can the application of the procedure to one floor of a structure be observed and recorded?
- *Do you have previous examples of where this type of data was collected or where the data collection methods/resources were applied?*
- *Do you have the skill-set to apply these resources and perform subsequent analysis?*
- *Do people in your organization have the necessary skill-set to apply these resources?*
- *What data format is appropriate for this data?*
- *What method of storage will be available?*
- *What equipment is required for this storage to take place?*
- *How will the data be extracted from this storage?*
  - *Will specialist tools be required?*
  - *Will the data have to be destroyed after analysis?*
- *Are there issues of privacy and/or anonymity to address?*
  - *Can your resources be modified to address this?*
- *How is the data going to be used?*
  - *How does influence the collection process?*
- *Who will be examining/extracting the information from the data-set?*
  - *What is their training, experience and expertise?*

DOCUMENTED FACTOR - SET OF DATA ACQUISITION RESOURCES REQUIRED
Sketch/Notes:

I **INVESTIGATION** – ***A range of questions and checklists are provided to remind the user of the factors that may be relevant to the observation at hand.***

TERMINOLOGY:

TARGET POPULATION [TP]: THOSE INDIVIDUALS SUBJECT TO THE PROCEDURE IN PLACE (E.G., AN EVACUEE, A PARTICIPANT);

ACTIVE STAFF: [AS] THOSE INDIVIDUALS EMPLOYING THE PROCEDURE IN PLACE (E.G., A FIRE WARDEN).

Appendix: [I,Pr] - Examine procedural issues employed by active members of staff.

Useful References			
Example Material			
Factor	Attributes	Questions /Actions	Addressed (X)
Nature of Procedure			
	Type	Whether it is managed, phased, zoned, staged, etc.	
	Scope	Who is involved? Sections of the structure/population?	
	Objective	Does the procedure require evacuation, shelter, etc.	
Management Structure			
	Active Staffing	What is the chain of command during the procedure employed?	
	Command / Control and Communication	What is the passage of information during an incident? Where is information sent in order for decisions to be made? Who is involved in this process? What communication systems are in place?	
Notification System		For instance, the emergency notification system.	
	Visual	Is graphical information provided; e.g., via LED, strobes, screens, etc? What information is provided?	
	Aural / Audible	Is aural information provided; e.g., via bells, tones, voice, etc? What information is provided? What is the message? What is the nature of the tone?	
	Other	Are other modes of notification employed; e.g., vibrating devices, handheld, etc?	
	Coverage	Is the entire structure covered by the notification system in place?	
	Visibility / Audibility	Does the information reach the target population?	
	Intelligibility	Can the information provided be understood?	
Additional notification systems		For instance, non-emergency notification system.	
		Are there additional non-emergency systems in place; e.g., PA system, screens, monitors, PC, etc? Are these systems de-activated during an emergency?	
Active Staffing Levels			
		How many active staff members are available during the emergency? Where are they located? How are these accounted for? Are these active staff already present, or do they need to be recruited, trained and informed?	
Responsibilities of Active Staff			
		What are the responsibilities of the active staff members? Are non-active (i.e., unplanned/unintended) members of staff	

		expected to help assist in the procedure?	
		Do these staff members carry equipment to assist in their activities? For instance, communication devices, registers, bullhorns, etc?	
Training of Active Staff			
		What training is provided to the population? What training is provided to the active staff members? Who is responsible for this training? Is this documented?	
Documentation			
		What documentation is available describing the emergency procedure?	
		What is the format of this documentation? Reports? Posters? Leaflets?	
		Who produces these documents? Is the AM responsible for this?	
		Who has access to this documentation?	
		Can this document be referenced/described in future publications of the data produced?	
Drills Conducted		Has the procedure been tested? Were these tests conducted in order to improve the effectiveness of the procedure, or to measure the time taken to enact the procedure; i.e., as a training exercise or an assessment? Are lower-level exercises performed to measure individual responsibilities? For instance, ability to operate a fire extinguisher, locate a stairwell, etc?	
		Are drills conducted? How frequently? Are these drills announced /unannounced/ quasi-announced? Who is involved? Are external agencies involved? Do they fully represent the 'procedure' in place? Are they documented/recorded/reported? Can you get access to previous reports? What were previous performance levels? Have there been previous incidents during the drills?	
Previous Incidents			
		Have there been previous emergency incidents on site? Who was involved? What was the response? Are these incidents documented? Do you have access to these documents? Have these required the implementation of the emergency procedure?	
Suppression			
		Is there a suppression system in place? What is the coverage of this system? Has it ever been activated? How often is it tested?	
Detection			
		What is the nature of the detection system in place? What is the nature of the signal provided? If an incident is automatically detected, how is this reported, and what impact does this have? Is there any information on the effectiveness of this system? For instance, manufacturer performance data, etc.	
Passive Fire Systems			
		Is compartmentalization used? Where are the fire doors?	

		What protection do they afford? Are they are automatic systems in place to close doors during an incident?	
Emergency Lighting			
		What is the nature of the emergency lighting system? What is the coverage? What are the lighting levels? When it is activated?	
Fire-fighting Equipment			
		Is there fire-fighting equipment? Where is located? What is its nature? Are people trained to use it? Who could/should use it?	
Signage		Is it possible to get the location of signs noted on a schematic/floor-plan, etc?	
	Information Provided	Emergency, routine information, security warnings, commercials, etc.	
	Intended Use	Emergency, Operational, Information, etc.	
	Type	Static / Dynamic, Regulation adhered to, Text/Graphic/Mixed, etc.	
	Design	Format, Content, Color, etc.	
	Size	Sign? Graphics? Lettering?	
	Locations	Location of signs throughout the space.	
	Routes Indicated		
Assembly Points		Is it possible to get the location of assembly points noted on a schematic/floor-plan, etc?	
	Location	In relation to the structure	
	Marking	Is it signed?	
	Capacity	Number of people that can be located at the assembly point?	
	Nature	Is it covered, accessible, apparent? Does it have a means of communication?	
Population Vulnerabilities			
		Are special provisions made in the procedure to address vulnerable sections of the population; i.e., those suffering with an existing impairment? Will these sections be involved in the incident? Do special provisions need to be made regarding these populations? What is the nature of these vulnerabilities? Innate, situational, experiential, procedural? Where are they located within the structure?	
Security procedures			
		What are the internal/ perimeter/external security measures? Where are they located? What staff members are involved? What equipment is involved? What impact does this have on movement about the space? What impact does an evacuation have upon the security procedures in place? Are the security procedures applied and managed separately from the other procedures in place?	
Operational / service / routine procedures			

		Are there dedicated facilities/amenities/services that influence the routine use of the building? What staff members are involved? What impact does this have on movement about the space? What impact does an evacuation have upon the routine operational procedures in place?	
Other procedures			
		Are there procedures in place that govern non-fire emergencies? What is the nature of these procedures? How are fire emergencies distinguished from non-fire emergencies? Is this determination manual or automatic? Are there traffic management procedures in place? Do these interfere with the passage of individuals during the event?	
Experimental procedures			
		Have dedicated experimental procedures been produced to manage the event? How are these stored? Where are they? Will they be distributed? If so, to whom? Do the procedures describe the activities of the active staff, the target population, etc? Who wrote these documents? Is the AM responsible? Is there quality control over the data collection/extraction process?	
Outside intervention			
		What are the expected activities of external agencies, such as emergency responders? Where are they located? How do they get into the structure? What is their anticipated arrival time? What resources do they bring? Are medical/first aid staff required? If so, are they on hand?	
OUTCOME: A PROCEDURE (OR AN UNDERSTANDING OF AN EXISTING PROCEDURE) DESCRIBING THE ACTIONS OF ACTIVE STAFF[AS] AND THE TARGET POPULATION[TP]. ***OUTCOME: TIMELINE OF EXPECTED MOVEMENT/BEHAVIOR OF STAFF AND TARGET POPULATION.*** ***OUTCOME: KEY EVENTS/ACTIONS OF INTEREST WITHIN THIS MOVEMENT/BEHAVIOR.*** ***OUTCOME: ACTIVE STAFF [AS] REQUIRED TO IMPLEMENT PROCEDURE. REDUNDANCY/RESERVE [AS] AVAILABLE.*** ***Sketch/Notes:***			

Appendix: [I,Re] - Establish behavioral factors that might lead target population to divert from the intended procedure being implement by active staff. For instance, have there been factors in previous events that have indicated potential behavioral responses in the planned event.

Useful References			
Example Material			
Factor	Attributes	Questions /Actions	Addressed (X)
Pre-Event			
	Use of building	What areas of the building would be people be familiar with? How do people move around the building? Stairs, elevators, etc. Are there areas with limited or restricted access? If so, who has access, how is this access constrained? Are there areas in which people would typically gather? How do people normally arrive at the structure? Does this mode of arrival influence how they would enter and leave the structure? How does the structure interact with adjacent transport systems? For instance, where it the parking, rail station, pedestrian paths, etc?	
	Access routes / Doorways	Where would they normally enter and leave the building?	
	Time spent in structure	Are people frequent visitors? How long have they belonged to the organization, etc?	
	Fluctuation	Are there seasonal/monthly/weekly/daily differences in the use of the building? When will the event take place in relation to daily events; e.g., arriving, meals, leaving, etc?	
	Foreknowledge	How much will people know in advance about the event? Who will tell them about this?	
	Experience	How familiar are people with the procedure in place (with what to do during the event)? Will they have taken part in similar events? Will they have had specific training?	
Pre-Response / Response			
	Individual attributes	Physical, cognitive, social, psychological, demographic, language skills, fitness, fatigue, etc.	
	Location	Room, floor, in relation to key egress components, etc.	
	Proximity to incident	In room of origin, same space, same floor, same building, etc.	
	State / Alertness (awake)	Will people in the building be awake? Will people be intoxicated? Will narcotic drug use be an issue?	
	Activities	What are people expected to be doing at the time of the incident? How long will they have been engaged in this action?	
	Engagement / commitment to activity	What will they have invested in conducting that activity? How engaged will they be? How focused will they be on this activity? Will they be reluctant to leave this activity?	
	Access to information	Will they be familiar with the alarm signal? Will they be able to distinguish the signal from other background noise? Will they be provided with information on how to respond? Will they have sufficient information on how to respond? Will they be able to follow the instructions provided?	
	Notification system in place	How much information is provided? What is the content of the message? What is the signal?	

		Does it interrupt the current activity of the population? What is the system coverage? Can it be perceived? Is it credible?	
	Presence of staff	Are active staff nearby? Are they assertive? Are they in positions of responsibility? Are they well-trained? Are they taken seriously (credible)?	
	Visual access to event/others	What cues are produced by the incident? Do the cues go beyond the room of origin?	
	Training / experience	Does the individual exposure level to drills and exercises influence their reaction/response to the event? Do they have reminders/documents/devices to guide them during an incident?	
	Impairment / health issues/ fatigue / encumbrance	Cognitive, sensory, social, medical, situational, temporary, etc.	
	Language / cultural issues	Can people understand the messages/information/notification/ signage being provided to them? Are they familiar with the safety concepts being employed? Do they have reduced expectations regarding the safety systems in place?	
	Organizational / hierarchical issues	Do the roles and relationships in the structure influence reaction / response to the incident? For instance, are people reluctant to use an exit given the sanctions that would normally be imposed upon them? Presence of safety culture. Would sub-populations be unfamiliar with certain areas of the structure through lack of use?	
	Environmental conditions	Orientation of space, complexity, deteriorating environmental conditions, ambient conditions (noise/visuals), debris/clutter/waste, temperature, visibility, etc.	
	Familiarity with structure	Known routes, preferred means of egress, etc.	
	Role / social affiliation	Position in social hierarchy/organization, status, responsibilities.	

OUTCOME: STORYBOARD OF BEHAVIORAL FACTORS THAT MIGHT INFLUENCE ADHERENCE OF TARGET POPULATION TO PROCEDURE

Sketch/Notes:

Appendix: [I,Or] - Negotiate access and complete documentation

Useful References	
Example Material	

- *Draft initial contact letters to potential organizations*
  - *Outline objectives, what is involved, benefits to the potential organization, costs, potential impact, why the potential organization has been selected, your credentials.*
  - *Suggest follow-up for further action.*
- *Organize site visit*
  - *Primary goal to present overview of event and gain interest*
  - *Examine appropriateness of structure*
  - *Establish the internal process- what issues need to be addressed within the organization to allow the event to take place*
  - *Legal / PR / Safety / Policy*
  - *Establish the limits of responsibility – yours and the organization*
- *Establish what is expected/acceptable for the organization:*
  - *issues of anonymity,*
  - *data ownership/sharing/release/storage,*
  - *management of the event,*
  - *access to the site,*
  - *access to existing data (e.g., previous incidents/events),*
  - *access to resources (human/material/technology),*
  - *disruption*
- *Prepare ethics/review documentation if necessary. If not necessary, still establish potential hazards/risks and how you address them – go through your own inhouse review process.*
- *Organize follow-up meetings*
  - *Primary goal to gather information – allow event planning [I,P]*
  - *Ensure that the organization is still willing to participate*
  - *Share information with the organization*
- *Organize preparation activities*
  - *The days involved in the incident*
  - *Security clearance*
  - *Access during these days (during the day/after hours, etc.)*
  - *Expected staff/population activities*
  - *The nature of the equipment to be used/brought into the structure.*
  - *Information control*
- *Develop/Present Procedure (if new procedure required)*
  - *Actions of active staff*
  - *Desired response of target population*

OUTCOME: AGREEMENT WITH ORGANIZATION TO TAKE PART ALONG WITH NECESSARY PERMISSIONS, WAIVERS AND AGREEMENTS
OUTCOME: ESTABLISH CONTACTS – MANAGEMENT LEVEL (PERMISSIONS) / PROCEDURAL LEVEL (ACTIVE DURING EVENT)
Sketches/ Notes:

Appendix: [I,Po] - Determine the target population's characteristics

Useful References			
Example Material			
Factor	Attributes	Comments	Addressed (X)
Label		Identification	
Nature			
	Relationship to structure	Are people occupants, visitors, residents, participants, etc?	
	Social Roles/Ranks	What is the range of roles and positions within the structure? Are people associated through familial, employment, professional, social relationships?	
	Procedural	What is the proportion of population that is actively engaged in the event procedure; i.e., what is the number of people involved in employing the procedure?	
Number / Size			
		How many people are in the building? Does this fluctuate? If so, why?	
Distribution			
		Where are people within the structure?	
	Throughout building		
	Specific locations	Where are people according to floors/ internal spaces, etc.	
Social Groupings			
		Are people isolated in the building? Are they in social groups? What is the make-up of these groups?	
Visual access			
		Can people see each other given the routine use of the structure?	
Language			
		What is the range of languages present within the structure?	
Culture			
		What is the cultural background of those within the structure? Safety expectations, familiarity with safety concepts, etc.	
Education			
		What is the educational level of those within the structure?	
Activities			
		What activities are people engaged in? Might their commitment to this activity delay their response to the event? Is their attention focused on this activity to the exclusion of other cues and information? For instance, if in a movie theatre where the individual's attention is clearly focused.	
Familiarity			
		Is the population familiar with the building? How does influence their use of the structure? How do they enter the structure?	
	Ingress	How do people normally enter the structure?	
	Circulation	What facilities are people most likely to use during routine structure operations?	
	Egress	How do people normally leave the structure?	
Training of the Target Population			
		Has the population been exposed to dedicated safety training? Is there any relevant literature / documentation to which they	

		have access? Is the target population exposed to the performance of drills? How frequently does this occur?	
Expertise			
		Is there an understanding of safety principles within the population? Can they operate the equipment needed to complete the procedure?	
Experience			
	Structure	How long have the population been using the structure?	
	Incidents	Have they experienced previous incidents? Are records kept on such incidents?	
	False alarms	Have they experienced previous false alarms? Are records kept on false alarms?	
Physical Dimensions / Anthropometrics			
	Height	What is the range of heights within the population?	
	Weight	What is the range of weights within the population?	
Age Range			
	Distribution		
	Presence of children		
	Presence of elderly		
Gender			
	Male		
	Female		
	Other		
Impairment / Movement Issue			
	Visual		
	Aural		
	Cognitive		
	Other		
	Encumbered		
	Pregnant		
	Obesity		
	Fitness levels		
	Existing Health Issues		
Health			
	Incident-related injuries	Are there injuries / health issues that have been produced by the incident? What are they?	
	Incident-related fatalities	Are there fatalities that have been produced by the incident? What are they?	
OUTCOME: CLEAR UNDERSTANDING OF THOSE TAKING PART AND THEIR RELATIONSHIP WITH THE STRUCTURE ***Sketches/ Notes:***			

Appendix: [I,Ob] – Establish how key objectives can be met

Useful References	
Example Material	

- *Does the current situation allow the original data objectives to be met?*
  - *Should you adjust your data objectives?*
  - *What impact might these adjustments have upon the intended application?*
  - *Will other applications now be possible, in addition or instead of the current application?*
  - *Do you have examples of these changes required and their impact?*
- *Does the current scope/detail of the target data influence the intended application?*
- *Do the current objectives require changes in the collection techniques/tools?*
- *Do the current objectives require changes in the extraction/analytical approaches adopted?*
- *Do the current objectives require changes in the presentation of the data?*
- *Have additional interested parties been identified? Does this influence how the data is collected / analyzed/ presented?*

OUTCOME: CORRESPONDENCE BETWEEN INTENDED PROCEDURE, DATA ACQUISITION AND OBJECTIVES
Sketch/Notes:

Appendix: [I,St] – Confirm pertinent structural details

Structure Overview

Useful References			
Example Material			
Factor	Attributes	Questions	X
Label			
Name			
Address			
Occupancy type / Use			
Height			
# Floors			
	Floor heights		
Footprint / Area			
Age of the building			
Fire history			
Date			
Season			
Floor layout			
	Internal separation		
	Visibility of exits		
	Configuration (use)		
Surrounding areas			
	Transport access		
	Parking		
	Neighboring structures		
	External conditions	Terrain immediately surrounding structure	
	Weather		
Perimeter access			
	External exits		
	Security		
	Main entrance		
	Access management		
Lighting system			
Electrical system			
Stair configuration			
	Number		
	Location		
Escalator configuration			
	Number		
	Location		
Ramp configuration			
	Number		
	Location		
Elevator configuration			
	Number		
	Location		
Tunnel configuration			
	Number		
	Location		

Travelator configuration			
	Number		
	Location		
Ramp configuration			
	Number		
	Location		

COMPONENT NUMBERING SYSTEM EMPLOYED

For instance [Floor | Component Type |Compass Direction], or [Floor | Component Type | Cell #] (if a grid is used), [Floor | Component Type | Number], etc.

OUTCOME: PLAN OF STRUCTURE AND DETAILED UNDERSTANDING OF KEY COMPONENTS AND THEIR ATTRIBUTES

Sketches/ Notes:

Structural Component: Doorway

Factor	Attributes	Questions / actions	Addressed (X)
DESCRIPTIVE			
Label		Identification	
Nature		Single / multiple – part of a set, etc. Grouping/ Configuration	
Type		Revolving, leaf, open, sliding, etc.	
Condition		Age, damage, etc.	
Opening Mechanism		Turn handle, key , panic bar, latch, etc.	
Direction of operation		Does it open towards or away for the flows adjacent to it?	
Magnetic Release		Is the door released during an incident?	
Material		Is the door made of wood/glass/metal, etc?	
Status		Open/closed/locked/blocked/unavailable	
Use		Routine / emergency/entrance, etc.	
Connected spaces		What are the egress components adjacent to the door?	
Visual access		How well can it be seen from adjoining components? Is it obscured, camouflaged, or badly lit, etc? Is there associated signage with the door?	
Appearance		Does the component look like it is in use and that it affords a means of egress? For instance, is there a chain across it, a panic bar, etc? Does it provide an attractive option to the evacuee, or does its appearance discourage use? For instance, does it lead directly to the outside?	
Approach		What is the angle at which the individual approaches the component? Direct path, right angle turn, etc. Does the individual approach the component at an oblique angle, or head on? Relationship to population flow.	
NUMERICAL			
Width			
	Physical		
	Effective		
Height			
Weight			
Access		Clear / debris / blockages / nature of the approach, etc.	
Sketches / Notes:			

Structural Component: Stair

Factor	Attributes	Questions	Addressed (X)
Label		Identifying label given to stair object.	
Type		Scissor / enclosed / [solid or framework] , etc.	
Nature		Single / multiple – part of a set, etc. Grouping/ Configuration	
Adjacent / Connecting floors		Floors associated with stair/ which have access to stair/through which the stairs run, etc.	
Location		Internal location, external, position within floor, etc.	
Approach / Access to stairs		Relationship between stair door / approach / landings. Relationship to population flow.	
Visual access		How well can the stair be seen from the adjoining spaces? Is it obscured, camouflaged, or badly lit, etc? Is there associated signage with the door?	
# flights/landings between floors			
Direction of descent		Clockwise / counter-clockwise	
Dimensions / configuration of landings		Size and shape of landings.	
Configuration of flights / landings		Relationship between flights and landings. Right angles / 180 / nature of connection, etc	
Steps			
	# steps / flight		
	Dimensions (Riser height / tread depth)		
	Appearance	Solid, grill, etc.	
	Nosing	Recessed, perpendicular, etc.	
	Covering	What material is used to cover the steps?	
	Edge of steps	Is the edge of the step marked?	
	Consistency	Are the steps the same dimensions, condition, appearance, etc?	
	Condition	Debris / damage / etc.	
	Material Used in Construction	Are the stairs constructed from metal, concrete, wood, etc.	
	Diagonal distance between landings	Approximation of travel distance.	
	Occupiable area of flight	Combined plan area of steps in a flight that can be occupied by evacuees.	
Clear Stair Width		Usable width of stair.	
Effective Stair Width		Derived width of stair that is likely to be used.	
Handrail			
	Projection from wall		
	Description	Rounded, flat top, solid, etc.	
	Material used		
	Height from the step		
	Number	0/1/2/ etc	
	Location	One side / both sides / central / etc.	
Clear head room		Step to ceiling or the bottom of stair above	
Lighting			
	Normal		
	Emergency levels		
Access		Can you leave the stair once they have been entered?	

Sign / guidance		Presence / illumination levels, etc.	
Sound levels		During normal / emergency levels. Can an alarm be heard clearly within the stair?	
		Is there much spill over of alarm sound between floors?	
Wall material			
Dimensions of stairwell		Dimensions of the structure encasing the stair.	
Status		Open/closed/locked/blocked/unavailable	

Sketches / Notes:

Structural Component: Horizontal Component

Factor	Attributes	Questions	X
Label			
Foot print/Area		Area occupied / Effective area occupied given boundary layer	
Height			
Type		Corridor, room, etc.	
Primary function/Use			
Adjacent components		Nature of adjoining spaces.	
Points of access		Connectivity to adjoining spaces	
Visibility of points of access		Are access points signed? Do they have different lighting conditions? Do they have different affordances? Are some innately more attractive?	
Status		Open/closed/locked/blocked/unavailable?	
#exits			
# escalators		Nature of connectivity	
# elevators		Nature of connectivity	
# travelators		Nature of connectivity	
#ramps		Nature of connectivity	
Lighting levels			
Internal objects			
Internal configuration		Presence of internal walls, separators, furniture, temporary fixtures, etc.	
Maximum population size		Code / Expected / Current	
Background Conditions/ Pollution		Noise, visuals, etc.	
Floor coverings		Does it aid in movement? Surface conditions?	
Wall coverings		Roughness, etc.	
Sketches / Notes:			

Structural Component: Elevator

Factor	Attributes	Questions	X
Availability		Is it working/operational/broken/being repaired/out of service?	
Type		Express . emergency, etc.	
Nature		Single / multiple – part of a set, etc. Grouping/ Configuration	
Label			
Age			
Capacity			
Operator / Constructor			
Speed between floors			
Floors served			
Door opening speed			
Door width			
Cab Dimensions			
Grouping		Is escalator isolated, in a bank, etc.	
Material Used		Clear material on door, on shell, etc.	
Shaft Location		Does it pass through a shaft, does it run exposed, internal/external, etc.	
Location on floor		Location within the floor	
Access		Which sections of building has access to elevator?	
Sign / guidance		Presence / illumination levels, etc.	
Floor Material			
Handrail			
Communication		Methods of communication present in cab.	
Lighting			
	Emergency		
	Normal		
Power		Location / protection	
	Emergency		
	Normal		
Staffing		Does it have an operator?	
Access			
Sign / guidance		Presence / illumination levels, etc.	

Sketches / Notes:

Structural Component: Escalator

Factor	Attributes	Questions	X
Availability		Is it working/operational/broken/being repaired/out of service?	
Label			
Type		Scissor / enclosed , etc.	
Nature		Single / multiple – part of a set, etc. Grouping/ Configuration	
Connecting floors			
Location		Internal location, external, etc.	
Speed			
Direction			
Angle			
Clear Width			
Effective Width			
Steps			
	Length of approach	Distance from start of escalator to first step	
	Length of run-off	Distance from last step to end of escalator	
	# steps		
	Riser height / tread depth		
	Nosing		
	Edge of steps		
	Consistency		
	Condition	Debris / damage / etc.	
	Material		
	Diagonal length		
	Occupiable area		
	End notification		
Handrail			
	Projection		
	Material used		
	Height from the step		
Clear head room		Step to the bottom of stair above	
Condition			
Lighting			
	Normal		
	Emergency levels		
Access			
Sign / guidance		Presence / illumination levels, etc.	

Sketches / Notes:

Structural Component: Travelator

Factor	Attributes	Questions	X
Availability		Is it working/operational/broken/being repaired/out of service?	
Label			
Type			
Nature		Single / multiple – part of a set, etc. Grouping/ Configuration	
Connecting spaces			
Location		Internal location, external, etc.	
Speed			
Direction			
	Consistency		
	Condition	Debris / damage / etc.	
	Material		
	Length		
	Occupiable area		
	End notification		
Handrail			
	Projection		
	Material used		
	Height from the floor		
Clear head room			
Condition			
Lighting			
	Normal		
	Emergency levels		
Access			
Sign / guidance		Presence / illumination levels, etc.	

Sketches / Notes:

Structural Component: Ramp

Factor	Attributes	Questions	X
Label			
Type			
Connecting floors			
Location		Internal location, external, etc.	
Angle			
Condition		Debris / damage / etc.	
Material			
Diagonal length			
Occupiable area			
Handrail			
	Projection		
	Material used		
	Height from the step		
	Location		
	Number		
Clear head room		Step to the bottom of stair above	
Condition			
Lighting			
	Normal		
	Emergency levels		
Access			
Status		Is it available?	
Floor covering		Surface conditions	
Sign / guidance		Presence / illumination levels, etc.	

Sketches / Notes:

Appendix: [I,En] – Establish environmental conditions that are of interest and the acquisition activities to facilitate recording these conditions.

Useful References			
Example Material			
Factor	Attributes	Questions	X
Natural Hazard / Weather		Wind / Rain/ Snow/ Storm/ Earthquake/ Wildfire/ Flood/ Mudslide/ Wave, etc.	
Temperature			
Radiative Flux			
Smoke			
Visibility			
Debris			
Natural Lighting			
Artificial Lighting			
Emergency Lighting			
Noise			
Water			
Damage to Structure			
Potential Narcotic gases			
	HCN		
	CO		
	CO_2		
	Low O_2		
	Other		
Potential Irritant Gases			
	Acrolein		
	Formaldehyde		
	HCl		
	HBr		
	NO_2		
	SO_2		
	HF		
	Other		
Potential Agents			
	Biological		
	Chemical		
	Radiological		
	Nuclear		

OUTCOME: DETERMINE THE ENVIRONMENTAL CONDITIONS OF INTEREST THAT MIGHT INFLUENCE PERFORMANCE

Sketches / Notes:

Appendix: [I,Da] – Get resources and confirm extraction/acquisition/analytical plan.
This is a list of data acquisition roles that are referred to in the following discussion. The roles are not mutually exclusive. In reality, an individual may adopt several of these roles simultaneously. Although not exhaustive, these roles represent the basic elements of a data acquisition team.

- *Acquisition Managers [AM]: Responsible for overseeing and planning the data acquisition*
- *Acquisition Assistants [AA]: Responsible for performing tasks identified by the AM – distributing surveys / collecting material / retrieving cameras / disseminating information, etc.*
- *Technical Assistants [TA]: Responsible for installing acquisition devices and ensuring that they are appropriately configured.*
- *Data Collectors [DC]: Responsible for operating collection devices and/or making manual observations. Survey designers, interviewers, transcribers. Participant Observers (e.g., moving with the flow of an incident, responding with a population covertly, etc.)*
- *Data Extractors [DE]: Responsible for extracting the data/information from the storage media.*
- *Data Analysts [DA]: Responsible for interrogating the data-sets.*
- *Contact Point [CP]: Member of staff in host organization that has access/influence to the implementation of the procedure and is sufficiently senior to liaise with those with overall responsibility for the event.*
- *Active Staff [AS]: Those actively involved in the implementation of the procedure. Involved in guiding the behavior of the target population. Depending on the nature of the event, these may be staff of the host organization (i.e., accessed through the CP), or may be managed by the AM (e.g., during an experiment).*
- *Safety Staff [SS]: Those responsible for ensuring that the safety of the target population is not compromised during the event. The SS may be part of host organization, your team, or third parties.*

A general list of actions that might be performed in the early stages of the data acquisition process.

Useful References			
Example Material			
Factor	Attributes	Questions / actions	Addressed (X)
ACTIONS			
Walk Through			
		– Walk through space in 'normal' use. When not occupied, walk through according to emergency procedure.	
Review incident / exercise reports		– Review available reports on previous drills, exercises, false alarms and real incidents/events.	
Produce acquisition documentation		– General instructions / script for data acquisition team. – Produce overview of anticipated team activities for contact point within the host organization. – Produce data collection documents – documents in which to record the data during the event. – Produce data extraction documents – documents in which extracted data (from documentary or digital medium) can be represented in full.	
Review procedures		– Use event plans and mark on them expected movement routes, observation points, potential issues, etc.	
Establish Meeting Points		– Meeting points for data acquisition staff before, during and after the event	
Identify Individual roles		– Identify tasks expected of all data acquisition staff	

Derive labeling Scheme		– Determine labeling scheme to associate with data-sets collected (e.g., digital tapes) with locations, times, people, components, etc.	
Acquire still shots of key locations		– Go through the building and record condition of structure, key components, etc. – If performed discretely, also record locations in constant use, gathering points, flows, etc. Useful for planning and for final report.	
Select/configure Command point		– Location from where data collection activities can be managed. May also be meeting point?	
Investigate Visual Access		– Can the desired component/activity be seen, recorded from the planned location of the data collection resource? For instance, if a camera is to be place on a stairwell, is the field of vision sufficient to capture the data required?	
Define Key Data Analysis/Extraction Terms		– Have definitions been clearly established for the data collected, such that data can be extracted by a third party? – Do the terms clearly define the data to be collected, extracted and analyzed? – Do they relate to the procedure employed? – Are these definitions sufficiently clear to configure the data collection process (see previous point)?	
Produce Event storyboard / timeline		– Has a clear picture of the event been established such that the data collected can easily be associated with the event as it unfolds?	
Produce Instructions for Data Acquisition Staff		– List of required actions: location, key signals, – Maps of structure, expected movement, data collection resources, meeting points, etc	
Determine Requirements of Recording medium		– Discs, tapes, drives, sheets, etc. – Estimate maximum capacity required. – Assume damage and loss.	
Design/ Produce Data Acquisition Documentation		– Overall procedural guidance – Collection activities / recording sheets / timelines/ templates – Extraction instructions / note-sheets / templates – Analysis instructions / recording sheets / templates – Print off necessary number of documents	
Review power supply issues		– Is there any equipment that needs to be charged on the day? – What equipment needs to be charged on the night before?	
Devise General Acquisition Plan		Acquisition plan – – Produce schematic/timeline/storyboard of expected procedural activity. Use to confirm data collection activities. – Determine the best locations/situations to acquire data according to the expected procedure/response and overall objectives. – Position Data Acquisition resources. Should be mindful of behavioral factors that might detract from procedure. – Perform a run through – ensure that data collection resource is able to collect the desired data. Test the effectiveness of these locations/situations. For instance, stills of camera positions, a script for the interview process, etc. Get a small sample of data to be collected. – Compile a sample of the data to be collected. Determine	

		whether it best exploits/represents the event being conducted. – Use sample/run-through data to inform extraction and analysis activities	
Devise General Extraction Plan		– Examine overall objectives, the event procedure, the expected response, the organizational limitations, the structural/population /environmental conditions. – Produce outline of data storage and extraction actions. – Produce schematic of passage of data from collection resource to the analytical phase. Establish that resources in place can fulfill the passage of data. This should take into account the limitations of the storage medium, the format of the data required, the intended analytical actions and the tools required/available	
Devise General Analysis Plan		– Examine overall objectives, the event procedure, the expected response, the organizational limitations, the structural/population /environmental conditions. – Outline key variables and factors to be examined, and the relationships of interest. – Determine techniques required to establish relationships of interest to the desired degree of accuracy/credibility/confidence. – Produce plan to outline key analytical activities: models required, expertise required, individuals involved, outcomes needed.	
Pre-Event Interview Design		Interviews to cater for upcoming event in support of other data collection activities. – Produce interview script – Pilot script – Train / Practice Interviewers – Establish sample size – Establish dedicated tools/storage required to collect / store/ examine interview data	
Pre-Event Survey Design		Survey to cater for upcoming event in support of other data collection activities. – Produce survey – Pilot survey – Establish mode of survey delivery [postal / on site/ web-based/ etc.] – Establish distribution / collection activities – Estimate required sample size / number of surveys to distribute – Establish dedicated tools/storage required to collect / store/ examine survey data	
Observations			
	Non-Emergency Ingress		
	Non-Emergency Circulation		
	Non-Emergency Egress		
Sketches / Notes:			

MATERIAL RESOURCES PURCHASES			
Video Cameras			
Tapes / Discs / Drives			
Stills Cameras			
Stopwatches			
RFID			
Dictaphones			
Microphones			
Headphones			
Pens / Pencils/Markers			
Clipboards			
Paper			
Measuring tapes			
Clamps / Adhesive / Velcro			
Duct tape			
Torches / Flashlights			
Additional batteries			
Connecting plug outlets / cords			
Boxes / Bags			
Printed Matter			
Hats / Caps			
Jackets / Bibs / Vests			
Laminated Cards			
Communication Devices			
General Tools			
Whistles			
Room/Space		Onsite activities – configuration / preparation / interviews / survey completion	
Cover story			
Extraction Software/Tools			
Storage Medium			
Analytical Software/Tools			
Sketches / Notes:			

HUMAN RESOURCES			
Acquisition Managers [AM]			
		Responsible for overseeing and designing/planning the data acquisition	
Acquisition Assistants [AA]			
		Responsible for performing tasks identified by the AM – distributing surveys / collecting material / retrieving cameras / disseminating information, etc.	
Technical Assistants [TA]			
		Responsible for installing acquisition devices and ensuring that they are appropriately configured.	
Data Collectors [DC]			
		Responsible for operating collection devices and/or making manual observations.	
		Survey designers, interviewers, transcribers.	
		Participant Observers (e.g., moving with the flow of an incident, responding with a population covertly, etc.)	
Data Extractors [DE]			
		Responsible for extracting the data/information from the storage media.	
Data Analysts [DA]			
		Responsible for interrogating the data-sets.	
Safety Staff [SS]		Responsible for ensuring that the safety of the target population is not compromised during the event.	

GENERAL PROCESS-

- *Examine overall objectives*
- *Determine the data required to meet these objectives*
- *Determine the best locations/situations to acquire this data*
- *Record intended data access – get an idea of the type of data that the data collection resources acquire. For instance, stills of camera positions, a script for the interview process, etc.*
- *Perform a run through – ensure that data collection resource is able to collect the desired data. For instance, position cameras and made test recording, conduct a pilot for the interview process. Achieve a picture of the expected performance of each data collection resource.*
- *Compile an estimate of the data to be collected. Produce an overview of this data to determine whether it best exploits/represents the event being conducted.*
- *Produce necessary supporting documentation*

ACQUISITION PLAN –

- *Location of resources – marked on floor-plan*
- *Material resources required*
- *Human resources [number of AM/AA/TA/DC/DE/DA/SS] required.*
- *Target actions/events to be acquired*
- *Script/timeline associated with each resource – when it is active, manned, inactive*
- *Data acquisition documents – record sheets, instructions*

Sketches / Notes:

P **PREPARATION –** ***Lists of actions are provided. These are associated with staff roles that need to be completed as part of the preparation stage of the data collection process.***

Roles Required During the Preparation Data Stage

Here is a list of data acquisition roles that are referred to in the following discussion. The roles are not mutually exclusive. In reality, an individual may adopt several of these roles simultaneously. Indeed, in many instances, resources may not be available for each role to be adopted by an individual. Although not exhaustive, these roles represent the basic elements of a data acquisition team.

- *Acquisition Managers [AM]: Responsible for overseeing and planning the data acquisition*
- *Acquisition Assistants [AA]: Responsible for performing tasks identified by the [AM] – distributing surveys / collecting material / retrieving cameras / disseminating information, etc.*
- *Technical Assistants [TA]: Responsible for installing acquisition devices and ensuring that they are appropriately configured.*
- *Data Collectors [DC]: Responsible for operating collection devices and/or making manual observations. Survey designers, interviewers, transcribers. Participant Observers (e.g., moving with the flow of an incident, responding with a population covertly, etc.)*
- *Data Extractors [DE]: Responsible for extracting the data/information from the storage media.*
- *Data Analysts [DA]: Responsible for interrogating the data-sets.*
- *Contact Point [CP]: Member of staff in host organization that has access/influence to the implementation of the procedure and is sufficiently senior to liaise with those with overall responsibility for the event.*
- *Active Staff [AS]: Those actively involved in the implementation of the procedure. Involved in guiding the behavior of the target population. Depending on the nature of the event, these may be staff of the host organization (i.e., accessed through the [CP]), or may be managed by the [AM] (e.g., during an experiment).*
- *Safety Staff [SS]: Those responsible for ensuring that the safety of the target population is not compromised during the event. The SS may be part of host organization, your team, or third parties.*

Appendix: [P,Pr] – Actions performed on the day of the event to ensure procedure is executed

Useful References	
Example Material	
ROLE	REQUIREMENTS
AM	– Ensure that [AS] have the necessary resources to conduct their activities. Ensure that they are familiar with procedure in place. – Check for discrepancies/changes in the procedure. May require contact with [AS] and [CP] to clearly establish this. – Establish whether other procedures currently employed (not directly related to the event) may influence the outcome. – Establish availability of [AS] to implement procedure. Take measures to compensate, should the procedure be the responsibility of the [AM]. – Attend pre-event organization meeting, if planned. May require [AM] to liaise with [CP] for this. – Establish 'Go' (that initiates the procedure) signal, 'Abort' signal (that indicates that the event has been abandoned or interrupted), and 'Recall' signal (that indicates that the event has ended). Communicate these signals to the rest of the team. – Communicate changes to [TA] and [DC] should changes be required.
AA	– Familiarize self with procedure in place. – Observe [AS] to gauge their activities. – Report back to [AM] as necessary
TA	– Familiarize self with procedure in place. – Examine technological resources. – May have to respond to instructions to [AM], should actions be required. – Report back technological status and issues to [AM] as necessary
DC	– Familiarize self with procedure in place. – May have to respond to instructions to [AM], should actions be required.
DE	N/A
DA	N/A
AS	– Familiarize self with procedure in place. – Report to [AM], if the [AM] is responsible for the active staff. Otherwise, enact the procedure according to plan.
SS	– Confirm that intended procedure is reasonable. Report back to [AM] and [CP], if need be.
General Issues	– Have [DC]/[DA]/[AA]/[TA] had prior access to procedural documentation? – What documentation is to be available during the event? – Do active members of staff carry reminders of expected duties? – Is there procedural information available within the structure itself (signage, posters, etc.)?
Sketches / Notes:	

Appendix: [P,Re] – Enable comparison on the day of the event between actual /expected response

Useful References	
Example Material	
ROLE	REQUIREMENTS
AM	– Receive information on potential behavioral issues; e.g., do they suspect that a specific route is not available. – Relay to [TA] should technical resources need reallocation/adjustment. – Relay to [DC] should their activities need modification.
AA	– Establish whether structure is being entered/accessed as expected. Are people entering the structure in an unexpected manner that might then influence the egress routes that they choose during an evacuation? – Establish whether amenities/facilities are being used as normal just prior to event. – Establish whether target population is engaged in the expected activities.
TA	– Respond to [AM] instructions
DC	– Report behavioral issues to [AM] that are immediately apparent – issues that might detract from the data acquisition activities. – Respond to [AM]
DE	N/A
DA	N/A
AS	– Report issues to [AM] should they arise – Respond to [AM] as needed
SS	– Does any unexpected behavior increase safety concerns? Report back to [AM] and [CP] if need be.
General Issues	– Ensure that the response of the target population is catered for by the data collection activities.

Sketches / Notes:

Appendix: [P,Or] – Ensure organization and acquisition is integrated.

Useful References	
Example Material	
ROLE	REQUIREMENTS
AM	– Liaise with [CP] to ensure that event will proceed as planned. – Inform [AA]/[TA]/[DC]/[AS] (if appropriate) of decision to proceed and/or any changes to the procedure.
AA	– Receive instruction from [AM]
TA	– Receive instruction from [AM]
DC	– Receive instruction from [AM]
DE	N/A
DA	N/A
AS	– Receive instruction from [AM]
SS	– Monitor impact of data acquisition activities on staff and target population. Report back to [AM] and [CP], if need be.
General Issues	– Confirm that the event is proceeding and that no high-level decisions have been made that will influence the outcome. – Conduct meetings with principle actors who already know about the data acquisition process.

Sketches / Notes:

Appendix: [P,Po] – Confirm population is as expected.

Useful References	
Example Material	
ROLE	REQUIREMENTS
AM	– Receive reports from [AA]
AA	– Establish whether current population attributes appear consistent with expectation. For instance, is the occupant population as expected on the day of the event? – Take care not to pre-empt, prompt or influence the response of the target population. – Inform [AM] of any serious discrepancies.
TA	N/A
DC	N/A
DE	N/A
DA	N/A
AS	N/A
SS	– Ensure that changes in the population (e.g., presence of small children) do not introduce new safety concerns. Report back to [AM] and [CP], if need be.
General Issues	– Determine whether the population's distribution and attributes are as expected.

Sketches / Notes:

Appendix: [P,Ob] – Ensure that objectives are met by procedure.

Useful References	
Example Material	
ROLE	REQUIREMENTS
AM	– Ensure that the current conditions, and any recent changes to the procedures, activities, and resources in place, are able to meet the objectives set previously.
AA	– Report back to [AM] any significant discrepancies from the data collection activities, response of the target population or procedure.
TA	– Report back to [AM] any significant discrepancies from the data collection activities, response of the target population or procedure.
DC	– Report back to [AM] any significant discrepancies from the data collection activities, response of the target population or procedure.
DE	N/A
DA	N/A
AS	N/A
SS	– If there are changes to procedure, ensure that they do not adversely affect safety levels. Report back to [AM] and [CP], if need be.
General Issues	– Determine whether the stated objectives can be met by the current conditions, plan and procedure.

Sketches / Notes:

Appendix: [P,St] – Determine status of structure during event.

Useful References	
Example Material	
ROLE	REQUIREMENTS
AM	– Prior to the commencement of the event, get confirmation from [AA] that the structure is appropriately configured (e.g., routes are available, doors locked/unlocked, etc.). – Inform [DC]/[TA] of any serious discrepancies that require changes to the data collection activities.
AA	– Determine whether current building attributes appear consistent with expectation; i.e., perform a walk through. Establish how the differences may influence performance. – Make any configurational changes to the structural components, consistent with the predetermined plan. – Take care not to pre-empt, prompt or influence the response of the target population. – Inform [AM] of any serious discrepancies.
TA	– Receive information from [AM].
DC	– Receive information from [AM].
DE	N/A
DA	N/A
AS	N/A
SS	– Ensure that population is able to safely make use of the structure. Report back to [AM] and [CP], if need be.
General Issues	– Outcome: Determine whether the status of the structure is suitable for the data collection activities to take place.

Sketches / Notes:

Appendix: [P,En] – Determine/ manage environmental conditions during event.

Useful References	
Example Material	
ROLE	REQUIREMENTS
AM	– Prior to the commencement of the event, get confirmation from [AA]/[TA] that the environmental conditions are as expected. – Inform [DC]/[TA] of any serious discrepancies that require changes to the data collection activities. – Check with [SS] to ensure conditions are reasonable and safe.
AA	– If environmental conditions are to be managed, configure equipment, etc. in accordance with the pre-determined plan, to achieve the desired results. – Determine whether current environmental conditions are consistent with expectation. Establish how the differences may influence performance. – Take care not to pre-empt, prompt or influence the response of the target population. – Inform [AM] of any serious discrepancies.
TA	– Receive information from [AM]. – Instructions may include resetting/reconfiguring equipment, should the environmental conditions be managed.
DC	– Receive information from [AM].
DE	N/A
DA	N/A
AS	N/A
SS	– Ensure that the environmental conditions are reasonable and do not pose an unacceptable risk. Report back to [AM] and [CP], if need be.
General Issues	– Outcome: Assess whether the environmental conditions are as expected and the necessary remedial actions.

Sketches / Notes:

Appendix: [P,Da] – Install/ implement acquisition tools / methods

Useful References	
Example Material	
ROLE	REQUIREMENTS
AM	– Ensure data acquisition plan is distributed and that everyone is familiar with it and their role in it. – Develop commencement signal. – Ensure that room/space is available for meetings/discussions/interviews, etc. – Arrive at meeting point. – Provide current data acquisition plan to staff. – Ensure [AA]/[TA]/[DC] have resources available to complete pre-determined task. – Ensure that [AA]/[TA]/[DC] are in the correct locations to perform their tasks. – Communicate with [TA] to ensure that the equipment is appropriately configured. – Provide instructions to [AA]/[DC] should actions be required. – Perform a walkthrough of the structure and of the data collection resources to get an overview of [DC] activities.
AA	– Collect necessary documentation/resources for distribution to other staff. – Arrive at meeting point. – Respond to [AM] instructions
TA	– Check that necessary resources are available. – Ensure that they are labeled correctly. – Arrive at meeting point. – Distribute communication devices. – Distribute technical resources for installation. – Ensure resources are in place, are accessible, operate according to expectation, are able to collect the necessary information, will survive the event, can be reasonably collected after the event. – For video equipment, ensure it is functioning; charged; time synchronized; configured appropriately; can be attached to necessary fitting; can be carried by the installer/operator; can be operated by associated [DC]; ensure views/access is still reasonable; has sufficient storage media. – Respond to [AM] instructions
DC	– Arrive at meeting point. – Collect documentation from [AA]. – Confirm communication devices. – Ensure that all necessary manual equipment (e.g., stopwatches, pens, clipboards, bibs, etc.) are available. – Receive final instructions from [TA] regarding the operation of any technological resources. – Confirm that all of the material resources are in place at their location. – Respond to [AM] instructions
DE	N/A
DA	N/A
AS	N/A

SS	– Ensure that the practice/procedure does not compromise the safety of staff or the target population. Report back to [AM] and [CP], if need be.
General Issues	N/A

Sketches / Notes:

E **EXECUTION** – ***Lists of actions are provided. These are associated with staff roles that need to be completed as part of the execution stage of the data collection process.***

Roles Required During the Execution Stages

Here is a list of data acquisition roles that are referred to in the following discussion. The roles are not mutually exclusive. In reality, an individual may adopt several of these roles simultaneously. Indeed, in many instances, resources may not be available for each role to be adopted by an individual. Although not exhaustive, these roles represent the basic elements of a data acquisition team.

- *Acquisition Managers [AM]: Responsible for overseeing and planning the data acquisition*
- *Acquisition Assistants [AA]: Responsible for performing tasks identified by the AM – distributing surveys / collecting material / retrieving cameras / disseminating information, etc.*
- *Technical Assistants [TA]: Responsible for installing acquisition devices and ensuring that they are appropriately configured.*
- *Data Collectors [DC]: Responsible for operating collection devices and/or making manual observations. Survey designers, interviewers, transcribers. Participant Observers (e.g., moving with the flow of an incident, responding with a population covertly, etc.)*
- *Data Extractors [DE]: Responsible for extracting the data/information from the storage media.*
- *Data Analysts [DA]: Responsible for interrogating the data-sets.*
- *Contact Point [CP]: Member of staff in host organization that has access/influence to the implementation of the procedure and is sufficiently senior to liaise with those with overall responsibility for the event.*
- *Active Staff [AS]: Those actively involved in the implementation of the procedure. Involved in guiding the behavior of the target population. Depending on the nature of the event, these may be staff of the host organization (i.e., accessed through the CP), or may be managed by the AM (e.g., during an experiment).*
- *Safety Staff [SS]: Those responsible for ensuring that the safety of the target population is not compromised during the event. The SS may be part of host organization, your team, or third parties.*

Appendix: [E,Pr]: Apply procedure of interest

Useful References	
Example Material	
ROLE	REQUIREMENTS
AM	– Receive reports regarding current conditions. – Review current conditions to determine appropriateness of acquisition plan. – Implement acquisition plan. – Remain in contact with [CP] to receive reports on progress of event and of data collection activities.
AA	– Provide feedback to [AM] regarding current conditions. – Remain in predetermined locations for next activity and remain in contact with [AM].
TA	– Remain with [AM] in contact with [AM] to provide technical support should the need arise. – Remain in constant contact with [DC] staff.
DC	– Receive instructions from [AM] regarding implementation of acquisition plan. – Engage in data collection activities. – Remain contactable during event in case of modifications. – Report significant issues to [AM], especially those that impact response.
DE	N/A
DA	N/A
AS	– Receive instructions from [AM] regarding implementation of acquisition plan and the commencement of the event. – Enact procedure
SS	– Sign off on procedure.
General Issues	– Ensure that the execution of the procedure is consistent with the data collection resources in place.
Sketches / Notes:	

Appendix: [E,Re]: Monitor/manage response

Useful References	
Example Material	
ROLE	REQUIREMENTS
AM	– Modify procedure/acquisition plan should serious discrepancies occur between the expected and actual behavioral response. – Inform [DC]/[AA] of any changes.
AA	– Continue to observe response of population from pre-defined locations. – Report significant discrepancies to [AM]
TA	N/A
DC	– Make direct observations (qualitative and quantitative). Record observations on resources provided. – Report significant issues to [AM], especially those that impact response.
DE	N/A
DA	N/A
AS	– Manage response of target population according to procedural objectives. – Receive instructions from [AM] regarding procedural modifications.
SS	– Monitor conditions. Report back to [AM], if need be.
General Issues	– Record the behavioral response.

Sketches / Notes:

Appendix: [E,Org]: Liaise with organization personnel

Useful References	
Example Material	
ROLE	REQUIREMENTS
AM	– Remain in contact with [CP].
AA	N/A
TA	N/A
DC	N/A
DE	N/A
DA	N/A
AS	N/A
SS	– Provide feedback to [AM], if need be.
General Issues	– Ensure that contact is maintained with contact points within the host organization to allow the event to proceed smoothly.

Sketches / Notes:

Appendix: [E,Po]: Observe changes in the population.

Useful References	
Example Material	
ROLE	REQUIREMENTS
AM	– Modify procedure/acquisition plan should serious discrepancies occur between the expected and actual population attributes/distribution.
AA	– Note discrepancies/developments in the population during the event. – Report serious discrepancies to [AM]
TA	N/A
DC	– Note discrepancies/developments in the population during the event. – Report significant discrepancies to [AM], especially those that impact response.
DE	N/A
DA	N/A
AS	N/A
SS	– Monitor situation. Report back to [AM], if need be.
General Issues	– Record the status of the population during the event.

Sketches / Notes:

Appendix: [E,Ob]: Establish whether key objectives are being met.

Useful References	
Example Material	
ROLE	REQUIREMENTS
AM	– Given the nature of the event and the information/resources available, determine whether the data collection activities should be modified to cope for any discrepancies between the objectives and the conditions present.
AA	– Record any discrepancies from the data collection activities, response of the target population or procedure.
TA	– Respond to technical discrepancies identified by [AM] between the data collected and the data desired and establish solutions.
DC	– Depending on the nature of the event, the discrepancy could be reported back to the [AM] (if there is the possibility of correcting it), or clearly record discrepancies such that they can be accurately documented.
DE	N/A
DA	N/A
AS	N/A
SS	N/A
General Issues	– Determine whether there are discrepancies between the current conditions, the data being collected and the stated objectives, and whether anything can be done about it.

Sketches / Notes:

Appendix: [E,St]: Monitor structural components

Useful References	
Example Material	
ROLE	REQUIREMENTS
AM	– Modify procedure/acquisition plan should serious discrepancies occur between the expected and actual structural status.
AA	– Monitor changes to the status of the structure and record. – Report serious discrepancies to [AM]
TA	– Monitor changes to the status of the structure and record. – Report serious discrepancies to [AM]
DC	– Monitor changes to the status of the structure and record. – Report significant discrepancies to [AM], especially those that impact response.
DE	N/A
DA	N/A
AS	N/A
SS	– Monitor structural conditions. Report back to [AM], if need be.
General Issues	– Record the status of the structure during the event.

Sketches / Notes:

Appendix: [E,En]: Monitor changes in the environmental conditions.

Useful References	
Example Material	
ROLE	REQUIREMENTS
AM	– Modify procedure/acquisition plan should serious discrepancies occur between the expected and actual environmental conditions.
AA	– Monitor changes to the status of the environment and record. – Report serious discrepancies to [AM]
TA	– Monitor changes to the status of the environment and record. – Report serious discrepancies to [AM]
DC	– Monitor changes to the status of the environment and record. – Report significant discrepancies to [AM], especially those that impact response.
DE	N/A
DA	N/A
AS	N/A
SS	– Monitor conditions. Report back to [AM], if need be.
General Issues	– Record the status of the environmental conditions during the event.

Sketches / Notes:

Appendix: [E,Da]: Acquire Data

Useful References	
Example Material	
ROLE	REQUIREMENTS
AM	– Receive reports on data acquisition activities – Modify data collection activities and inform [AA] and [DC] if necessary – Inform [TA] of technical issues should they arise.
AA	– Respond to [AM] instructions as needed
TA	– Respond to [AM] instructions as needed
DC	– Implement data collection activities according to procedure. – Report technical issues to [AM] – Respond to instructions from [AM]
DE	N/A
DA	N/A
AS	N/A
SS	N/A
General Issues	– Acquire the data as per the acquisition plan.

Sketches / Notes:

DATA EXTRACTION – ***Lists of actions are provided. These are associated with staff roles that need to be completed as part of the extraction stage of the data collection process.***

Roles Required During the Data Extraction Stage

Here is a list of data acquisition roles that are referred to in the following discussion. The roles are not mutually exclusive. In reality, an individual may adopt several of these roles simultaneously. Indeed, in many instances, resources may not be available for each role to be adopted by an individual. Although not exhaustive, these roles represent the basic elements of a data acquisition team.

- *Acquisition Managers [AM]: Responsible for overseeing and planning the data acquisition*
- *Acquisition Assistants [AA]: Responsible for performing tasks identified by the AM – distributing surveys / collecting material / retrieving cameras / disseminating information, etc.*
- *Technical Assistants [TA]: Responsible for installing acquisition devices and ensuring that they are appropriately configured.*
- *Data Collectors [DC]: Responsible for operating collection devices and/or making manual observations. Survey designers , interviewers, transcribers. Participant Observers (e.g., moving with the flow of an incident, responding with a population covertly, etc.)*
- *Data Extractors [DE]: Responsible for extracting the data/information from the storage media.*
- *Data Analysts [DA]: Responsible for interrogating the data-sets.*
- *Contact Point [CP]: Member of staff in host organization that has access/influence to the implementation of the procedure and is sufficiently senior to liaise with those with overall responsibility for the event.*
- *Active Staff [AS]: Those actively involved in the implementation of the procedure. Involved in guiding the behavior of the target population. Depending on the nature of the event, these may be staff of the host organization (i.e., accessed through the CP), or may be managed by the AM (e.g., during an experiment).*

Appendix: [D_E,Da] : Extract data from storage media

Useful References	
Example Material	
ROLE	REQUIREMENTS
AM	– Have clear script/timeline/storyboard of events/items that demarcate the extraction process. – Provide guidance to the [DE] regarding events/attributes of interest – Liaise between [TA] and [DE] as necessary. – Monitor progress of [DE]. Compare with objectives. – Assess issues of consistency between members of [DE] team. – Take samples from [DE] team. Possibly have [DE] members work on same data sample for consistency check.
AA	N/A
TA	– Receive guidance from [AM] – Provide support to [DE] as necessary
DC	N/A
DE	– Extract data from media per extraction plan – Have a clear understanding of the overall objectives. – Be familiar with the terms used to define the data being analyzed. – Contact [AM]/[DC] for guidance on procedures employed, the procedure employed, the event and the definitions used. – Report procedural/technical issues to [AM]
DA	– Liaise with [DE] – remain familiar with extraction procedure.
AS	N/A
General Issues	– [DE] should be mindful of other components of data acquisition timeline during the extraction phase. o The procedure employed – the event timeline; i.e., where the extraction definitions fit into the overall plan. o The overall data objectives. Are there discrepancies between the extraction terms, the data produced and the analytical objectives? o The organizational limitations o The behavioral response of the target population – determine whether there are discrepancies that make the extraction activities inappropriate. o The structural/environmental/population conditions o The data collection resources employed o The data acquisition plan
General Issues	– Provide a data-set that can be analyzed in a manner consistent with the overall objectives.
Sketches / Notes:	

DATA ANALYSIS – ***Lists of actions are provided. These are associated with staff roles that need to be completed as part of the analysis stage of the data collection process.***

Roles Required During the Data Analysis Stage

Here is a list of data acquisition roles that are referred to in the following discussion. The roles are not mutually exclusive. In reality, an individual may adopt several of these roles simultaneously. Indeed, in many instances, resources may not be available for each role to be adopted by an individual. Although not exhaustive, these roles represent the basic elements of a data acquisition team.

- *Acquisition Managers [AM]: Responsible for overseeing and planning the data acquisition*
- *Acquisition Assistants [AA]: Responsible for performing tasks identified by the AM – distributing surveys / collecting material / retrieving cameras / disseminating information, etc.*
- *Technical Assistants [TA]: Responsible for installing acquisition devices and ensuring that they are appropriately configured.*
- *Data Collectors [DC]: Responsible for operating collection devices and/or making manual observations. Survey designers, interviewers, transcribers. Participant Observers (e.g., moving with the flow of an incident, responding with a population covertly, etc.)*
- *Data Extractors [DE]: Responsible for extracting the data/information from the storage media.*
- *Data Analysts [DA]: Responsible for interrogating the data-sets.*
- *Contact Point [CP]: Member of staff in host organization that has access/influence to the implementation of the procedure and is sufficiently senior to liaise with those with overall responsibility for the event.*
- *Active Staff [AS]: Those actively involved in the implementation of the procedure. Involved in guiding the behavior of the target population. Depending on the nature of the event, these may be staff of the host organization (i.e., accessed through the CP), or may be managed by the AM (e.g., during an experiment).*

Appendix: [D_A,Da]: Analyze Data

Useful References	
Example Material	
ROLE	REQUIREMENTS
AM	– Provide guidance to the [DA] regarding events/attributes of interest – Liaise between [DE] and [DA] as necessary – Receive sample of analyzed data for review. – Modify approach as needed.
AA	N/A
TA	– Provide general technological guidance as requested.
DC	–
DE	– Receive guidance from [AM] – Provide support to [DA] as necessary – Respond to queries from [AM]/[DA] regarding analytical activities
DA	– Have a clear understanding of the overall objectives. Do the tools/techniques employed achieve these objectives? – Be familiar with the terms used to define the data being analyzed. This is critical to appropriately analyze and present data. – Have a detailed understanding of the analytical tools employed – the functionality/limitations of the tools being employed – Contact [AM]/[DC] for guidance on procedures employed, the procedure employed and the event. – Analyze data per analytical procedure.
AS	N/A
General Issues	– [DA] should be mindful of other components of data acquisition timeline during the analytical phase. o The procedure employed – the event timeline o The overall data objectives o The organizational limitations o The behavioral response of the target population o The structural/environmental/population conditions o The data collection resources employed o The data acquisition plan o The extraction plan – Produce data in accordance with overall objectives.
Sketches / Notes:	

Appendix C: DATA TEMPLATE – LEVEL 1 DOCUMENT

The *Data Template* is used to frame the description of each data-set. Each completed *Data Template* represents a single record within the overall *Data Portal* (forming a database of searchable records). The *Data Template* has a comprehensive list of sections enabling the user to provide information on a number of different facets of the data-set many of which are not directly related to the numerical data itself.

Each section (heading and sub-heading) is accompanied by a brief description of its purpose. Each section has placeholders for information/data to be entered. These are shown in order to indicate that information can be provided, rather than as a representative amount of space for the information to be provided. The format of the template (including the space available for each response) will undoubtedly be modified during the online implementation in order to cope with the changing nature of the information needs and on the technology available.

The template is presented in the order in which the information/data tends to appear in the original sources rather than the order in which it would be completed by the user. In the online implementation a tabbed (or similarly selective) design may be more appropriate where the user can identify the order in which the template is completed according to their needs.

Throughout the template, the user is able to insert information as required. This may be through directly inserting text, inserting figures or objects (e.g., in the sections marked with crossed circles, or as required), completing linked documents (e.g., Level 2 documents), or providing their own link resources. Where indicated, a link is provided that takes the user to associated documents (Level 2 document). (If read in PDF form, the identifying link/label in the template matches up with the heading of the Level 2 document so that it can be easily followed.)

DATA TEMPLATE: Level 1 Document				
OVERVIEW: *OVERVIEW OF BEHAVIORAL COMPONENTS ADDRESSED AND NATURE OF THE FINDINGS*				
CONTENT	**PRE-CUE PHASE**	**PRE-RESPONSE PHASE**	**RESPONSE PHASE**	**POST-RESPONSE PHASE**
NUMERICAL				
DESCRIPTIVE				

A. BACKGROUND INFORMATION – *OVERVIEW OF DATA SOURCE* **Or**

A-1. Reference: *DESCRIPTION OF DATA SOURCE/SOURCE MATERIAL*

A-2. Organizations Involved In Data Collection: *BACKGROUND INFORMATION ON NATURE /CREDIBILITY OF ORGANIZATIONS INVOLVED*

Organization	Name	Primary Function of Organization	Secondary Function of Organization
1			
2			
3			

A-3. Date of Data Collection: *OVERVIEW OF AGE OF DATA*

Accuracy	X	Comment
Specific Date		
Estimated (Prior To)		
Unknown		

A-4. Reviewed Material Accompanying Data-Set: *DESCRIPTION OF SUPPORTING MATERIAL PRESENTED BY AUTHORS*

A-5. Original Purpose of Data Collection: *DESCRIPTION OF OBJECTIVES BEHIND DATA COLLECTION*

	X		X		X		X
Empirical Data		Model Dev./Valid./Calib.		Theory Dev.		Exam. Specific Factor	
Code Development		Specific Application		Performance Issue		Incident Investigation	
Other							
General Description of Objective							

B.SUMMARY INFORMATION – *OVERVIEW OF DATA CONTENT*

B-1. Factors/Variables Being Examined: *EXAMINATION OF INFLUENTIAL FACTORS (I.E., INDEPENDENT VARIABLES, IV) AND OUTCOMES (I.E., DEPENDENT VARIABLES, DV) RELATED TO THE DATA COLLECTION PROCESS. MAY BE NON-LINEAR, MULTI-VARIATE, ETC. MAY BE THAT MANY IV LEAD TO SINGLE DV, OR SINGLE IV LEADS TO MANY DV. THIS IS SIMPLY TO PROVIDE HIGH-LEVEL GUIDANCE ON THE FACTORS OF INTEREST.*

Independent Variables	Dependent Variables

B-2. Key Terminology Employed: *DESCRIPTION OF THE (1) KEYWORDS STATED BY AUTHORS (I.E., IDENTIFIED IN KEY WORD SECTION OF ARTICLE); (2) SIGNIFICANT TERMS MANUALLY DERIVED FROM REVIEW OF MATERIAL; (3) PARENT TERMS ASSOCIATED WITH ANALYSIS OF (1) AND (2) USING BEHAVIORAL/ENGINEERING DICTIONARY*

Original Keywords:					
Terms Derived From Associated Text:					
Parent / Inserted Terms:					

C. PROCEDURE-*DESCRIPTION OF NATURE OF EVENT AND PROCEDURE EMPLOYED TO MANAGE RESPONSE OF TARGET POPULATION*	**Pr**

C-1. Nature of Event: *DESCRIPTION OF THE EVENT FROM WHICH THE DATA WAS COLLECTED*

Event Type	**x**	**Details**	
Actual Incident			*LINK*
Unannounced Drill			*LINK*
Quasi-Announced Drill			*LINK*
Announced Drill			*LINK*
Experimental Trial			*LINK*
Simulation			*LINK*
Case Study			*LINK*
General Circulation / Non-emergency Operation			*LINK*
Ingress			*LINK*
Other			*LINK*
Description:			*LINK*
Additional Resources: Images / Schematics / Documents/ Timeline / Storyboard			*LINK*

C-2. Procedure Employed: *DETAILED UNDERSTANDING OF THE PROCEDURE EMPLOYED TO MANAGE THE EVENT*

		X	Details	
Procedure Employed				
	Type of Procedure		Non-Emergency/Emergency/ Experimental / Imposed / Ad hoc	*LINK*
	Key Steps in Procedure			*LINK*
	Routes Available to Proc.			*LINK*
	Routes Lost to Proc.			*LINK*
	Routes Actually Used			*LINK*
	Key Locations/Areas Involved in the Procedure			*LINK*
	Degree of Management		Managed / Unmanaged / Controlled / Uncontrolled	*LINK*
	Degree of Prior Knowledge		Announced / Unannounced	*LINK*
	Timing		Phased / Simultaneous	*LINK*
	Involvement of Space		Complete / Full-Scale / Partial / Selective / Zoned	*LINK*
	Unspecified / Other			*LINK*
	Active Staff Responsibilities			*LINK*
	Intended Target Population Activities			*LINK*
	Other Procedures in Place (Operation, Security, Emergency, etc.)			*LINK*
	Outside Intervention			*LINK*
Description:				*LINK*
Additional Resources: Images / Schematics / Timeline / Storyboard				*LINK* [PR1]

C-3. Preparation for Procedure: *DESCRIPTION OF THE (PRE-EVENT) PROCEDURAL PREPARATIONS MADE PRIOR TO THE EVENT*

		X	Details	
Preparation				
	Documentation			*LINK*
	Drills (Approach Adopted / #)			*LINK*
	Training			*LINK*
	Previous Incidents			*LINK*
Description:				*LINK*
Additional Resources: Images / Schematics / Timeline / Storyboard				*LINK*

C-4. Technological Resources Employed within Procedure: *DESCRIPTION OF THE EQUIPMENT USED TO ENABLE THE PROCEDURE TO BE EMPLOYED*

		X	Details	
Technological Resources				
	Notification System (Coverage / Audibility / Intelligibility, etc.)			*LINK*
	Signage System			*LINK*
	Visual System			*LINK*
	Distributed Systems (Pagers, Cell, PDAs, etc.)			*LINK*
	Monitoring Systems			*LINK*
	Communication Systems			*LINK*
	Emergency Lighting			*LINK*
	Assembly Points			*LINK*
	Suppression System			*LINK*
	Detection System			*LINK*
	Passive System			*LINK*
	Fire-Fighting Equipment			
	Other			*LINK*
Description:				*LINK*
Additional Resources: Images / Schematics / Timeline / Storyboard				*LINK*

C-5. Human Resources Employed within Procedure: *DESCRIPTION OF STAFF REQUIRED TO FACILITATE PROCEDURE*

		X	Details	
Human Resources				
	Staff Levels Available			*LINK*
	Staff Training			*LINK*
	Staff Experience			*LINK*
	Staff Activities			*LINK*
	Staff Roles/Hierarchy / Structure			*LINK*
	Staff Distribution			*LINK*
	Emergency Responders			*LINK*
Description:				*LINK*
Additional Resources: Images / Schematics / Timeline / Storyboard				*LINK*

D.STRUCTURE – *THE PHYSICAL SPACE IN WHICH THE EVENT TOOK PLACE* **St**

D-1. Structure/Space Characteristics: *DETAILED INFORMATION ON PHYSICAL SPACE IN WHICH THE EVENT TOOK PLACE*

	X	Details	
Name			*LINK*
Address / Location			*LINK*
Age of Structure			*LINK*
Surrounding Areas / Buildings			*LINK*
Type of structure / Occupancy Type			*LINK*
Dimensions (Height / Footprint / Area)			*LINK*
Fire History			*LINK*
Construction History			*LINK*
Exercise/Experiment/Drill History			*LINK*
No. of Rooms / Floor			*LINK*
No. of Floors			*LINK*
No./Config. of Stairwells			*LINK*
No./Config. of Elevators			*LINK*
No./Config.. of Escalators			*LINK*
No./Config. of Ramps			*LINK*
No./Config. of Travelators			*LINK*
No./Config. of Tunnels			*LINK*
No./Config. of Exits			*LINK*
General Floor Layout (Internal Separation / Exit Visibility / Configuration)			*LINK*
Perimeter Access (Ext.Exits / Security / Main Exits / Access Management)			*LINK*
Notification Equip. (Audio)			*LINK*
Notification Equip. (Visual)			*LINK*
Suppression System			*LINK*

Detection System			*LINK*
Guidance Equip.			*LINK*
Description:			*LINK*
Additional Resources: Images / Schematics / Timeline / Storyboard			*LINK* [SD1]

E.POPULATION – *DESCRIPTION OF THE TARGET POPULATION SUBJECT TO THE PROCEDURE* **Po**

E-1 Population Characteristics *INFORMATION ON TARGET POPULATION; I.E., THOSE SUBJECT TO THE PROCEDURE*

		X	Details	
Situation				
	Size			*LINK*
	Distribution/Location			*LINK*
	Activities			*LINK*
	State/Alertness			*LINK*
	Commitment to activities			*LINK*
	Engagement / Focus			*LINK*
Relationship to Structure				
	Time spent in structure			*LINK*
	Participants			*LINK*
	Residents			*LINK*
	Occupants			*LINK*
	Transient			*LINK*
Attributes				
	Gender Info			*LINK*
	Age Info			*LINK*
	Initial Location / Distribution			*LINK*
	Height			*LINK*
	Weight			*LINK*
Impairments / Impediments				
	Visual Impairments			*LINK*
	Aural Impairments			*LINK*
	Cognitive Impairments			*LINK*

	Existing Health Issues (Obesity, Pregnancy, etc.)			LINK
	Incident-Related Health Issues			LINK
	Incident-Related Health Fatalities			LINK
	Fitness / Fatigue			LINK
	Encumbrance			LINK
Familiarity				
	Key ingress points			LINK
	Key internal facilities			LINK
	Key egress points			LINK
	Routine Use of Space			LINK
	Access Restrictions			LINK
Social/Cultural Attributes				
	Nature of social/role structure			LINK
	Description of groups		*[Social / Familial / Employment / Unfamiliar, etc.]*	LINK
	Size of social groups			LINK
	Native Language			LINK
	Education Level			LINK
	Cultural Issues		*[E.g., familiarity with safety / security culture, etc.]*	
Experience				
	Prior Training			LINK
	Experience with Drills			LINK
	Experience with Prior Incidents			LINK
	Familiarity with Structure			LINK
	Time spent in structure			LINK
	Procedural Responsibilities			LINK

Description:	*LINK*
Additional Resources: Images / Schematics / Timeline / Storyboard	*LINK*

F.ENVIRONMENTAL CONDITIONS – ENVIRONMENTAL CONDITIONS IN WHICH THE EVENT TOOK PLACE

En

F-1. Environmental Conditions: *INFORMATION ON THE ENVIRONMENT IN WHICH THE EVENT TOOK PLACE*

			Details	
Internal		X		*LINK*
	Temperature			*LINK*
	Radiative Flux			*LINK*
	Smoke			*LINK*
	Visibility			*LINK*
	Debris			*LINK*
	Lighting (Ambient / Emerg.)			*LINK*
	Noise			*LINK*
	Water			*LINK*
	Damage to Structure			*LINK*
	Narcotic Gas: HCN			*LINK*
	Narcotic Gas: CO			*LINK*
	Narcotic Gas: CO_2			*LINK*
	Narcotic Gas: Low O_2			*LINK*
	Narcotic Gas: Other			*LINK*
	Irritant Gas: Acrolein			*LINK*
	Irritant Gas: Formaldehyde			*LINK*
	Irritant Gas: HCl			*LINK*
	Irritant Gas: HBr			*LINK*
	Irritant Gas: NO_2			*LINK*
	Irritant Gas: SO_2			*LINK*
	Irritant Gas: HF			*LINK*
	Irritant Gas: Other			*LINK*
	CBRN: Chemical			*LINK*
	CBRN: Biological			*LINK*

	CBRN: Radiological			*LINK*
	CBRN: Nuclear			*LINK*
External				*LINK*
	Weather			*LINK*
Other				*LINK*
Description				*LINK*
Additional Resources: Images / Schematics / Timeline / Storyboard				*LINK* [EC1]

G. DATA PROCESSING – *DESCRIPTION OF THE COLLECTION, EXTRACTION AND ANALYSIS PROCESSES AND THE RESOURCES INVOLVED* **Da**

G-1. Data Collection Methods: *INFORMATION ON THE DATA COLLECTION TECHNIQUES EMPLOYED*

Technique	X	Resources Employed	Data Collected	Assumed Degree of Accuracy	
Manual Observation					*LINK*
Video Cameras Introduced					*LINK*
Still Photograph					*LINK*
CCTV					*LINK*
Sensors					*LINK*
Survey					*LINK*
Interviews					*LINK*
Participant Observation					*LINK*
Simulation					*LINK*
Secondary Material (Reviewed)					*LINK*
Other					*LINK*
Description:					*LINK*
Additional Resources: Images / Schematics / Timeline / Storyboard					*LINK* [DCR1]

G-2. Methods/Tools Used to Extract Data: *DESCRIPTION OF EXTRACTION/SAMPLING TECHNIQUES EMPLOYED*

	LINK

G-3. Methods/Tools Used to Analyze Data: *DESCRIPTION OF THE DATA ANALYSIS TECHNIQUES EMPLOYED*

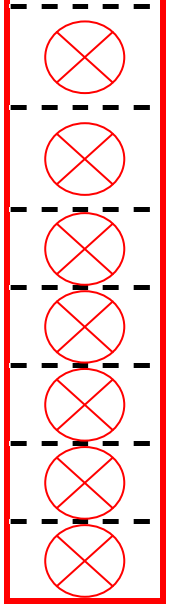
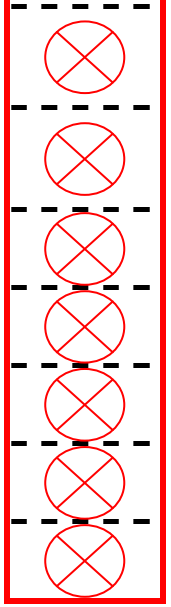
	LINK

G-4. Description of Data Presented: *DESCRIPTION OF THE DATA-SET FORMAT AND CONTENT*

Performance Component Represented *[Behavioral response, population, procedural, environmental, organizational, structural component, etc.]*	# of observ. / data-points	Nature *[e.g., whether the data presented are quantitative, quantitative, etc.]*	Scope *[factors that are addressed in the observations]*	Refinement *[e.g., whether the data are at the individual level, a section of the population, entire population, etc]*	Format *[e.g., raw data points, curves, average, range, etc.]*	Unit *[m,m/s, p/m^2, etc]*	
							LINK
							LINK
							LINK
							LINK
Description:							*LINK*
Additional Resources: Images / Schematics / Documents							*LINK*

H. EVENT TIMELINE: *DESCRIPTION OF EVENT EVOLUTION* — Re

H-1. Timeline Notation: *DESCRIPTION OF THE EVENT TIMELINES OF THE VARIOUS EVENT COMPONENTS ALLOWING DIRECT COMPARISON*

Supporting Images	Event/Incident Timeline		Intended Event Procedure **Pr**	Act. Proc. Events / Response **Re**	Population Status **Po**	Structural Status **St**	Environ. Status **En**	Data Activities **Da**	Supporting Images
	Pre-Event	t_{-1}							
	Pre-Cue (Initial Conditions)	t_0							
	Pre-Response	t_1							
	Response	t_2							
	End	t_3							
	Post-Response	t_4							
	Post-Event	t_5							
			LINK [IP1]	*LINK*[AP1]	*LINK*[SS1]	*LINK*[ES1]	*LINK*[PS1]	*LINK*[DA1]	

Description:	*LINK*
Additional Resources: Images / Schematics / Timeline / Storyboard	*LINK*

I. RESULTS – *DATA COLLECTED*	Da	Ob

I-1. Reported Results: *DETAILS OF THE NUMERICAL/DESCRIPTIVE RESULTS REPORTED*

	Tabular Representation		Graphical Representation		Animated Representation		Narrative Representation	
Raw data		*LINK*		*LINK*		*LINK*		*LINK*
Compiled data		*LINK*		*LINK*		*LINK*		*LINK*
Extrapolated data		*LINK*		*LINK*		*LINK*		*LINK*
Simulated Data		*LINK*		*LINK*		*LINK*		*LINK*
Reported Data		*LINK*		*LINK*		*LINK*		*LINK*

Detailed Description:	*LINK*
Other Forms of Data Representation:	*LINK*
Additional Resources (Timelines, Storyboards, Photographs, Commentary Recordings, Related Material, etc.)	*LINK*

I-2. Quotations from Text: *KEY COMMENTS FROM THE ORIGINAL AUTHORS/DATA COLLECTORS*

	LINK

I-3. Conclusions Drawn: *KEY CONCLUSIONS DRAWN BY THE ORIGINAL AUTHORS/DATA COLLECTORS*

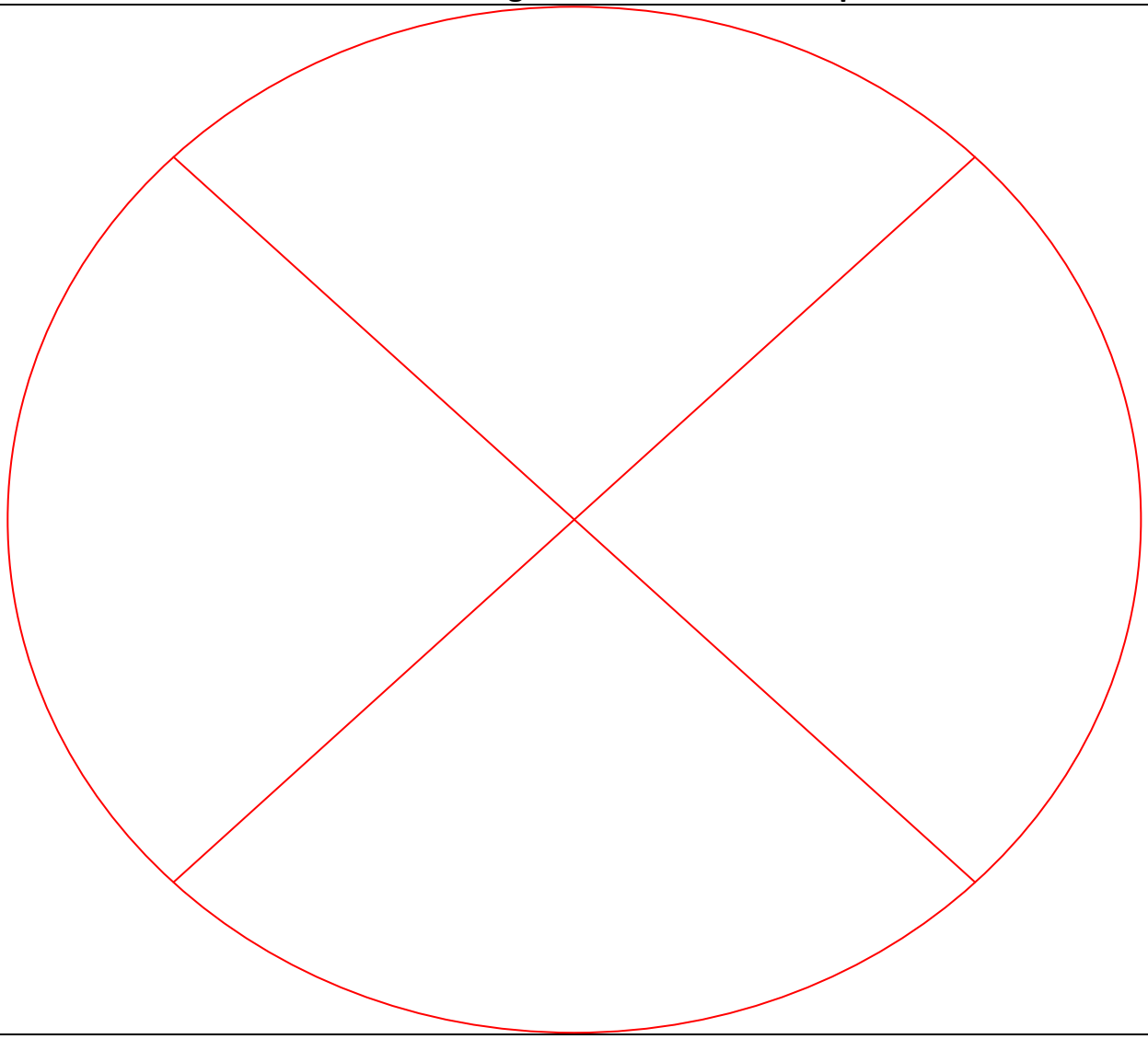
	LINK

I-4. Theory Development (i.e., major findings): *SUMMARY OF KEY RELATIONSHIPS BETWEEN THE VARIABLES IDENTIFIED AND THE STRENGTH OF THESE RELATIONSHIPS (E.G., ANDECDOTAL, STATISTICAL, ETC.)*

Modifier	IV	Relationship	Modifier	DV	Strength	Miscellaneous	*LINK* [TD1]
							LINK
							LINK
							LINK

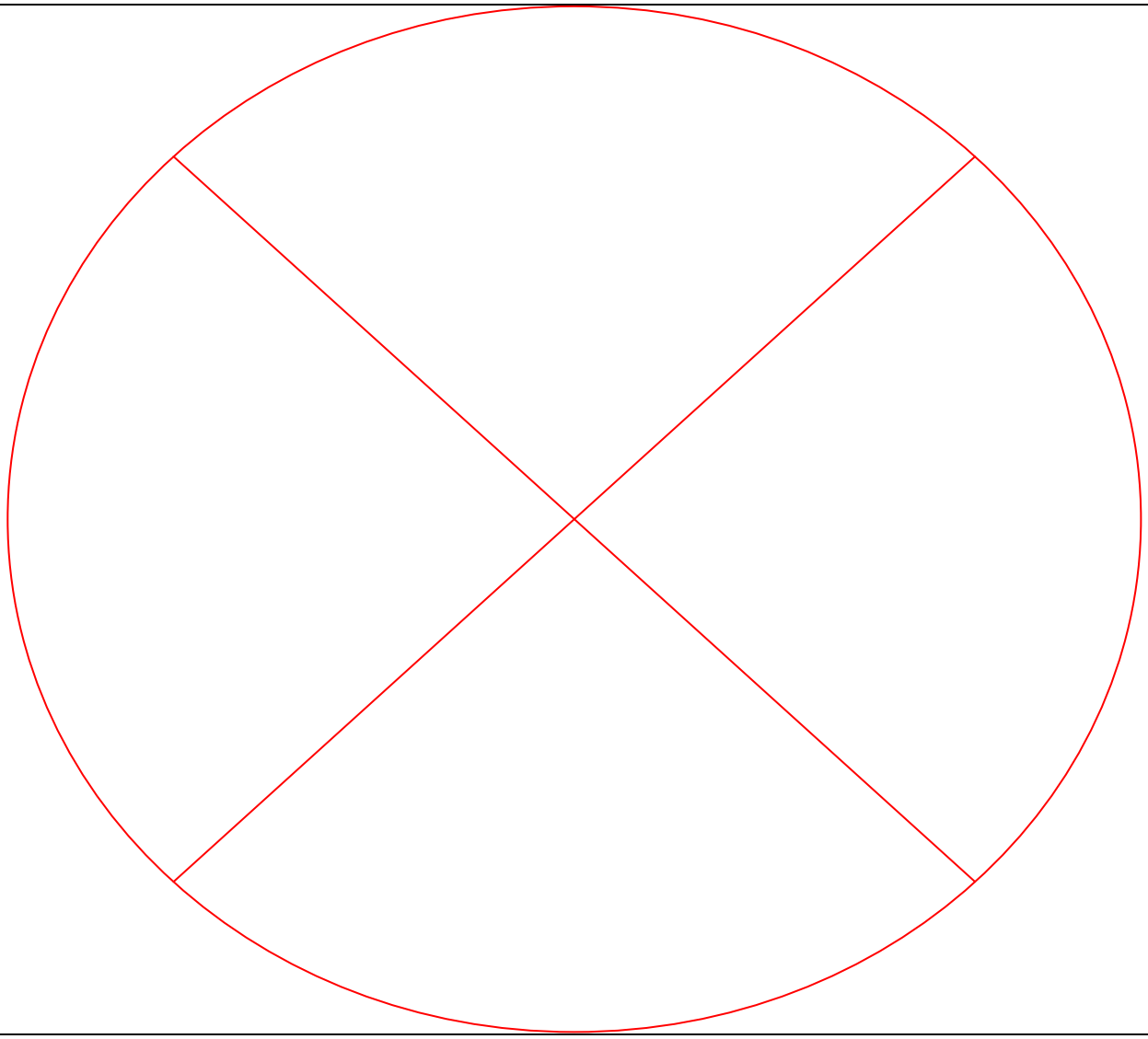
DATA TEMPLATE: Level 2 Documents

PR1: Documents Relating to the Procedural Response Pr



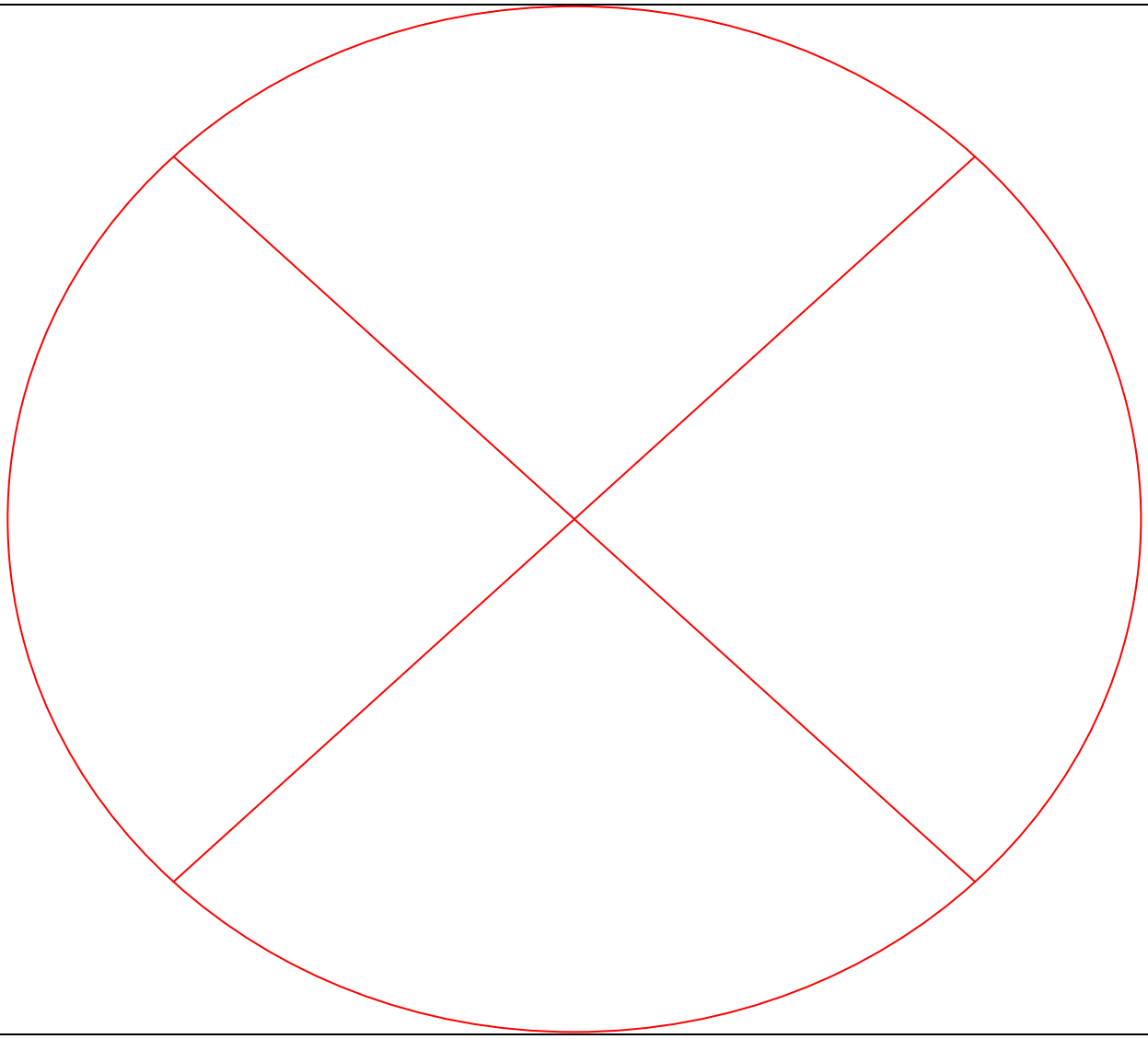
Description: Event Procedures / Experimental Procedure / Schematics

SD1:Structural Details St



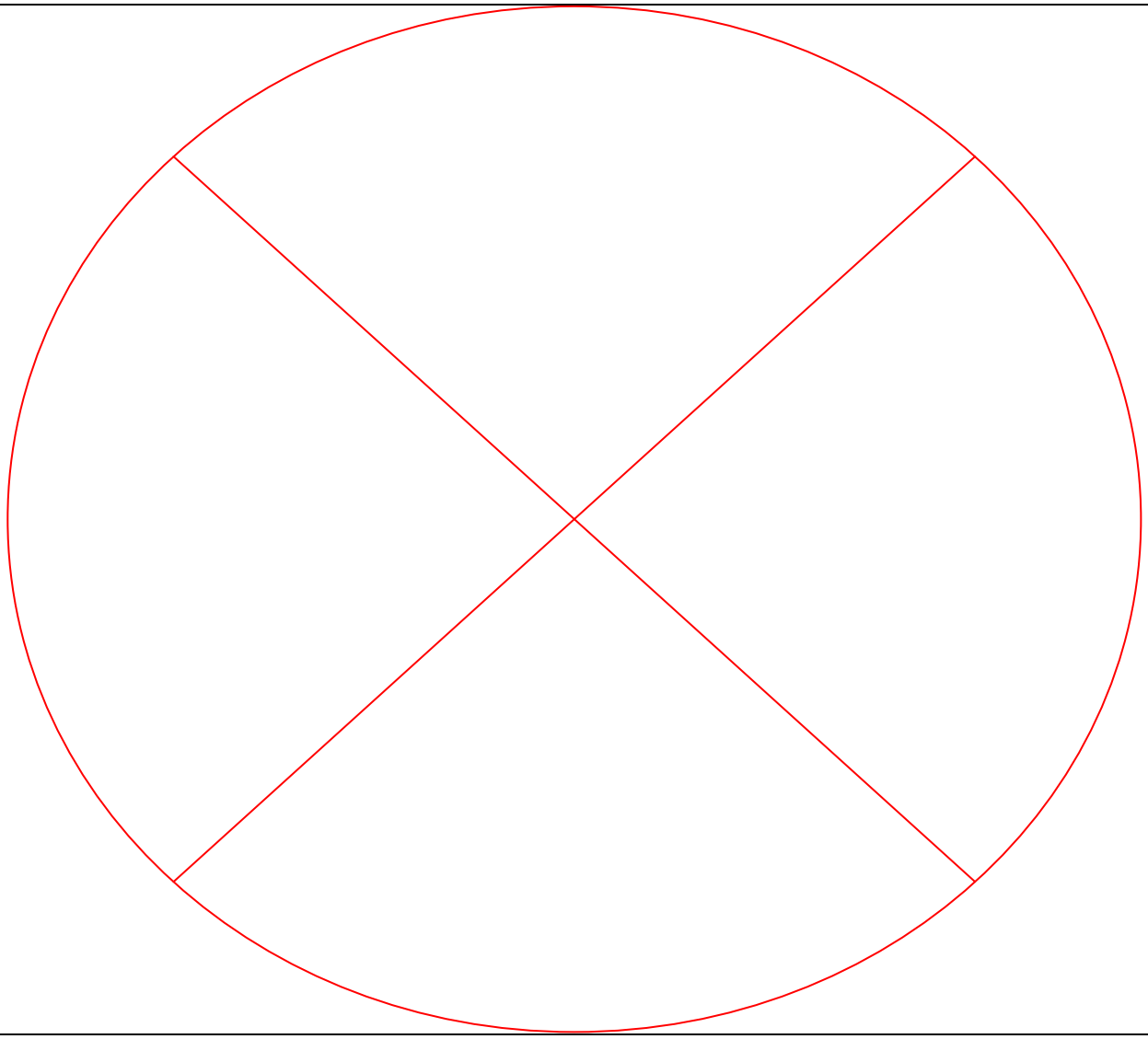
Description: Schematic / Architectural Diagrams / Photographic Evidence

EC1:Environmental Conditions En

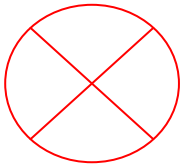
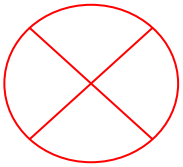
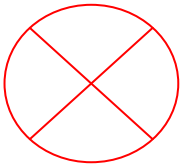
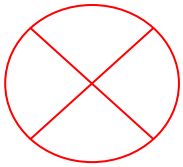
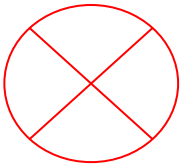
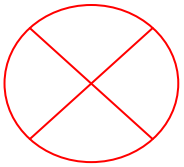


Description: Schematic / Architectural Diagrams / Photographic Evidence

DCR1:Data Collection Resources Da



Description: Information on data collection resource locations / specification / catchment areas / management

	IP1:Intended Event Procedure Pr		
Pre-Event			
	Description (t_{-11})	Description (t_{-12})	Description (t_{-13})
Pre-Cue (Initial Conditions)			
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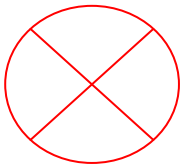
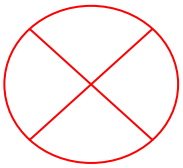
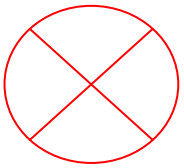
Pre-Response			
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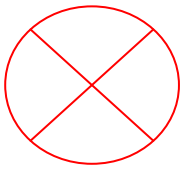
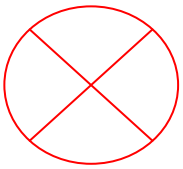
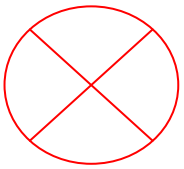
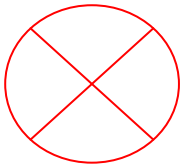
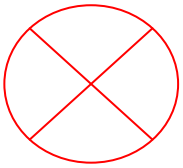
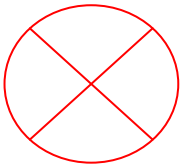
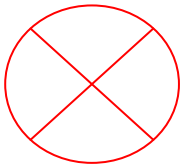
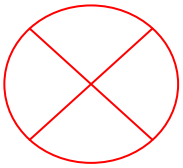
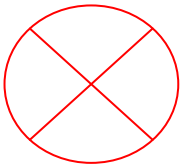
Response			
	Description (t_{21})	Description (t_{22})	Description (t_{23})
End Conditions			
	Description (t_{31})	Description (t_{32})	Description (t_{33})
Post-Response			
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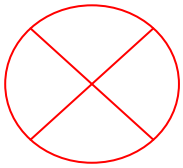
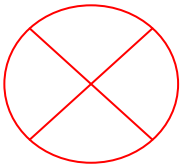
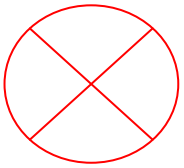
Post-Event			
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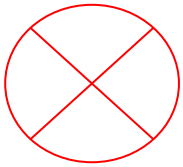
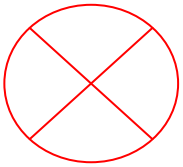
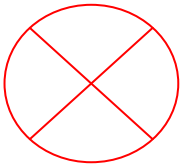
Pre-Event			
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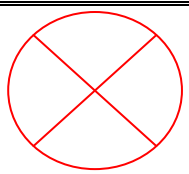
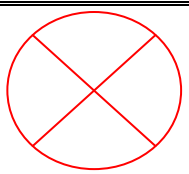
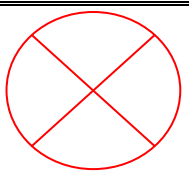
Pre-Cue (Initial Conditions)			
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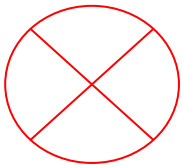
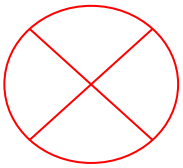
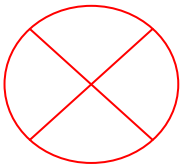
Pre-Response			
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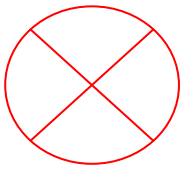
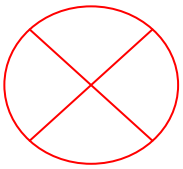
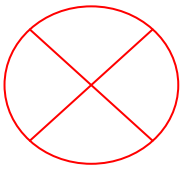
Response			
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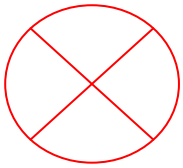
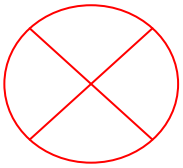
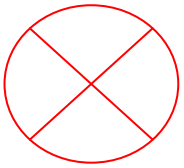
End Conditions			
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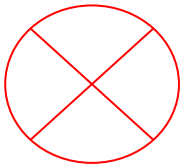
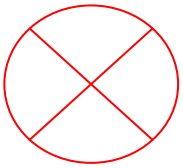
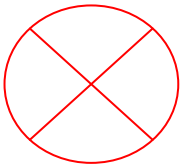
Post-Response			
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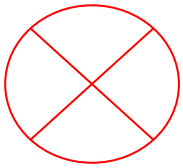
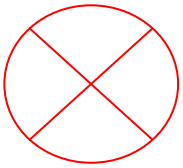
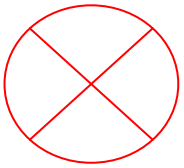
Post-Event			
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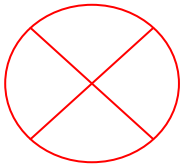
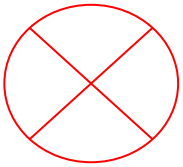
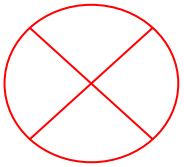
Pre-Event			
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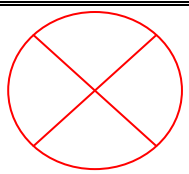
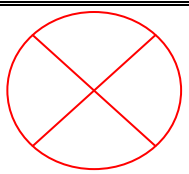
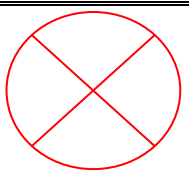
Pre-Cue (Initial Conditions)			
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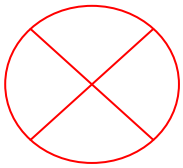
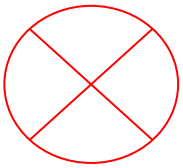
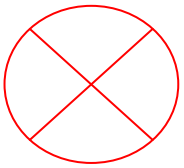
Pre-Response			
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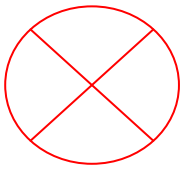
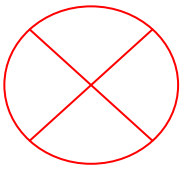
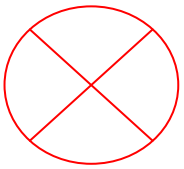
Response			
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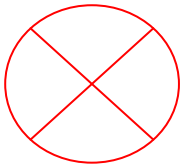
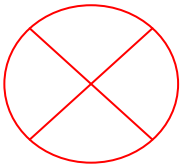
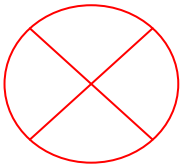
End Conditions			
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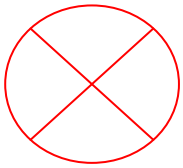
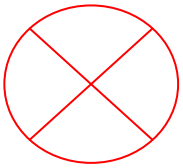
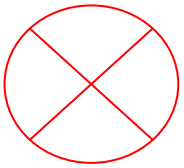
Post-Response			
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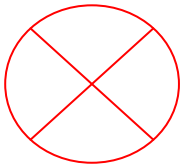
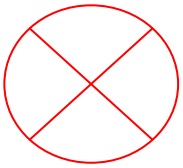
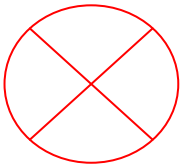
Post-Event			
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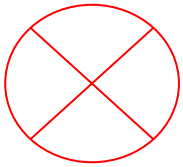
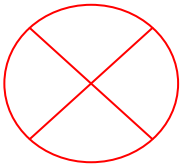
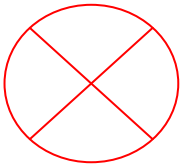
Pre-Event			
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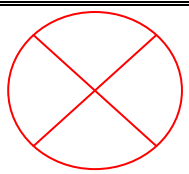
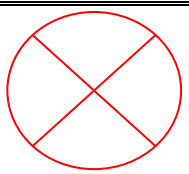
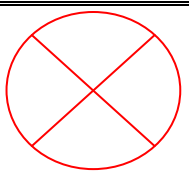
Pre-Cue (Initial Conditions)			
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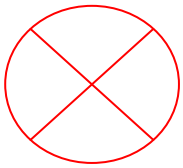
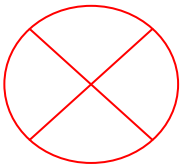
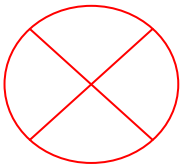
Pre-Response			
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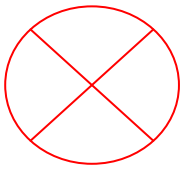
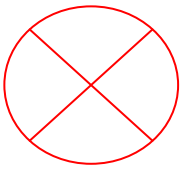
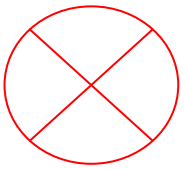
Response			
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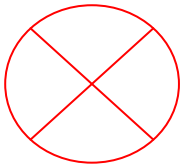
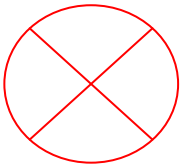
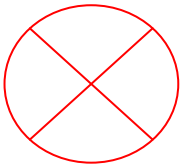
End Conditions			
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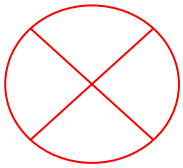
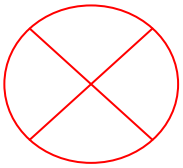
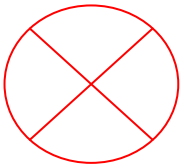
Post-Response			
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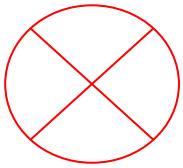
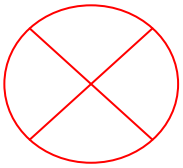
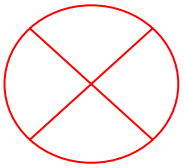
Post-Event			
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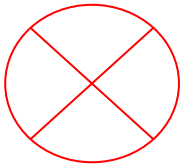
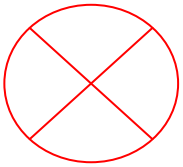
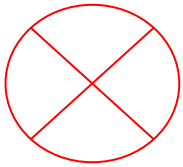
Pre-Event			
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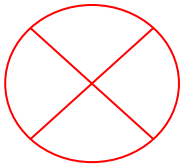
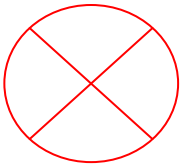
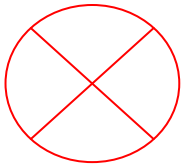
Pre-Cue (Initial Conditions)			
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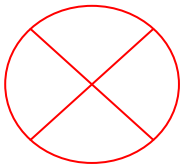
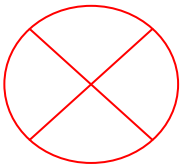
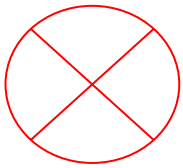
Pre-Response			
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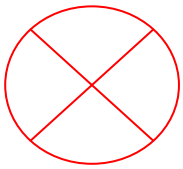
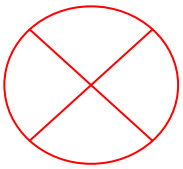
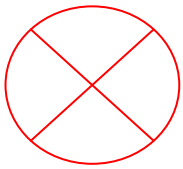
Response			
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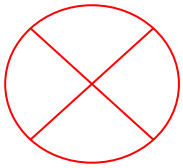
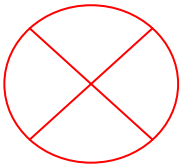
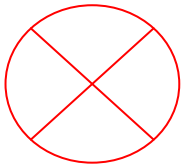
End Conditions			
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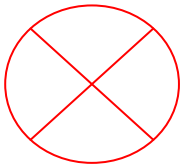
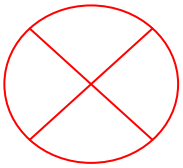
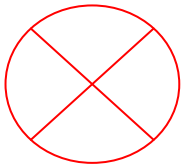
Post-Response			
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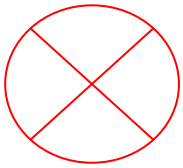
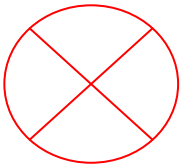
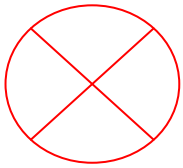
Post-Event			
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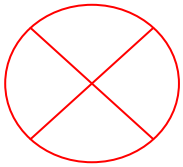
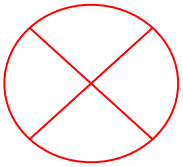
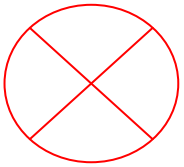
Pre-Event			
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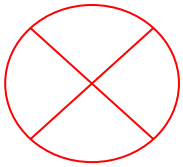
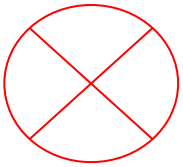
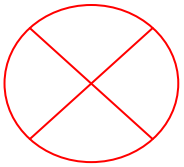
Pre-Cue (Initial Conditions)			
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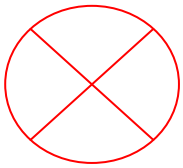
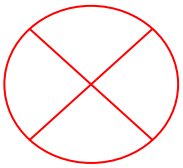
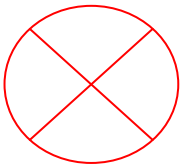
Pre-Response			
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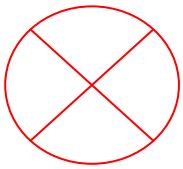
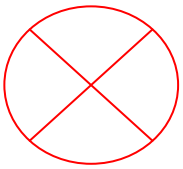
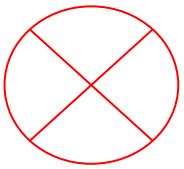
Response			
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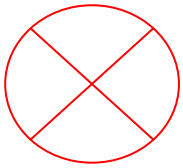
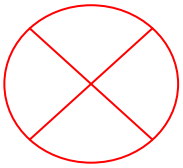
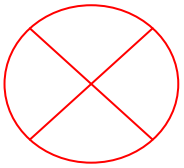
End Conditions			
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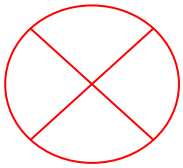
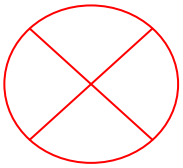
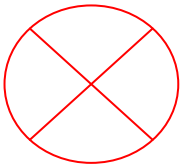
Post-Response			
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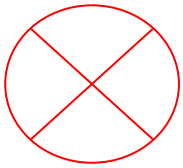
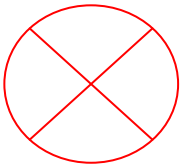
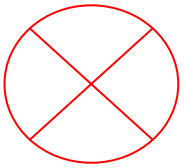
Post-Event			
	Description (t_{51})	Description (t_{52})	Description (t_{53})
RETURN TO MAIN DOCUMENT			

TD1: Basic Notation

Modifier	IV	Relationship	Modifier	DV	Strength	Miscellaneous
	[TERM]			[TERM]		

		Example
©, ∝	Is correlated with /proportional to	Walking Speed (flat) © Walking Speed(stair)
AND (^) | OR(^{V})		
≈	Is approximately equal to	Movement rates in airports ≈ Movement rates in other transport terminals
≡	Is equivalent to	Pre-Movement time ≡ Pre-Evacuation time ≡ Pre-Response time
≤ ≥ < >	Greater/less than	Stair (up) speed < Stair (down) speed
↑↓	Impact on variable – increase / decrease	↑Pre-Evacuation times
⇒	Leads to/implies	↓Information ⇒ ↑Pre-Response times Placed in Relationship or Miscellaneous
=	Is equal to	Max(ρ) = 0.92 m^2/m^2
MAX|AVG|MIN	Maximum | Average | Minimum	Max(ρ) = 0.92 m^2/m^2 Avg(ρ) = 0.45 m^2/m^2 Min(ρ) = 0.22 m^2/m^2
∃	There exists	∃ ρ > 0.9 m^2/m^2
∴	Therefore	Placed in Relationship or Miscellaneous columns
∵	Because	Placed in Relationship or Miscellaneous columns
↙	Connected to next line	Placed in Miscellaneous column to connect adjoining lines

Appendix D: KEYWORD EQUIVALENCE CLASSES

This appendix represents a categorization of vocabulary into broadly related sets of terms. This was completed to simplify the development of the keyword search facility in the template. Terms in bold are suggested keywords (i.e., words to be inserted into the template). Terms underlined are tentatively suggested as keywords. Terms on the same line as each other have a similar meaning (i.e. equivalent terms) or address a related subject. Terms indented and below another term (i.e., child terms) are attributes, adjectives, components, members or terms related to the parent term. Parent terms are left justified; child terms are then indented into the page. Depending on the term, child and parent terms may be included as keywords. For instance, the term 'loading' is equivalent to [Size], which has the parent term [Population]. Therefore, both [Population] and [Size] would inserted into the results of a keyword search.

To cope with the range of terms that may be provided to the portal, the following list would have to be expanded to address the different tenses, forms and uses of the terms employed in the field.

POPULATION

[Population]/ [crowd/ group/collective/mass/herd/mob/aggressive mob/casual crowd/audience/gathering/cluster/herd/ community/collective/alliance/flock/people]

- **[size]/** [Population numbers / Number / Loading]
- **[distribution] /** [location/ initial location/Initial distribution/clustered/grouped/even]
- **[nature]**
  - [Handicapped population / Able-bodied population / Gender distribution / Homogeneous / Heterogeneous / Age distribution / Impaired / with Impairments /diverse/uniform/equal/similar /different/ casual/ cohesive/ expressive/ aggressive/competitive/cooperative]
- **[Group]**
  - Group [**Size]**
  - Group [**Distribution**]

Actions of surrounding population can act as Event-Specific External Cues upon the Decision-Making process.

INDIVIDUAL –component of a population or a group

[Individual]/ [Passenger / Pax / Agent / Pedestrian / Occupant / Person / Patrons / Residents / Building Occupants / Confederates / Significant Others / Participants / Volunteers / Associates / Helpers / Avatar/ Spectator / Automaton/ Steward / Marshal / Fire Marshal/ Fire Fighter/ Responder/ Helper/Guards / Carer/Leader/ Responders / Movers / Walkers /Crawlers / Runners]

Individual **[**Characteristics**]/** [occupant characteristics / person characteristics / person attributes/ occupant limitations/ individual capabilities/traits]

PRE-EVENT: PHYSICAL ATTRIBUTES

- **[Physical Attributes]** / **[**Physical Capabilities / Physical Factors/ Physical Condition]
  - [Demographic-[**Age]** /Children/ Elderly/Adult/Youth/Child/Adolescent**]**
    [Gender]/[Sex]
    [Physical Condition/Constitution/Health/ Status/Well-Being/Vigor/Condition/Existing Health Issues]
    [**Height] [Weight]/[**Stature /Bulk/Depth / Body Plan / Individual Footprint/ Pedestrian Area/ Projection/Dimensions/ Shoulder Width / Body Ellipse]
    [Horizontal Walking [**Speed]** / Free Speed / Desired Speed /[**Horizontal]** Speed /Stair Ascent / Stair Descent/Stair Descent Device / Vertical Walking Speed / Inclined Walking Speed / Individual Velocity/ Walking Velocity /Acceleration / Jogging Speed / Locomotion Speed/[**Ascending]** Speed / [**Descending]** Speed / Free-Flow Walking Speed]
    [Gait/Stride / Step Length]
    [Vulnerabilities / Limitations / Weaknesses / Strengths / Abilities / Capabilities / Issues /

[Impairments] /[Susceptibility]/
[Sensory] [Visual]Ly Impaired/ [Blind/Color Blindness/Myopia/Partial Sighted/ Vision / Vision Impairment/Visual Field]
[**Hearing]** Impaired - Deaf/Hearing Loss/Hearing Limited]
[**Mobility]** (Impaired)/ Disabled / Slow Movement/ Encumbered/ Fitness /Mobility Limitations / Handicap/ Mobility Level /Lame/ Mobility Aid/ Wheelchair / Frame /Walking Stick/Crutches/Walking Aid]
[**Fatigue]**/ Tiredness/Health Issues / Pregnancy / Encumbrance / Clothing /Physical Disability/ Able/ Obesity]

PRE-EVENT: COGNITIVE ATTRIBUTES

[Cognitive Attributes]**/** [Cognitive Factors / Cognitive Capabilities]
[Mentally Impaired/Slow / Backward/ Retarded] / **[**Cognitively Impaired]/ [Cognitive Impairment]
[Intelligence / IQ] / [Cognitive Skills]/ [Education/Memory/Recollection/Spatial Awareness/Cognitive Mapping/Orientation/Ignorance]
[Language/Skills / Native Language/Comprehensive / Mother Tongue]
[Patience/Impatience/ Drive / Motivation / Energy/Impetus/Urgency/Aggression]

PRE-EVENT: EXPERIENCES

[Experience]/[**Familiarity**]/[Use]/[**Training]**/[Expertise]/[Habituation/Memories/Recall]
[**Role]**/[Status/Responsibility/ Social Affiliation/ Status/Seniority/Authority/Cultural Factors/Social Affinity /Social Factors/Identity /Culture/Association/Belonging]/[Social Attributes]/[Cultural Attributes]
[Organizational Characteristics] / [Hierarchy/Organization/Social Structure/Social Network/Social Affiliation/Social Position/Job Title/Occupant Groups/Social Groups/Role Structure/Power Structure/Cultural Context/Seniority/Junior/Power/ Influence/Command/Dominance/Role Structure/Organizational Hierarchy/Management/Staff/ Employer/Employee/Credibility/Authority/Responsibility/ Jurisdiction/ Control/Work Environment/Social Environment/Familial Setting/Domestic/Social Setting/Social Environment/Public /Private/Formal/Informal/ Residential/Resident/Transient/Frequent Visitor/Managed/Supervised/ Unsupervised/ Related/ Connected/Friends/Acquaintances/ Socially Significant/Strangers/Unfamiliar/ Distant/ Neighbors/ Associates/ Colleagues/ Relation (Father, Mother, Daughter, Son)/ Extended Family / Nuclear Family]

EVENT SPECIFIC SITUATIONAL FACTORS

[Active / Passive/Involved/Uninvolved]
[**State]** / [Alertness/Status/ Mental Alertness/Asleep/Tired/Unconscious/Awake]/ [Intoxication]/[Drunkenness/Alcohol Impairment/Sensory Access]
[Posture/Stance/Upright/Crawling]
[**Location]**/[Position/Situation/]
[Proximity To Others/Surrounding Population/Alone/Isolated/In-A-Group/Associated]
[Actions/[**Activity]**/Current Activities/Current Actions]
[Attention/ Attraction /(Level Of)[**Engagement]**/ [Interest/ Concentration/ Focus/ Distraction/ Level Of Investment In Activity]
[Awareness/Alertness/Attentiveness]
[**Commitment]**/[Reluctance To Leave/Reluctance To Disengage]
[Dress/Footwear / Clothing / Encumbrance / Shoes / Spectacles / Glasses/Visual Aids/Outfit/Baggage/Luggage]
[Comfort / Discomfort]
[Exposure Induced Impairments]/[Injury / Casualty / [**Fatality]/** Heat Stress / FED/ Death/Trauma/Exposure/Temperature Exposure/Hyperthermia/Hypothermia]

EVENT SPECIFIC EXPERIENCES

[DECISION-MAKING PROCESS]/[Individual Decision Process/RRI/BDI (Belief-Desire-Intention)/PIA]
[Stress Psychological Stress/ Anxiety/Time Pressure/Time Constraints/Tunnel Vision/Focus] Disorientation /Orientation]
[**Perception**]/[Self-Perception/Threat Perception / Perception Of Threat/Ambiguous

Information/Perceptual Capacity/Cue Attenuation/Information Landscape/Exposure/Self-Aware/Threat Perception]

[Cue] /[Cue Credibility/Applicability/Ownership/Visual / Verbal Cues/Social Perception /Social Response/Physical Perception/ Rumors /Signal /Peer Influence / Peer Pressure/ Observable Occupant Actions/Social Awareness /Observed Cue/ Physical Cue/Social Cue/Ambiguous Cue/Fire Cue/ Identify/ Perceive/External Cue/Internal Cue/Sound/Crackle/Burning/ Unfamiliar(Noise/Sound/Smell/Feeling/Sensation)]

[Interpretation]/[Understanding/Integration/Cue Assessment / [Situation Awareness**]** / Recognition / Awareness /Deliberation/Situational Awareness]

[Analysis] / [Bounded Rationality/Evaluate/ Validate/ Commitment/ Reassessment/Information Processing/Problem-Solving/(Internal/Mental)Simulation / Estimation/Optimizing/Satisficing /Feedback/ Reasonable/Rational / Response Selection/ Action Selection/Act/Action Refinement/Processing/Solving/Creating/ Responding/Verification]

[Response]

[Behavioral Response/Person Flight/Hysteria / Antisocial Behavior / Mass Hysteria / Collective Behavior / Negative Panic/ Panic / Evacuation Inertia / Panic/Craze/Flight/Negative Panic/Irrational/Competitive/Selfish/Amoral/Non-Responsive/Inaction/ Fight/Flight /Flight Response][Deference/Altruistic Behavior/Non-Competitive / Cooperative/Altruism /Route Choice/ Unsocial Behavior/Panic Flight/Qualitative / Quantitative Decisions]

Response: Action Related

The high-level 'placeholder' terms presented at the head of the following action descriptions represent the associated actions, removed from the context of the action itself; i.e., in a general form. Therefore, the high-level terms should be able represent the set of related actions with the appropriate changes to the object/subject and a more specific, but related, verb.

([Assess] |[Commence]|[End]| [Modify]|[Maintain]) [Action]

[Movement/ Misstep/Overstep/Understep / Slip / Fall / Trip /Stumble]/ [Rush / Hurry / Motivated Movement/Run/Sprint]/[Follow Other / Follow Leader / Go For Help / Investigate Fire / Involuntary Action/ Wait / Wait For Help / Escape / Leave Area /Evacuate Self / Self Evacuate / Seek Refuge / Wait /Control Situation / Move /Escape/ Traverse / Travel / Movement Through Smoke / Notifying Others / Beginning To Evacuate / Continuing/ Relocating]/[Shuffle/Push /Sway / Shuffle / Body Sway/Forward/Lateral Direction /Forward/Lateral Movement /Jostle] / [Bypassing / Overtaking/ Action Choice/ Assist]/ Local Navigation / Non-Egress Activities/Normative Actions/Panic Behavior/Human Response]

([**Modify]|[Maintain])[Objective]**

[Exit Change / Redirection /Adapt / Direction Of Movement / Trajectory / Direction / Angle/ Desired Direction / Target / Direction/ Destination/Bearing/Goal Change/Lose Task/Maintain Task /Path Adopted/ Path Choice/ Path Selection /Travel Path / Travel Route / Route Choice/ Expectation / Goal/ Objectives / Goals / Targets/Referents/Intentional]/ [Purposeful/Purposive/Convention / Norms / Mores/Convenience/Normalcy Bias]

Response: Information Related

([Emit] | [Receive] | [Update] | [Process] | [Interpret] | [Seek]) [Information]

[Call For Help/ Seek / Seek Others /Investigate / Communicate /Search/Warn / Ignore / Reaction / Seeking Additional Information /Searching For Others /Wayfind / Communication/ Route Navigation / Wayfinding / Route Selection/Exit Choice / Exit Choice Decision]

Response: Social Interaction

([Give]|[Receive]) [Aid]/[Aid Self]

[Provide Assistance / Help Others/Lift Person/Lift Patient/Support/Tend/Carry/Push/Force/ Assist/Lift/Fireman's Lift]

Response: Object Related

([Collect] | [Deposit] | [Use]) [Object]

[Mitigate Fire / Collect Items /Fight Fire /Operate Extinguisher/Carry/Pick Up/Smash/Drop/ Throw/Spray/Lock/Unlock/Don/Discard/Jam]

STRUCTURE
The structure is categorized as a *Pre-Event External Factor* for the individual; i.e., it existed prior to the event. **[Structure]** / [Building / Construct] [Structural Characteristics]/[Building Characteristics / Architectural Characteristics/ Building Design / Floor Layout/ Age/Construction Date/Modifications/Fire History/Surrounding Areas/Construction/Exit Configuration/Exit Access/Perimeter Access/Security Levels/Security Access/Restricted Areas/Access Management] **[**Configuration] /[Geometry / Architecture / Complexity /Building Layout /Visual Access /Structure Layout / Floor Layout/ Spatial Organization/ (Stair/Escalator/Tunnel/ Ramp/Doorway/ Travelator) Configuration (Number, Location)/Internal Configuration]**[**Evacuation Route / Egress Route/ Exit Location / Number Of Exits/ Component][Discharge/Redundancy/Remoteness] (Occupancy) **[Type]** /[Use/ High-Rise / Mid-Rise/Low-Rise/Skyscraper / Office / Hotel /Public Building / Office / Multi-Apartment / Residence / Domestic/Assembly/Assembly Occupancy / Stadium/ Tunnel/ Arena/Theatre/Cinema/Festival Seating/Grandstand / Heritage Site / Monument / Nightclub / Bar / Club / Sports Facility/ Conference Hall/Outdoor/Temporary Structure / Base / Military Base-Facility/Correctional Facility/Prison/School/University/Library/ Concert Hall / Cabaret / Factory/ Warehouse / Industrial Site / Plant/ Hospital / Reserved Seating Event/ Sport Event/ Terracing / Transport Terminal / Airport/ Rail Station/ Bus Terminal/Bus Stop/Bus Station/ Venue/ Outdoor/Outside Event/ Street/ Venue] **[Height]/[**Number Of Floors**]**/ Dimensions / Footprint/Plan/Floor [**Area]** /Space/Available Space/Boundary /Occupiable Space]

STRUCTURAL COMPONENT
This focuses on structural components that are related to movement. Structural components are categorized as a *Pre-Event External Factors*. *Structural Component* **[Floor]** / [Level / Refuge Floor / Elevator Floor / Mezzanine / Grade] [Public Areas/Classroom /Lecture Hall/Lecture Room/Computer Laboratory/ Changing Room/Men's Room/Ladies Room/Locker Room/Gym/Conference Hall/Function Hall/Library/Study/ Lobby/ Lounge/Office/Restroom/Bathroom / Washroom/Toilet/Security Desk/Waiting Room/Common Room/Games Room/Dining Room/Home Office/Kitchen/Library/Living Room/ TV Room /Home Theater/Recreation Room/Study/Sunroom/Solarium/Private Space/Bedroom / Guest Room / Nursery/Safe Room/Suite/Walk-In Closet/Passages/Alcove/Atrium/Balcony/Corridor/ Deck/Foyer/Hallway/Loft/ Patio/Porch/Skyway/Terrace/Veranda/Vestibule/Attic/ Basement/Box Room / Storage Room/Cellar/Cloakroom/Closet /Electrical Room/Equipment Room/ Boiler Room/Garage/Laundry Room / Utility Room/Mechanical Space/Pantry/Studio/ Server Room /Wardrobe/Workshop/Wine Cellar/Ballroom/Drawing Room / Salon/Great Hall/Larder/Parlour/Scullery/Smoking Room/Conservatory /Outhouse/Shed/Swimming Pool / Security Desk / Ticket Control] [Slipperiness / Trip Hazard / Slope/ Underfoot Condition / Unstable Footing / Walkway Surface] [Vehicle / Buggy/ Bicycle/Bike/Stroller/Pram/Stretcher/Carrier/Mattress] [Grab Bar / Guardrail / Rail / Queuing Rail/ Guardrail Strength / Stability/ Barrier / Crowd Barrier/ Temporary Barrier/Fencing/ Fixed Beam/ Glazed Partition/Chain&Rope/Retractable/Barrier Tape] Gate/Turnstiles/Ticket Booth/Ticket Barrier/Pass/Curb / Curb Ramp/ /Electronic Gate/ Security Gate/ Drop Arm] *Vertical Component:* vertical means of egress **[Elevator]** / Lift / Fire Lift / Cab / Dumb Waiter/Mover]

[Dimensions/Size/Height/Width/Depth/Capacity/Footprint/Floorspace/Occupiable Floor Space/ Area/ Occupiable Area/Usable Area/ Cab Dimensions]/[Maximum Load]/[Capacity]
[Door]/(Door|Effective)[Width] /[Opening Speed/ Door Opening Speed]
[Age/Date Of Operation/Years Operational]
[Constructor/Operator]
[Speed]/[Speed Of Movement/Rate Of Movement/Speed Of Operation/Acceleration/Deceleration/ Elevator Speed/ Acceleration]
[Procedure/Floors Served/Priority/Stops/Stations/Refuge Areas/Staffing]
[Communication, Intercom/Telephone/Walkie-Talkie/PA/Visual/None/Emergency Button/Panic Button]
[**Type**] [Express/Routine/Emergency/Goods/Trade/Loading/Service]
[Configuration (Location, Grouping]

[Stair][Exit Stairs / Stairway / Staircase / Stairs /Stairwell/Emergency Stairs/Temporary Stairs /Stair / Aisle Accessway / Aisle Stairs/ Aisle]

[Type] [External/Internal, Helical/Emergency/Straight/Scissor/Open/Enclosed/Monumental/Wall Material/Roughness/Smoothness/Color/Appearance]
[**Direction]** [Counter-Clockwise / Clockwise**]**
[Headroom, Clearance, Lighting Levels/Ambient Lighting, Sound Levels/Ambient Sound, /
[Stair Width] /[**Effective] [Width]**
[Riser / Going/Tread Height / Tread Depth/ Step Height / Step Nosing / Covering/ Material/[**Riser Height]** / [**Tread Depth]**
[Step Geometry/[**Step]**
[Consistency/Occupiable Area/Footprint/Condition (Debris, Worn, Damage, Wet/Dry/Icy) Diagonal Distance / Horizontal Distance / Vertical Distance]
[Handrail Reachability/ Stairway Flight]/[**Handrail]**/Rail/Grab-rail/Central Rail (Projection From Wall/Distance From Wall), Material, Height From Step/Height From Landing, Location (One Side/Both Sides/Central)]
[Landing] / [Inter-Level Landings / Mezzanine Landings]
[Stair Gradient /Stair Paths / Exit Step / Step]
[Configuration (Perpendicular, Angle, Straight On), Size]

[Ladders]

[Rungs / Height]
[Type][Fixed/Extendable/Mechanical/Fire/Rope]

[Rope/Slide/Chute]

[Escalator]

[Angle] / [**Speed**]/ [Step Geometry/Slope/Angle]
(Clear) [**Width**]/[Effective Width/ Headroom]
[**Direction**] / [Direction Of Operation / Direction Of Movement / Alternate / Intelligent / Adaptive]
[Location/Connected Spaces]
[Emergency Stop/Emergency Halt]
[Length Of Approach / Run-Off] /[Horizontal Component]/[Top/Bottom/Head/Foot]
[Handrail]/[Height/Movement/Height From Step/Height From Start/Projection]
[**Riser Height]/[Tread Depth]**/[Step Height/Step Depth]
[Nosing / Edge Of Steps/Edge Of Steps Markings]

[Ramp]/[Wheelchair Ramp**]/ [**Disabled Access/Handicapped Access]

[Slope / Angle] / [Incline]
[Surface / Slipperiness]
[Location, Access, Configuration]
[Headroom]
[Condition/ Presence Of Debris/ Wetness/Slipperiness/Ice/ Damage/ Unevenness/ Floor Covering]
[Lighting Levels – Illumination, Routine Lighting, Emergency]

[*Horizontal Component*]/[Horizontal Means Of Egress] [Flat/Corridor / Walkway / Hall/ Horizontal Passage

Way/ Horizontal Means Of Egress/ Flat Surface/Passage/ Passageway/Horizontal Plane/Flat] [Bridge / Sky Bridge] [Sidewalk/Path/Pavement]
- [Footprint/Area/Dimensions/Occupiable Space/Capacity/Loading]
- [Height]/[Clearance/Headroom/Ceiling Height]
- [Area]/[Occupiable Area]/ [Occupiable Space/Dimensions](Effective)[Width]/[Maximum Population Size/Maximum Load/Boundary Effects/Edge Effects]/[Usable Area]
- [Use / Type/ Occupancy Type/ Function]
- [Environmental Conditions / Lighting/Ambient Lighting/Emergency Lighting Levels/Visibility Levels/ Emergency Lighting]
- [Wall Covering/Wall Surface/Floor Covering/Floor Surface/Reflectivity/Rough/Smooth/

[**Seat**] / Chair/ Stool/ Sofa/Couch/Lounger / Deckchair / Rocking Chair/ Dining Chair/Recliner/Patio Chair]

[Travelator**]** / Mover / People Mover/ Pedestrian Mover/Moving Walkway/ Accelerating Walkway
- [Connected Spaces/Configuration/Access]
- [Use]/ [Direction]
- **[Speed]** / [Acceleration/Deceleration /Movement Speed]
- [Available Width/(Effective) [Width]/[Size/Occupiable Area/Usable area]/ [Capacity]/ [Loading/ Length]
- [Associated Notification/End Warning/End Notification]
- Use [Emergency | Non-Emergency]
- [Handrail]/ [Rail] [Projection]/[Handrail Height | Clear Height | Material | Speed)]
- [Lighting Levels (Ambient| Emergency)]

Access Component:

[Doorway] /[Fire Exit / Emergency Exit / Door / Exit Access/ Main Door / Main Exit / Familiar Exit / Non-Familiar Exit]
- [Door Operation] /[Door Hardware /Panic Bar /Entryway/ Entrance /Exit/ Stair Door / Exit Point / Access Point/ Exit Point]
- [**Type**]/[Leaf / Revolving / Sliding / Sliding/Swing/Folding/Gate/Leaf/Pocket/Rotating/False/Butterfly/ Self-Bolting/French/Panel/Emergency/Automatic Door/ Revolving Door/Magnetic Release]
- [**State**]/[Open/Closed/Locked/Blocked/Unavailable/ Inoperative/Damaged]
- [Opening Mechanism] /[Turn/Panic/Latch/Bolt/Dead Lock/Key, Hinged, Remote Sensor, etc.]
- [Material][Wood/Metal/Glass /Combination), Status (Open/Closed/Blocked/Locked/Unavailable]
- [**Use**]/[Routine/Emergency/Exit,Egress/Entrance,Access,Ingress/Security]
- [Access]/[Visual/Visibility/Camouflage/Livery/Color/Approach/Clear/Blocked/Debris]
- [Direction Of Operation]/[Door Direction Of Use / Door Swing Direction][Inward/Outward/ Away/ Towards/ Left-Hand/Right-Hand]
- [Dimensions/Size][Door Height /[**Height**]/Clearance/Headroom/Ceiling Height/Weight]
- [Door Width / Exit Width /Available Width]/(**Effective)[Width]**/[Nominal Width]
- [Appearance][Condition][Damaged/Direpair/Dirty/Locked/Open/Available/Visible/Secure]

[Area Of Refuge] / [**Refuge]** / [Shelter/ Refuge Area/Place Of Safety/Place Of Refuge/Area Of Refuge]
- [Communication / Hardened/ Amenities/Provisions/Filtering/Air Supply/ SCBA/ Protective Suits/ Capacity/ Location/ Protection/ Status/ Signage/ Associated Staff-Wardens-Marshals]

[Muster Point] / [Assembly Point] / [Meeting Point]
- [Capacity]/ [Location/ Status/ Signage/ Associated Staff-Wardens-Marshals]

PROCEDURE

[**Procedure**]

[Type][Evacuation Procedure / Emergency Procedure / Plans /Emergency Plan / Evacuation Strategy / Evacuation Program /Evacuation Procedure/Safety / Circulation / Route / Security / Access / Organizational Norms/Social Norms/ Safety Culture/ Safety Hierarchy/ Ticketing/ Security / Maintenance/ Normal Use/ Ingress/Egress/ Circulation/ Operation/Routine/ Safety / Security / Non-Emergency/Use/ Contrived/ Ad Hoc/ Artificial/ Unplanned/ Drill / Exercise / Evacuation Drill / Emergency Exercise / Evacuation Exercise / Evacuation Experiment/ False Alarm / Non-Event / Pre-Announced Drill / Inaccurate Alarm / Fire Exit Drill/Case Study / Experiment /Direct Evacuation / Indirect Evacuation / Gradual / Announced / Unannounced / Ad Hoc Procedure / Full Evacuation / Partial Evacuation / Zoned / Phased / Staged / Uncontrolled / Controlled / Total/Targeted / Full-Scale / Spontaneous / Sequential / Live / Pre-Recorded/ Disembarkation / Muster / Assembly]

[Evacuation Route / Emergency Route / Egress Route / Protected Route / Egress Paths / Stair Paths]

Pre-Event External Factors and Experience have been combined, as every procedure would initially be an external factor that then becomes a recalled experience.

Pre-Event (External Factor/Experience)

[Event Planning]/ [**Preparation**] /[Training/ Exercise/ Standard Of Care/ Environmental Design/ Evacuation Drill/ Drill/ Exercise/ Demand Management /Consequence Management / Safeguarding/ Implementation / Maintenance/Testing]

[Documentation]/[Literature/Posters/Leaflets/Manuals/ Evacuation Maps / Training Videos/Training Programs/ Games / Public Address / Notification Systems / Mass Communication / Big Voice / Video Screens / LED Devices]

Event-Specific External Cues and Individual Factors have been combined as the impact of a procedure for the first time can be categorized as being an Event-Specific External Cue; however, when subsequently encountered, it may be better characterized as an interaction between Event-Specific External Cue and Event-Specific Individual Factor.

Event (-Specific External Cue/Individual Factor)

[Human Resources]/[Event Management / Facility Management /Deference Behavior Management / Sequencing /Metering /Flow Metering /Metered Flow/ Constraining/ Limiting Access /Throttling / Channeling/ Crowd Processing / Crowd Control /Crowd Managers/ Phasing / Zoning/ Building Services Disruption/ Manual Intervention / Physical Assistance / Aid / Staff Instructions/Staff/ Wardens/Active/ Emergency Response Coordinators/Marshals/Helpers/Buddy System/ Police Action / Intervention/Surveillance/ Monitoring/ Supervision/ Support] / [Management]/ [Passive Egress Management / Active Egress Management / Crowd Management / Crowd Control]

[Technological Resources]

[Mass Notification /Emergency Communication System/ Big Voice / Evacuation Alarm / Alarm System / Notification System / Alarm /Type/Bell/Siren / Public Address / Pa / Intercom/ Emergency Information Systems /Exit System/ Information Fire Warning System/Warning System / Voice Communication System /Fire Safety System/ Directive Public Announcement]

[Led/Screens / Household Strobe/Flashing Lights/ Industrial Strobe/ Strobe System]

[Text/ Symbol/ Visual Instructions/Visual Notification]

[Voice Message/ Verbal Instructions/ Tone / Signal / Alert / Sound/ Beep / T-3/ Swoop/ Modified T-3/ Announcement/ Command/ Call]

[Audible/ Aural/Visual/Tactile/ Aural/ Sensorial]

[Message Content / Information]

[Notification] / [Means Of Awareness / Ambiguous Cue / Unambiguous Cue/ Detectable Warning]

[Voice Quality / Intelligibility /Audibility/Visibility/ Pitch/Volume/Urgency/Motivation /Priority]

[Connectivity / Network / Addressable/Panel Instructions]

[**Sign] /[Signage**] / [Directional Sign / Emergency Sign / Building Signaling System / Egress Marking / Egress Signage/ Marker System/ Luminance/Photoluminescent / Fluorescent / Led / Color / Brightness/Illumination / Reflective Properties/ Backlit/Reflective]

[Lighting System/Emergency Lighting/ Ambient Lighting/Dynamic/Static/ Tactile Warning/ Safety

Sign/ Ambient Lighting / Backlighting/ Mood Lighting / Side Lighting/ Lighting]
[Smoke Detection / Smoke Alarm/Mist System / Suppression System / Sprinkler System]

Post-Event

[Assembly/Mustering/Registration/Recording/Assembly Staff/Muster Point/Assembly Point/Meeting Point/Attendance]

ENVIRONMENT

Pre-Event External Factors

[**Ambient**]/[Ambient Noise/ Background Noise/ Noise/Pollution]
[PA/Announcements/ Music/Radio/Conversation/ Traffic/Shouting]
[Ambient Lighting/ Normal Lighting/Daylight/Background Lighting/Television/Screens/Computer Screens/Lighting/Lights/Flashing Lights/Lighting Effects/Sunlight/Advertising]

Event-Specific External Cues

[Natural Hazard/ Weather/ Snow/ Rain/ Wind/ Heat/ Sun/ Hail/ Flood/ Mudslide/ Natural/ Earthquake/ Tidal Wave/ Lightning Strike/Tornado/ Hurricane/ Cyclone/ Thunderstorm]
[Environmental Impact/ Debris/ Damage/Smoke/ Lighting Level/Ambient/Emergency Lighting Conditions/Visibility Distance/Range/ Viewing Distance/ Darkness/Extinction Coefficient / Optical Density/ [**Smoke**]/[Spread / Smoke Development / Smoke Evolution/ Opacity] / **[Visibility]** /[Smoke Cue/ Visible Smoke]
[**Gas**]/[Irritant / Non-Irritant / Toxic/Non-Toxic/Narcotic/Agent/Toxin/Acid/Acidic/Organic/Inorganic/Inert/ Poison/Asphyxiant/ HCN / CO / CO_2/ LOW O_2/ ACROLEIN / FORMALDEHYDE/HCl/HBr/NO_2/SO_2/HF]
[**Fire**]/[Fire Attributes / Fire Characteristics/ Fire Cue/ (Non-)Visible Flame]
[**Temperature**]/Ignition/Vitiated/ Smoldering/Oxygen Deprived]

Primarily of interest here as the Environmental Conditions can act as Event-Specific External Cues upon the Decision-Making process, and also influence the Individual's physical attributes.

EVENT LEVEL

BASIC ENGINEERING TERMS

These terms represent input values and potentially results, depending on the manner in which they are used.
[Specific] /[Flow] [Flow Rate/Rate/ Service Rate/ Discharge Rate/ Flow / Specific Flow / Exit Flow / Exit Flow Rate / Door Flow Rate / Rate Of Discharge / Mean Flow Rate / Max Flow Rate / Optimal Flow / Flow Characteristics/Demand]

[Dynamic Capacity/Flow Equation/Fundamental Equation/Flow Per Effective Width/Unit Flow/Population Per Effective Width/ Channel / Channel Capacity/Egress Capacity/ Traffic Demand]

[Route Use][Critical Path/Nearest/Design/Proximity/Random/ Transition Point / Controlling Component / Constriction / Constraint / Bottleneck/ Pinch Point / Transition In Egress Components

[Critical Conflicts/ Merging/ Branching/Mixing Capacity Factor/ Catchment Area]

[Speed] Travel Speed / Velocity/ Running Speed / Crawling Speed / Movement Speed / Movement Rate

[Speed – Distance Curves / Speed –Density Curves / Flow-Density Curves / Fundamental Diagram]

(Population) [Density]/[Pedestrian Module/ Density / Level Of Service/Pedestrian Density/ Footfall /Crowd Density/ Occupant Load / Occupant Capacity/Occupant Flow Density/Occupant Density]

[Time][Outcome]/[Movement Time / Refuge Time / Response Time/Time Of Evacuation/Arrival Time / Individual Escape Time / Personal Evacuation Time /Overall Evacuation Time/Clearance Time / Evacuation Time / Egress Time / Escape Time / Time To Reach Safety/Decision Time/ Walking Time / Travel Time/Flow Time/Congestion Time/Queue Time/Wait Time/ Cumulative Wait Time/Personal Evacuation Time / Building Evacuation

Time/Average Flow Rate/Peak Flow/Escape Time/ Evacuation Performance/Tenability Criteria/ Available Safe Egress Time / Available Safe Escape Time/Required Safe Egress Time / Required Safe Escape Time]

[**Population Size**][Loading/Critical Capacity/Number Of (People,Pedestrians,Evacuees)/Crowd Size/Mass/Agent Population/ People Count/Person Count/No.People/Occupant Load/ Expected Occupancy Level/Nominal Use/Expected Use/Occupant Load]

(Occupiable| Usable) **[Area] /** [Space/Available Space/Floor-Space/Room/Available Room]

[Distance (Travelled**)]**[Length/Travel Distance /Journey Length]

[Physical]**[Width][Height][Depth]**[Unit Of Exit Width /Unit Of Stair Width/Available Width/Usable Width/Actual Width/ Lane Width]

(Effective)[Width][Height][Depth][Boundary Layer / Boundary Layer Width/Edge Effects/Width Used]
EVENT LEVEL TIMELINE
[Pre-Event] [Phase][Time]
[Pre-Cue] [Phase][Time]
[Pre-Response] [Response Time / Pre-Evacuation Time / Pre-Movement Time / PTAT/Delay Time / Alarm Time / Initial Delay Time / Delay Time To Start / Start-Up Time/Delay/Awareness/Time To Start/Dawdle Time/Recognition Time/Alert Time/PIA Time/Reaction Time/Time To Initial Move/Time To Move/Pre-Egress Activities / Occupant Delay Time/ Time To Start Evacuation-Relocation/Presentation Time
Pre-Evacuation Activities / Response / Pre-Egress Activities] **[Phase][Time]**
[Response] [Incident/Drill/Exercise/Movement/Experiment/Activity/ Incident/ Fire Emergency/ Event /Refuge/Accident / Emergency/ Incident / Event] **[Phase][Time]**

> [Evacuation Phase/Evacuation Movement/ Egress Response/Emergency Behavior/ Behaviour / Physical Movement/Movement Phase /Trans-movement Decisions/ Movement/Refuge/Arrival/Escape/Clearance/ Egress/Movement/Evacuation/Action/Refuge/Defense]

[Post-Response] [Phase][Time]
[Post-Event]/ Routine**[Phase][Time]**
EMERGENT CONDITIONS
Emergent conditions are categorized as event-specific experiences.
There is some limited overlap between the Flow Characteristics described below and the Engineering Terms described previously. This is felt reasonable given that the Engineering terms describe the phenomena that appear in the analysis of the flow characteristics below.
[Flow Characteristics]/ [Flow Dynamics/ Crowd Configuration/People Movement/ Group Dynamics/Crowd Movement Characteristics/Flow Movement - Movement Characteristics/Walking Patterns]

> [Unstable Flow / Stable Flow/[Priority/ Stream/ Unidirectional Flow]/[Bidirectional Flow]/[Counter Flow] / [Contra-Flow]/[Upstream/Downstream]/**[Merging]/[Branching]**/[Jamming/ Merging Egress Flows/ Merging/ Laminar/ Turbulence/Uniformity/ Stable Flow / Unstable Flow/ Impedance /Impeded Flow /Crossing Flow / Herding/ Lane Formation/Merging Flow /Coherent Flow/Collision /Crosswalks]
> [Impact/Compression/Crush/Force / Friction/ Cumulative Pressure /Crush/ Arching/Trampling]/ [**Congestion**](Level/Experienced) /[Crowdedness/ Shock Wave/ Front To Back / Back To Front Communication/ Crowd Crush / Crowd Incident / Crowd Pressure / Compression/Jam / Jam Point /Pressure / Pressure Points/Overcrowding / Stoppage /Blockage/Pinch-Point/Riot / Stampede / Trample/Violence/Melee/Disorder/Panic Situation]
> [Group Formation / Cluster / Convergence Clusters/ Gathering /Focal Point/Staggered Configuration/ Balanced Use Of Routes/ Used According To Design / Expected Use/Efficient Use/ Headway / Interpersonal Distance / Inter-Pedestrian Spacing]

[**Queue**]/Queuing/Linear Queue/ Organized Queue / Disorganized Queue/ Folded Queue/ Lines]
[Crowd Formation/Population Density / Pedestrian Density/ Footfall /Density/Crowd Density/ Occupant Load / Occupant Capacity/Occupant Flow Density]

MODEL

These terms are derived from an examination of articles and reports related to specific models and also from a sample of the many model reviews available; i.e., those existing approaches developed to categorize models.

[Model][Learning Model / Transport Model/ Scheduling Model / Cellular Automata / Code / Computer Animation /Computer Model/ Deference Behavior Modeling / Evacuation Model / Egress Model/ Escape Model / Movement Model/ FIST Model/ Fluid Model/ Gas Model/ Lattice Model / Particle Model / Graphical Model / Hydraulic Model / Mathematical Model /Movement Analysis/ Network Model/ Network Analysis/ Optimization Model/ Pedestrian Model/ Circulation Model/ Queuing Model/ Risk Model / Simulation/ Social Force Model/Real-Time Model /Analog Model /Effective Width Model /Time Based Analysis/Action-Oriented Model/ Theoretical Model/ Prescriptive Codes/ Prescriptive Model /Goal-Oriented Model/ Derived Equation / Flow/ Hydraulic/ (General Purpose) Modeling Tools/ Evacuation Simulation / Conceptual Model / Table-Top/ Agent-Based Model / Naturalistic Model / Response-Primed Model / Egress Calculation Model/ Movement Algorithm/ Rulebase Model/ Analogy Model/ Stress Model/ Calculation Procedure/ Expert Analysis/ Mathematical Calculation/ Hydraulic Analogy / Network Flow Models/ Behavioral Models/ Partial Behavioral Models /Analog Model/ Discrete Model/ Perception Control Theory / Egress Prediction/ Ellipse Model/ Fractional Effective Dose Model/ Engineering Analysis / Calculation/Transport Model/Traffic Model/ Life Safety Code/ Life Safety Evaluation /Factor Of Safety/Fire Codes /Evacuation Time Prediction / Evacuation Simulation Model/ Parallel/ Distributed]

The following list represents a combination of terms used in model reviews and terms used by model developers to describe their own model developments.

[Testing][Validation / Verification / Testing / Component Testing/ Peer Review/Benchmarking / Functional Testing / User Testing / Third Party Testing/ Back Of Envelope/ Sanity Check/ (Alpha/Beta) Testing]
- [Code Requirements / Fire Drills / Previous Experiments / Other Models / Third Party / None / Calibration Of Parameters / Validation Of Results/ Functional Testing/ Component Testing / Qualitative Testing / Quantitative Testing / Parametric Testing / Full-Scale Tests]

[Model Origins] /[Background]:
- [References /Developers / Organization / Language / Country Of Origin / Age/ Date Of Development]

[Availability]:
- [Free / Fee / License / Consultative]

[Requirements]:
- [Input / Data Needs / User Expertise / Hardware Requirements / Memory Requirements / Windows/ Apple/Size / PC-Based / Technical Requirements]
- [CAD/CAM [Yes/No]

[Application Area]:
- [Activities Within Specific Areas / Specific Area / Structural Area/ Surrounding Area]
- [Process / Component/Structure/Area]

[Use]:
- [Naïve / Operational / Engineered / Predictive / Real-Time / Interactive]

[Environment] (Representation)/ [Fire]:
- [Incorporate Data / User-Data / Internal Model / FED / Fire/Smoke / None]

[Population] (Representation)/[Crowd Mass/Human Related]:
- [Human-Related / Individual / General / Global / Aggregate]
- [Agent / Audience /Person / Evacuee / Avatar / Automata / Individual / Population / Actor / Passenger / Particle / Walker / Runner / Crawler /Reactive Agents / Synthetic Humans / Participant/ Grain / Autonomous Agents]

[Behavioral Response] (Representation)/ Behavior-Related:
- [AI (Genetic Algorithm, Neural Net, Artificial Life, Case-Based, Learning Model, Decision Theory, Agent-Based, Intelligent, Evolutionary Computing, Heuristics, Genetic Programming, Vr)/Rule-Based / Functional

Analogy / Implicit / None / Movement / Behavior / Partial Behavior/ Movement (Fluid) / Movement (Particle) / Matrix/ Fluid-Based / Matrix-Based / Discrete Choice / Adaptive]

[Organization]/[Host/ Developer/ Funding Organization/ Sponsor/ Supporter]

[General Approach] / [Model Resolution / Refinement / Key Theories]:

[Simulation / Optimization / Risk Assessment / Monte Carlo / Node-Network Model / Fine Structure Simulation / Stochastic / Deterministic / Conditional Stochastic / Microscopic / Mesoscopic / Macroscopic / Conceptual / Computational / Estimated / 1st Principle / Fundamental/ Emergent / Grid-Based/ Simple Calculation Method / Estimation Model / Movement Model / Behavioral Simulation Model / Flow-Based/ Cellular Automata / Agent-Based / Models Including Sociological Factors / Specific/General / Phenomenological/First Principles / Discrete/Continuous/ Numerical / Analytical/ Quantitative / Qualitative/ Level Of Refinement / Resolution/ Scale /Scope/ Generation / Skill-Based / Rule-Based / Knowledge-Based / Operational/Tactical/Strategic / Logistical Model/Field/ System Dynamics/Game/Discrete Event Simulation/General Force Model/ Hierarchical Model/ Social Force Model/Activity-Based Model]

[Output]:

[Quantitative / Qualitative / 2D / 3D / None / Textual / Visual / General / Specific / Animation / VR]

[Procedure] (Representation)/ [Scope]:

[Pedestrian / Ingress / Egress/ Circulation / Emergency / Non-Emergency / Assembly / Boarding / Entrance]

[Structure] (Representation)/ [Building Related]:

[Scale/Fine/Coarse/Continuous/Discrete/Mesoscopic / Discretization/Individual-Specific/Decision/Event]
[Basic Elements: Area / Node / Tile/ Space / Square / Cell / Plaquette / Arc / Edge / Links / Constraints/Passage / Connectors/ Region / Zone / Loading / Lattice/ Flow/ Force /Capacity/ Network / Grid / Numerical Grid / Map / Node-Network / Matrix /Contour / Routes / Probability / Exit Choice / Dynamic Capacity / Traversal/ Paths / Transition Probabilities/Distance Map/Queuing Network / Layout / Configuration / Spatial Structure / Radial Directions / Von Neumann Neighborhood/ Moore Neighborhood/Network Representation/ Neighborhood/Attraction Surfaces / Sink/Source/Gradient / Space / (Evacuation) Tree / Difficulty / Cost / Ranking / Demand / Ribbons/ Connectivity/ Index / Topological Map/Risk Ranking /Rank/Metric / Network Diagram/Potential Field/Domain/ Social Distance/ Graph/Intelligent Space/Architecture/Layout/Weighted Map]

[Calculation / Update]:

[Parallel / Parallel Update / Sequential / Shuffled Sequential / Ordered Sequential / Random Sequential]

DATA

[Acquisition][Process/Data Collection/ Acquisition/Observation /Measurement / Experiment / Participant Observation / Interview / Survey/ Drill/ Exercise / Data Acquisition / Naturalistic Observation / Tracking/ Monitor/Review/Research/Literature Review/Reading/ Structured Observation / Unstructured Observation]

[(Acquisition|Collection) [Device]: Video Recording / Video Monitoring / CCTV Monitoring/ Camera /Questionnaire (Open-Ended/Closed-Ended) /Poll/Empirical Data /Couple/Empirical Evidence / Measurement/ Mensuration/ Counter / Sensor Mat/ Pressure Mat/ Active Infrared Sensor/Passive Infrared Sensor/ Laser Scanner/Microwave Sensor/Tracking Device/ RFID]

[Source][Experiment/ Drill/ Circulation / Routine Use/ Entering/ Filling / Loading/ Ingress Movement/ Egress Movement / Exercise/ Real Event/ Incident/ Disaster/ Evacuation/ Movement/ Trial/ Experiment/ Online Source/ Footage/ Stills/ Photographs/ Anecdote/ Newspaper Reports/ Newscast/ News Cast/ Reading Material/ Journal Articles/Reports/Papers/Websites/Personal Experience / Direct Observation / Live Viewing/Pre-Existing Record]

Outcome [**Format**][Footage/ Tape/ Films/ Photographs/ Stills/ Pictures/ Notes/Observations/Manual Notes/ Numerical/Quantitative / Descriptive / Qualitative / Sample / Representative / Graphical]

Appendix E: Information Provided to the Narrative Timeline Notation

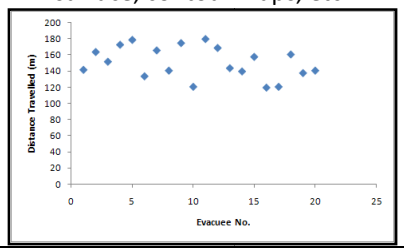
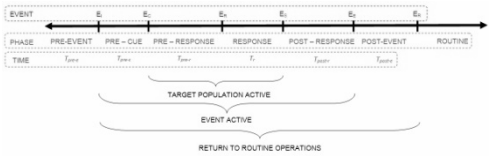
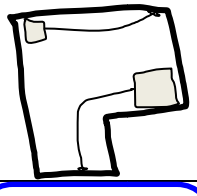
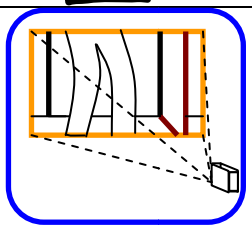
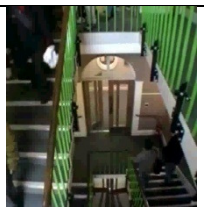
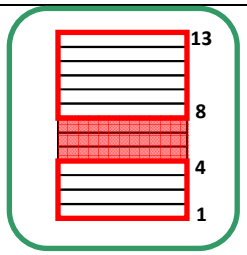
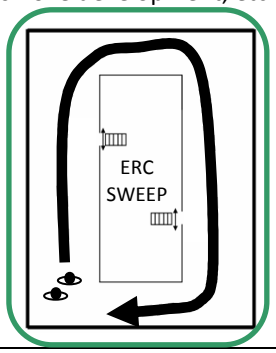
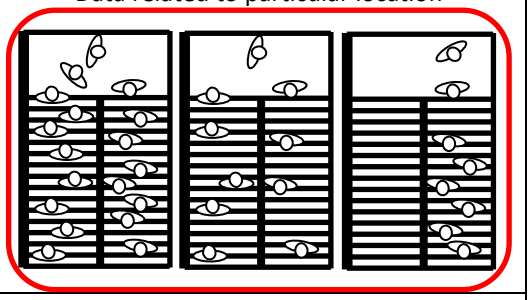
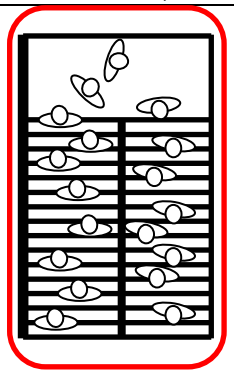
<table>
<tr><th>LABEL</th><th>CATEGORIES</th><th>SUB-CATEGORIES</th><th>COMMENTS</th></tr>
<tr><td rowspan="6">FORMAT</td><td>Numerical
A set of raw data</td><td></td><td>[1.3, 4.6, 5,2]</td></tr>
<tr><td>Tabular
Results organized into measures against categories</td><td></td><td><table><tr><td></td><td>Pre-Response time (sec)</td><td>Speed (m/s)</td></tr><tr><td>Men</td><td>80</td><td>1.2</td></tr><tr><td>Women</td><td>90</td><td>1.1</td></tr></table></td></tr>
<tr><td>Descriptive
Text describing some aspect of the event</td><td></td><td>“We moved along the corridor only to find the exit overcrowded. However, we could not turn back given the arrival of smoke.”</td></tr>
<tr><td>Chart
Graphical representation of the data.</td><td></td><td>Scatter-plot, line, pie-chart, bar/column, surface, contour maps, etc.
 
</td></tr>
<tr><td rowspan="3">Pictorial</td><td>Conceptual
Symbolic representation of some aspect of the event. For instance, high-level process diagram, timeline, etc. representing some aspect of the event.</td><td> 
</td></tr>
<tr><td>Simplistic
Simplified sketch of a situation related to the event.</td><td>  </td></tr>
<tr><td>Realistic
Naturalistic representation of a scene during the event (e.g., a rendered storyboard), or the development of some aspect of the event (e.g., crowding at an exit).</td><td>  </td></tr>
</table>

		Photo-Realistic Actual footage from the event. For instance, video footage / photographic footage, etc.	
SCALE	**Event-level** Information at the level of the event itself. For instance, the manner in which the structure was cleared. Emergent conditions that develop at the scenario level.		 High-level contour maps, footfall diagrams, itinerary maps, etc.
	Key Event Elements Information related to the development of one of the key elements of the event or the data collection process.	*Procedure* Information related to the procedure	**Pr**
		Response Information related to the behavioral response of the population of interest	**Re**
		Organization Information related to the organization within which the event took place.	**Or**
		Population Information related to the target population involved	**Po**
		Objectives Information on the underlying targets and objectives of the data collection process.	**Ob**
		Structure Information on the structure in which the event took place	**St**
		Environment Information on the evolving environmental conditions.	**En**
		Data Collection Activities Information on the methods employed to	**Da**

		collect the data of interest.	
	Individual Level Information related to one of the individual components of within the key elements.		For instance, at the level of a person, door, smoke development, etc. 
	Individual Process A process related to one of the individual processes described above.		Process within an individual level component. For instance, cognitive process, door operation, etc.
DIMENSION	**1D**		Line plot
	2D		Scatter-plot / storyboard
	3D		Surface
	Multi		Set of results
FOCUS	**Chronological** Information in relation to the event time		Data related to time
	Spatial Information on the locations being described or referred to.		Data related to particular location 
	Episodic Information on the passage of incidents, not necessarily consistent or uniform.		Data related to particular events, itinerary maps, etc.
	Abstract Information related to some conceptual process or component.		Data related to a particular process; e.g., decision-making.
PROGRESS	**Dynamic** Information that is related to the	*Discrete*	Storyboard of pictures, itinerary maps, etc.

	passage of time.		
		Continuous	e.g., continuous function, animation, etc.
	Static Information that is not related to the passage of time.		 Snapshot
TIMELINE COMPONENT	**Pre-Event**		Time between initial use of structure to the beginning of an event (if appropriate).
	Pre-Cue		Time between the beginning of an event and the presence of the first cues that may indicate the existence of the event. For instance, presence of smoke, alarm initiation, staff activities, etc.
	Pre-Response		Time between receiving cue(s) and initiating purposive action to reach a point of safety.
	Response		Time spent performing purposive actions to reach objective. For instance, evacuating the building, reaching a shelter, etc.
	Post-Event		Time from objective being reached to active procedures being stopped; i.e., time for the event to be declared over once safety has been reached by the population.