NIFSIP

Analysis Phase Report

United States
Department of
Agriculture

Forest Service

September, 1998

National Interagency Fire Statistics Information Project

Acknowledgments

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We appreciate those agencies that provided people and resources to complete this effort, and gratefully acknowledge the hardworking individuals who contributed to this project.

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We also wish to thank the project advisory group:

- Scott Bradshaw, Bureau of Indian Affairs
- John Gebhard, Bureau of Land Management
- Andrea Olson, Fish and Wildlife Service
- Bruce Keene, National Park Service
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Contents

Analysis Stage Report

Summary

The Analysis Stage of the National Interagency Fire Statistics Information Project was conducted to achieve three primary goals:

- perform a detailed analysis of existing data items collected by Federal Wildland Fire Agencies
- analyze current business process related to wildland fire statistics collection and documentation
- analyze future data requirements that result from the implementation of the National Fire Policy.

Analysis of existing data items

A detailed analysis of data items collected through the Department of Interior form 1202 and the U.S. Forest Service form 5100-29 reveals many similarities between the two sets of data. For example, both forms identify fire name, acres burned, statistical cause, and general cause data items. This similarity is due to the continued coordination efforts between agency officials.

In addition, analysis of the National Fire Information Reporting System (NFIRS) administered by the U.S. Fire Administration reveals similarities to these two Federal systems. NFIRS is used by State, Municipal and Rural emergency response agencies.

Analysis of current business processes

Current business processes for collecting, documenting, and storing fire statistics data are very similar for all Federal wildland fire agencies:

1. Data is collected by fire response units and documented on a form.
2. This data is then entered into a centralized computer system, allowing it to be available to users nationwide.

Department of Interior business process

Department of Interior (DOI) data is stored and maintained on a computer system located at the National Interagency Fire Center in Boise, Idaho. Access to this data is through field computer terminals or via written request to system management staff.

U.S. Forest Service business process

U.S. Forest Service data is collected and documented in the same manner as the DOI data. It is entered into a locally (unit level) managed database and then transmitted to a central computer system located in Kansas City, Missouri. Data is retrieved using automated report writing software.

These current systems provide a firm reporting foundation for natural and human-caused ignitions that were determined to be wildfires of a statistical nature. However, these systems do not adequately meet the needs of the managed fire program. Utilizing a single system provides the opportunity for standardized data collection, documentation, and storage for all Federal wildland fire agencies.

The National Fire Policy

The National Fire Policy implements a new vision to manage natural, human-caused, and management-ignited fires. This interagency-wide policy includes all Federal wildland fire agencies. While there may be varying interpretations of this policy, the goal is to increase management and decision space for all types of wildland fire.

The analysis phase of this project outlines the data needs for every type of fire identified in the National Fire Policy. The deliverable located in Appendix B, ‘‘NIFSIP Data Dictionary,’’ lists reference and data entities, attributes, domains, and formats.

Scope Clarification

The original scope statement was revised to clarify the purpose for the types of data that is collected.

Issues

The summarized issues to be resolved after the analysis phase include:

- Incident Cost Accounting
- Incident Numbering
- Incident Reporting Process
- Urban / Wildland Interface Definition
- National Fire Information Reporting System (NFIRS) Data Transfer.

Incident Cost Accounting

Regardless of fire ownership and the participating agencies, calculating the true cost of a fire is extremely difficult. This is due to the many independent financial systems and is further complicated by differing financial calculation policies and processes of the agencies.

This issue is a National concern, affecting many projects and systems across agency boundaries. The National Wildfire Coordinating Group is working to resolve this issue. The business team elected to resolve this issue by designing a one-to-many relationship in the model between a fire and a financial code.

Incident Numbering

Each Federal wildland fire reporting system uses a different numbering system to identify incidents:

- The DOI 1202 system uses pre-assigned fire numbers for each reporting year. These are aggregated at the National Level.
- The USFS system uses a decentralized numbering system to identify fires by the reporting unit id, reporting unit fire number, and year of the report. For example, a fire might be identified by report unit 0212, fire #16, reporting year 1997.

Since the only purpose of the current incident numbering system is to create a distinct occurrence of a fire record, the analysis team decided to maintain the current numbering system in the database. The report unit and reporting year remain as required data items. Fire name, which identifies a given fire, will become a member of the primary

key. This primary key consists of fire owner identifier, year in which the fire originated, and the fire name.

Incident Reporting Process

There have been questions regarding the integrity of fire statistics data for many years. Previous studies have shown that many data components are not as accurate as desired. Fire statistical data is collected by:

- completing an agency fire report form (DOI-1202 or FS 5100-29)
- entering the data into a computer program.

Fire statistics data collection usually begins at the time a fire is reported. It ends when the fire is declared out or when all action on the fire ends. Data collection points range from on-site collection to dispatch offices to estimation. In many cases employees who were not involved in the actual incident determine its data.

Fire statistical data is used by participating agencies to determine budget information. The integrity of this data may call into question the validity of our fire planning results and other statistical products.

Recommendations

- Develop an interagency fire information card. This information card, completed at the fire scene by incident management personnel, would document many of the information requirements for the fire report.
- Require fire reports to be completed by dispatch. Using the fire information cards described above, dispatch would record fire and fire investigation information on the fire report.

Urban/Wildland Interface Definition

The ability to obtain fire statistical information for fires that occur in Urban/Wildland Interface Areas was of keen interest to all stakeholders. To provide this functionality, an Urban Wildland Interface definition must be established.

A committee formed by the FFALC, which included State and Federal wildland fire agency representatives, completed the development of this Urban Wildland Interface definition. Urban/Wildland Interface Areas are areas where either:

- fire suppression tactics are influenced by a geographic area or zone where structures and other human development meet or intermingle with wildland or vegetative fuels, or
- structures are threatened, damaged or destroyed.

National Fire Information Reporting System (NFIRS) Data Transfer

Over the past several years there has been a strong interest in the upward reporting of Federal wildland fire data to the NFIRS system. The National Fire Policy Review Action Plan calls for closer coordination and cooperation with NFIRS administrators and stakeholders.

During these meetings, agreements were made to establish common data standards and a revised NFIRS wildland fire form, which will better meet the needs of State Forestry Agencies. The National Association of State Foresters is working toward establishing incentives to encourage States to use the NFIRS Wildland Reporting Form.

Analysis Process Approach and Challenges

Team Selection and Use

Two teams were established for the NIFSIP Analysis Stage:

- The core team included the Project Leader, Business Facilitator, Systems Analyst / Modeling Specialist, and Technical Writer. The core team completed all necessary documentation and modeling. The Project Manager led team meetings, resolved management and technical issues, defined quality assurance requirements, and selected appropriate CASE tools and methodology for the project. The Business Facilitator led business modeling sessions.

- The business team included five field business experts representing the Bureau of Indian Affairs, Bureau of Land Management, Fish and Wildlife Service, National Park Service and US Forest Service. This team's primary goal was to describe the fire statistics business and the data that represents the business.

Field Validation Process

Field visits were completed between March 3 and April 4, 1997. The nine field validation sessions were conducted in Denver, Wenatchee, Redding, Eugene, Tallahassee, Missoula, Boise, Albuquerque, and Fresno.

Session participants were divided into work groups and received instruction on data review techniques and documentation procedures. Each work group reviewed the modeled data and developed a list of questions that typically require answers derived from fire statistics data.

Lessons Learned

Perhaps one of the most important lessons learned during the NIFSIP Analysis Phase is that all participating agencies have a common interest in fire statistics. As each meeting progressed, the analysis team discovered that each agency had a strong desire for one common system, regardless of that agency's mission. Other lessons learned during the NIFSIP Analysis Phase include:

- The interagency team conducting this analysis believed the meeting room needed windows and improved ventilation. The duration of the meeting and the environment of the room took a toll on the group.

- The field review sessions were an outstanding method to validate the NIFSIP data dictionary.

- The group believed that agency managers were not briefed sufficiently prior to the start of this project. Many believed that these managers expected the complete development and build of the application. However, the goal of this project was to produce the data standard only.

Analysis Stage Deliverables

The following list identifies the deliverables for the analysis stage:

- Business Process Model
- Conceptual Data Model
- Data Dictionary.

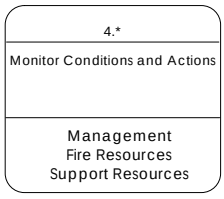
Business Process Model

A Business Process Model (BPM) provides a representation of business activities and interactions within a scope of study using a Data Flow Diagramming (DFD) modeling formalism. This business-focused representation expresses the activity flow, data sharing, and responsible parties within a business process. The model is composed of a graphical portion (diagrams) and a dictionary portion (database) and contains all the model objects including:

- Processes
- External Entities
- Stores
- Flows
- Resources
- Data Structures.

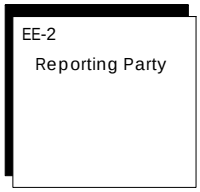
Process

A Process represents an activity or set of activities within the scope of study. It may include manual or automated processes, high level or very detailed activities. A process model often has multiple layers. Each process may have a decomposition diagram that details the activities operating within the higher level process. A process is described by either a process narrative or by a decomposition diagram. A process is identified on the model as a rounded rectangle, as shown below:



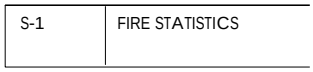
External Entity

An External Entity is used to express the boundary of the business process. An External Entity may be a person, organization, or system that sends something to or receives something from the business process. An entity is identified on the model as a shaded square, as shown below:



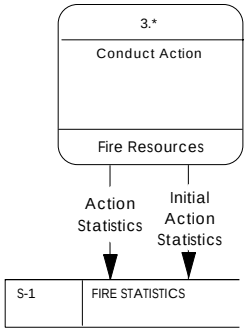
Store

A Store represents a *conceptual bin* or stopping place for whatever is flowing through the business process. It may be a manual or an automated store. In most Business Process Models the store does not refer to a physical database, per se. A store is defined by a name and data structure. A store is identified on the model as an open-ended rectangle, as shown below:



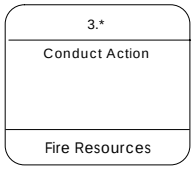
Flow

A Flow represents the movement of goods or information between processes and entities, stores, or other processes. It may represent a one-way or two-way flow. A trigger flow is a special type of flow that serves as the stimulus to start a process. In general, a process has only one trigger and these types of flows are graphically distinguished on the diagrams. A flow is defined by a name and a data structure. A flow is identified on the model as a line between a process and other model objects, as shown below:



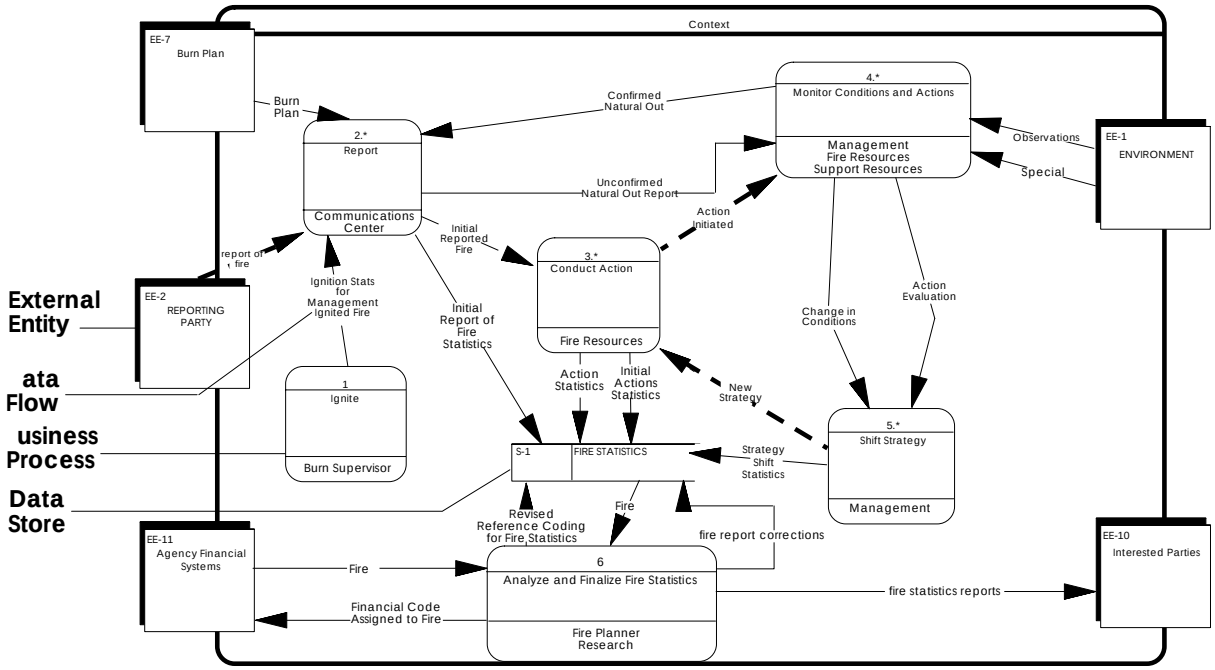
Resource

A resource is a component of the business process that participates in or is used up in a process. The kinds of resources often found in process models include personnel, organizations, facilities, raw materials, equipment, and systems. A resource may be associated with many processes, while a process may use multiple resources. Each resource has a role and a usage in its association with the process. A resource is identified on the model as a name in the bottom of the process, as shown below:



Data Structure

A data structure is a hierarchical grouping of data elements *as you find them*. A data element is an atomic (non-decomposable) data item of interest. Data structures are used to document the contents of flows and stores. Data elements and data structures may also be moved into the data model to provide a starting point for data analysis.

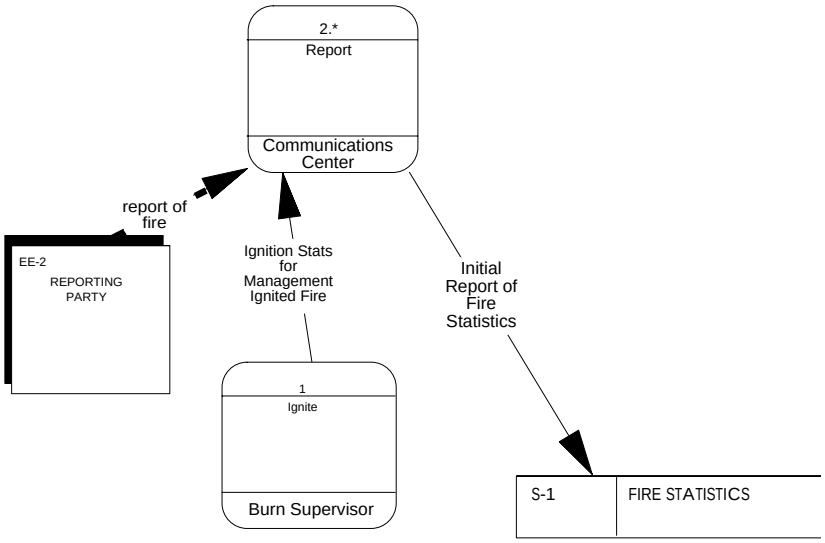


For more information see the section, ''Business Process Model Narratives.''

How to read a Business Process Model

The diagram shown below identifies these business rules:

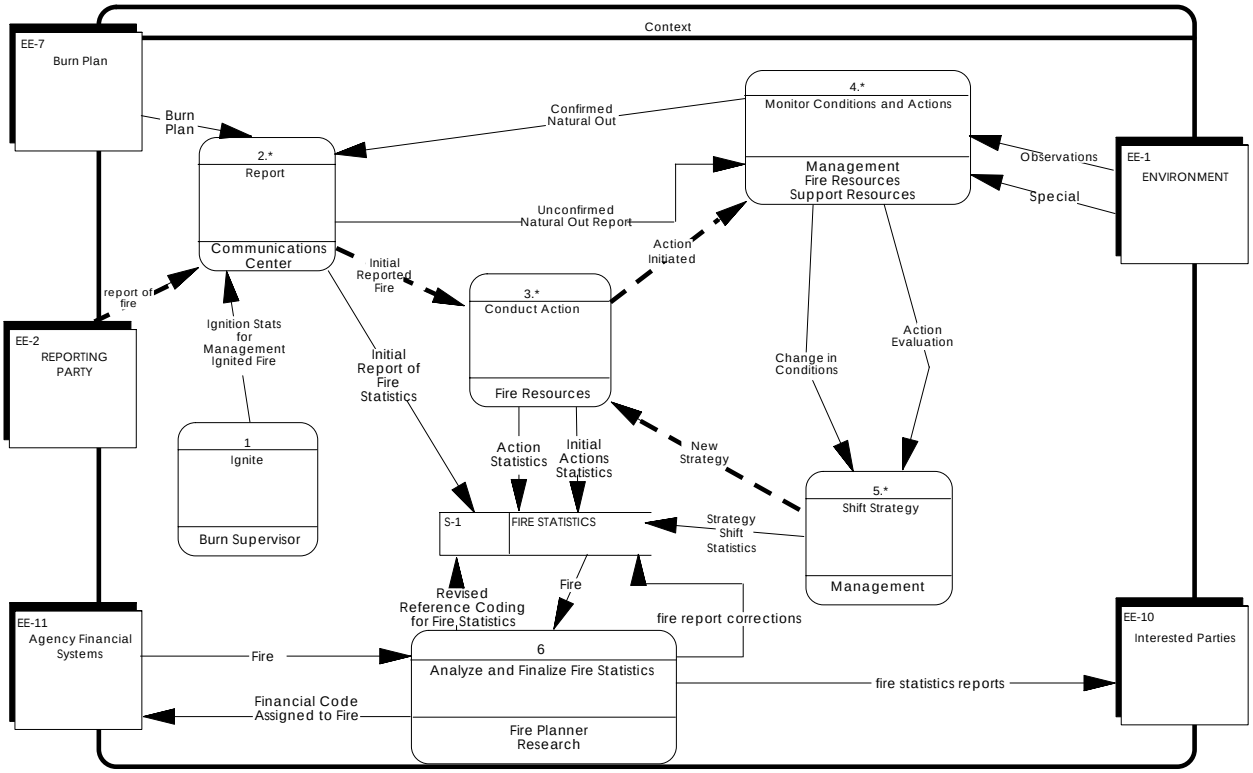
- An ignition (business process 1) occurs, which is reported (data flow) by the REPORTING PARTY (external entity).
- Initial report information is processed (business process 2) by the Communications Center.
- An initial report of fire statistics (data flow) is generated from report information (business process 2) and saved in the FIRE STATISTICS (data store) database.



Note: A BPM does not reflect the actual timing of the model. For example, fire statistics may be stored in the data store after the fire is out.

Business Process Model Narratives

Context



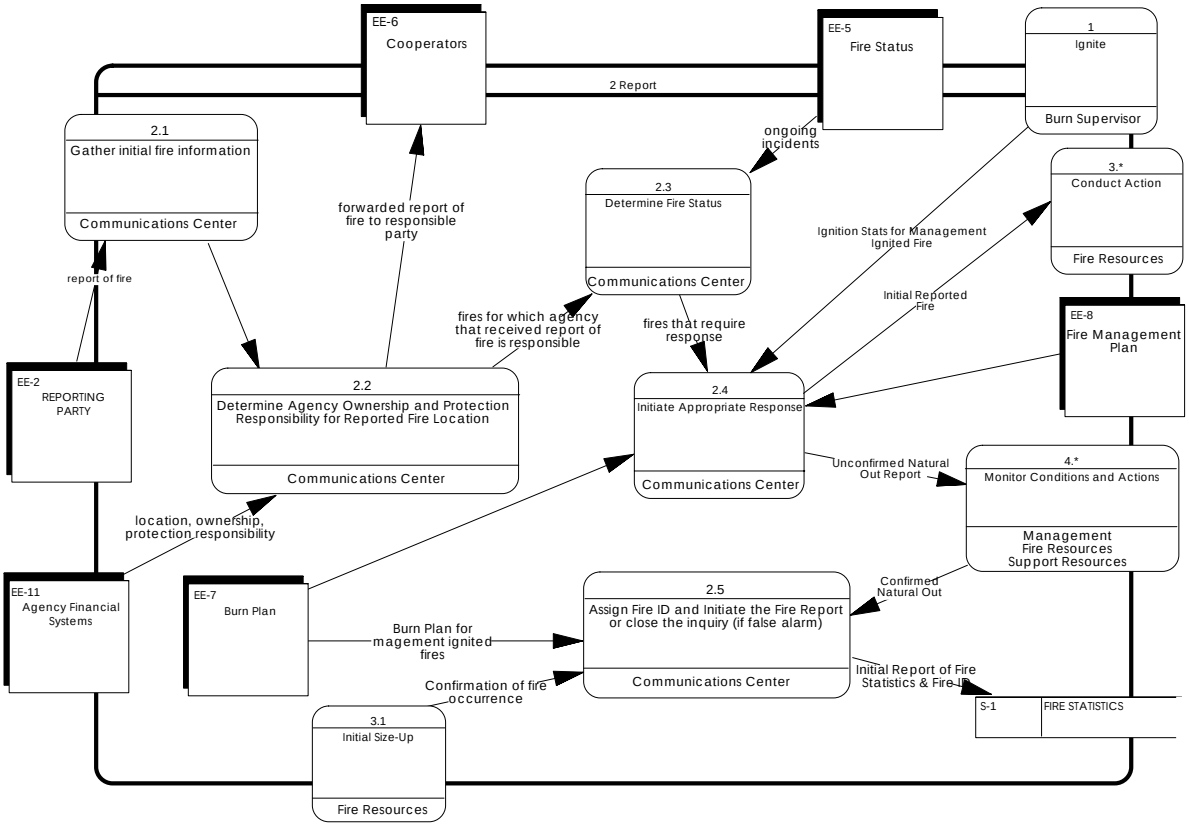
1.0 Ignite

a. Burn Plan developed for a Management Ignited Fire.

b. Burn Supervisor determines that conditions are favorable for a management ignited fire.

c. Ignition statistics generated from the Management Ignited Fire.

2.0 Report



2.1 Gather initial fire information

a. Communications Center gathers Initial fire report information generated from the Management Ignited Fire or from a report of fire from a Reporting Party.

2.2 Determine Agency Ownership and Protection Responsibility for Reported Fire Location

a. Communications Center determines the location, ownership, and protection responsibility using information from agency financial systems.

2.3 Determine Fire Status

a. From an Initial Reported Fire, Fire Resources performs an Initial Size-Up.

b. For ongoing incidents, Communications Center determines fire status.

2.4 Initiate Appropriate Response

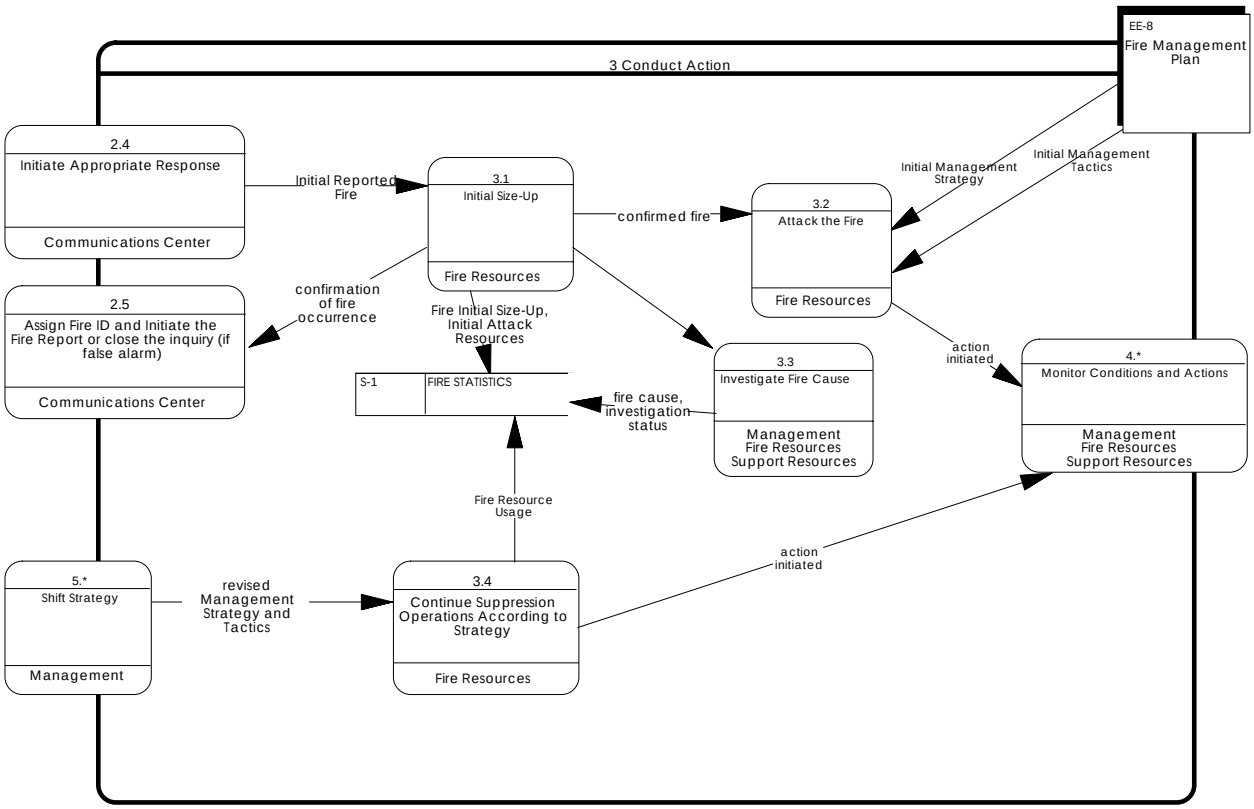
a. Communications Center initiates an appropriate response based on Burn Plan.

2.5 Assign Fire ID and Initiate the Fire Report or close the Inquiry (if false alarm)

a. For confirmed fire occurrence, Communications Center assigns Fire ID and initiates Fire Report.

b. For false alarm, Communications Center closes the inquiry.

3.0 Conduct Action



3.1 Initial Size-Up

a. Fire Resources sizes-up fire based on Initial Reported Fire.

3.2 Attack the Fire

a. For a confirmed fire, Support Resources, Management, Fire Resources, Communications Center, and Burn Supervisor deploy equipment.

b. Based on the Fire Management Plan, Fire Resources develop Initial Management Strategy and Tactics.

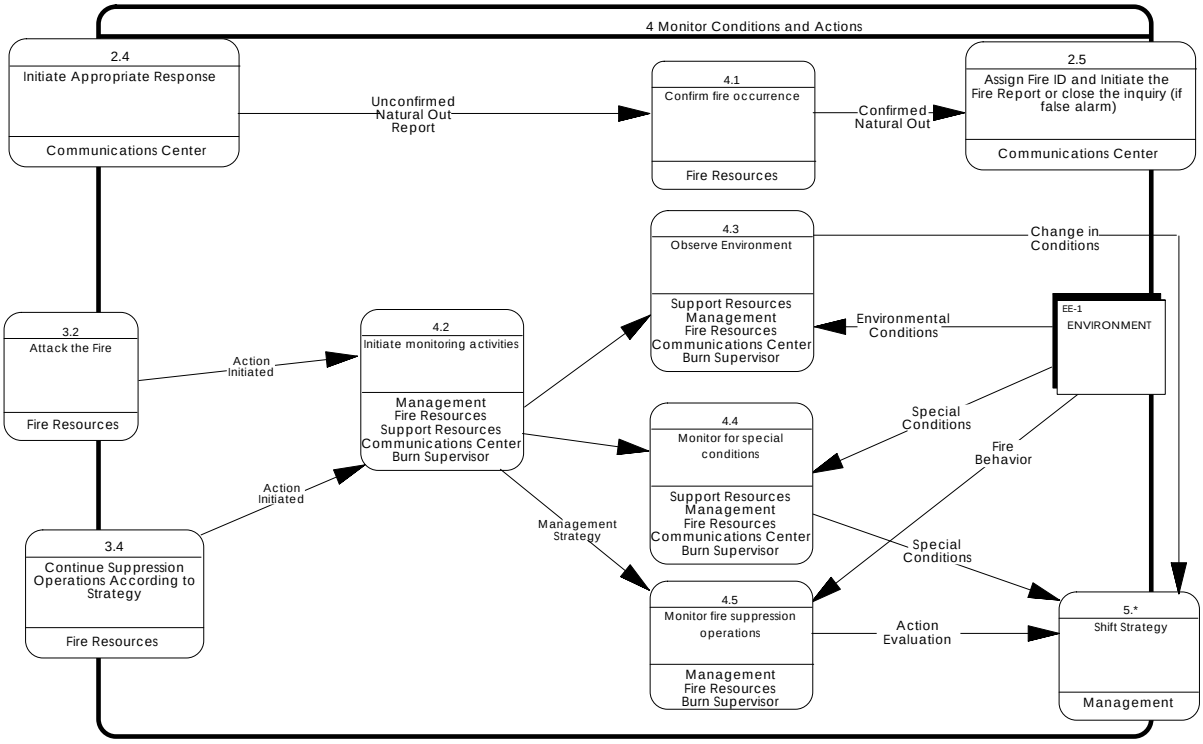
3.3 Investigate Fire Cause

a. For a confirmed fire, Support Resources, Management, and Fire Resources investigate the fire cause.

3.4 Continue Suppression Operations According to Strategy

a. For a shift in strategy, Fire Resources revises Management Strategy and Tactics.

4.0 Monitor Conditions and Action



4.1 Confirm the occurrence

a. For Unconfirmed Natural Out.

4.2 Initiate monitoring activities

a. Fire Resources.

4.3 Observe Environment

a. Support Resources, Management, Fire Resources, Communications Center, and Burn Supervisor monitor environment for a change in conditions.

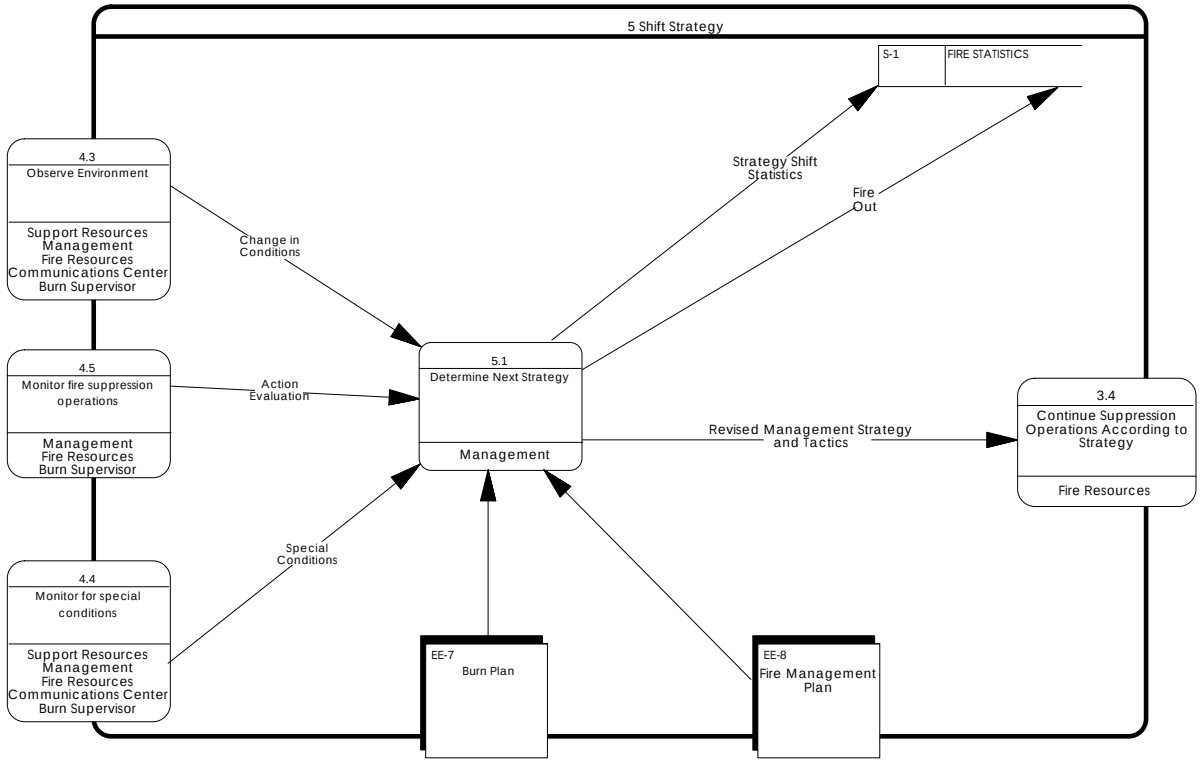
4.4 Monitor for special conditions

a. Support Resources, Management, Fire Resources, Communications Center, and Burn Supervisor monitor environment for a special conditions.

4.5 Monitor fire suppression operations

a. Management, Fire Resources, and Burn Supervisor monitor fire suppression operations.

5.0 Shift Strategy BPM



5.1 Determine Next Strategy

a. Management evaluates fire suppression operations.

b. Management shifts strategy for Special Conditions and / or for observed changes in environment.

Conceptual Data Model

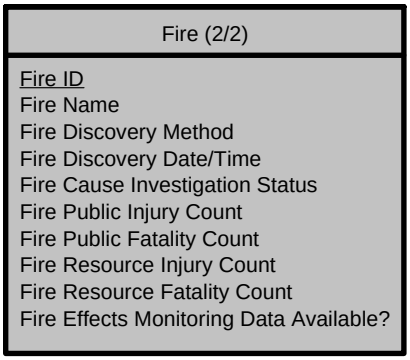
A conceptual Data Model (CDM) provides a representation of business data, their characteristics, and interactions of interest within a scope of study using the Entity-Relationship (E-R) modeling formalism. This conceptual or business view represents data, their characteristics, groupings, and relationships without regard to implementation. The model is composed of a graphical portion (diagram) and a dictionary portion (database) and contains all the model objects including:

- Entities
- Relationships, Arcs, and Connectivities
- Attributes and Identifiers
- Integrity Constraints.

Unlike the multi-level Business Process Model, the E-R Model is contained within a single diagram.

Entity

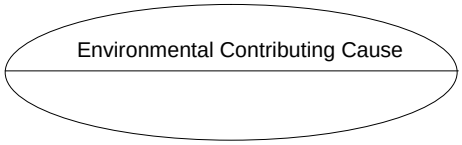
An entity represents a category of concrete or abstract business object of interest, some thing about which the business desires to keep information. An entity is described by a set of non-repeating attributes. All occurrences of the entity must be identifiable. A properly constructed entity may not be decomposable. An entity is identified as a rectangle on the diagram, as shown below:



Note: The Data Entity in a data model is not the same as the External Entity in a process model.

Relationship, Arc, and Connectivities

A relationship represents an association between entities. A relationship may involve one, two, or more entities. For each occurrence of the relationship an occurrence from each associated entity must participate. A relationship is defined by all the participating entities, the relationship attributes (if any), and the connectivity rules for each of its arcs. A relationship is identified on the diagram as an oval, as shown below:



Entity participation in a relationship is identified on the model via an arc (line between entity and relationship) and its connectivities (number pair on the arc). Connectivities indicate the participation rules for any particular occurrence of an entity in the relationship. The first number in the connectivity pair identifies the minimum participation rule and the second (right) number identifies the maximum participation rule:

- 0, N - zero or many
- 0, 1 - zero or one
- 1, N - one or many
- 1, 1 - one and only one
- 2, 5 - minimum of two but up to and including five.

Attribute and Identifier

An attribute is an atomic (non-decomposable) data item that represents the relevant characteristics of an entity or relationship. An attribute may take on a single value for each occurrence of the entity or relationship it describes. Attributes are defined by a name and a domain. Attributes are identified on the data model as names within the lower portion of an entity or relationship.

An attribute or set of attributes uniquely identifies a particular occurrence of an entity. Attributes that participate in an entity identifier are shown in Figure 1, ‘‘Conceptual Data Model example.’’

Domain

A domain describes a class of elemental data items. The domain can be used to document the validation rules and valid values for data elements (in data structures) and attributes (in entities and relationships). Domains may be prepared in either Business Process or Conceptual Data Models and reused across the modeling techniques. In the models, domains are linked to data elements and attributes to constrain the values these data items will accept.

Integrity Constraint

An integrity constraint documents a management rule that cannot be expressed graphically in the model. This may be a policy, regulation or standard, or other business rule and is associated with a relationship or entity.

How to read a Conceptual Data Model

Figure 1, ‘‘Conceptual Data Model example’’ expresses these business rules:

- Each fire must be identified by a unique Fire ID.
- A Lookout is known by its unique Lookout ID.
- For a particular fire, there may not be a discovering lookout (minimum or zero). If one exists, that fire may have only one discovering lookout (maximum of one).
- A particular lookout may be the discovering lookout for may fires (maximum of N), although it may not be related to any fire (minimum of zero).

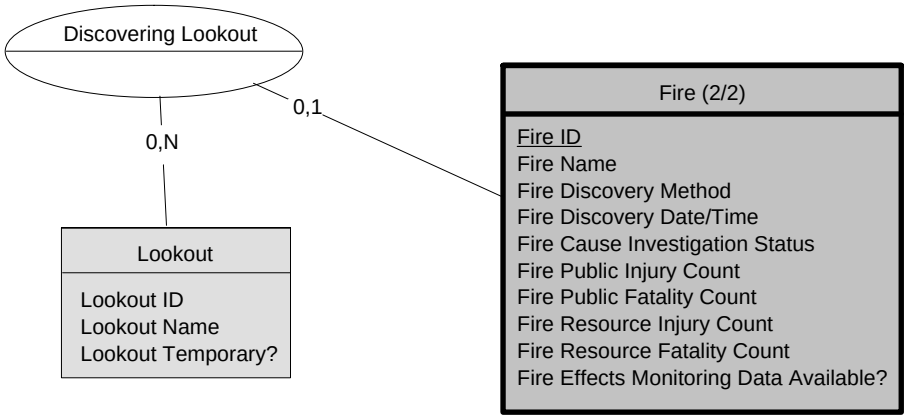


Figure 1 Conceptual Data Model example

Data Dictionary

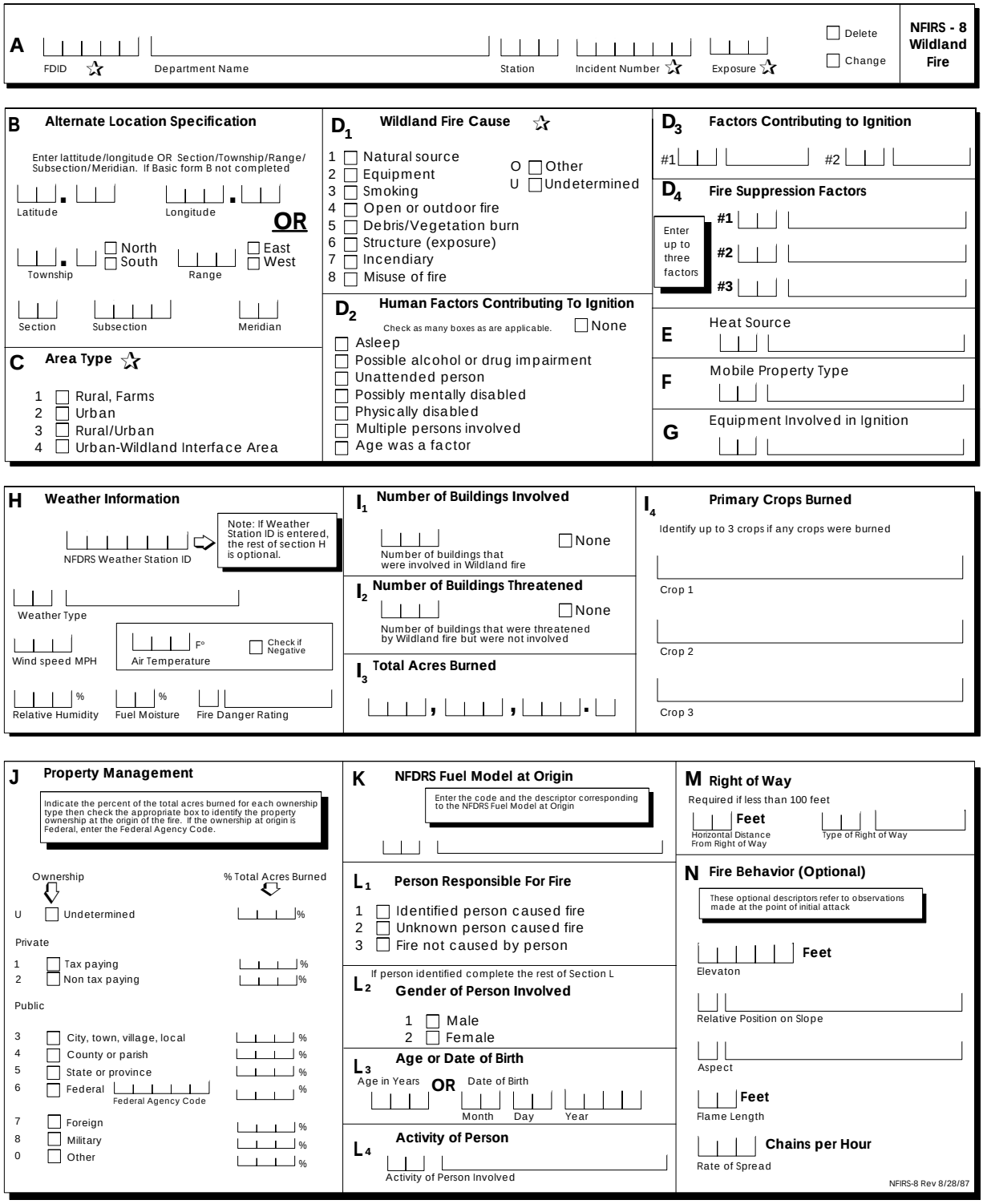
Each object in a business process or data model is documented in the dictionary (database) portion of the model. The model contents, along with other documents and deliverables are contained in the Project Dictionary. The model dictionary entries that describe data objects (data structures, data elements, entities, relationships, and attributes) are collectively considered to be the Project's Data Dictionary.

In this project, business process modeling was used to determine the primary data requirements documented as data structures within the business process model. We then moved these data structures to an entity-relationship data modeling tool to create the conceptual data model and to refine the data definitions. The final Data Dictionary, then, is the product of the conceptual data model. It is the most advanced expression of the project's data requirements.

Appendix A. Wildland fire information

- NFIRS - 8 Wildland Fire Form and Instructions
- Wildland Fire Fields.

NFIRS - 8 Wildland Fire Form and Instructions



Wildland Fire Fields

Order	Field	Block Letter	Size	Type
1	Wildland location	B		
1a	*Latitude*	B	2.2	N
1b	*Longitude*	B	3.2	N
1c	*Township*	B	2.2	N
1d	*North/South*	B	1	A/N
1e	*Range*	B	3	N
1f	*East/West*	B	1	A/N
1g	*Section*	B	2	A/N
1h	*Subsection*	B	4	A/N
1i	*Meridian*	B	2	A/N
2	Area type	C	1	A/N
3	Wildland fire cause	D1	1	A/N
4	Human factors contributing to Ignition	D2		
4a	*Asleep*	D2	1	T/F
4b	*Possible alcohol or drug impairment*	D2	1	T/F
4c	*Unattended person*	D2	1	T/F
4d	*Physically disabled*	D2	1	T/F
4e	*Mentally disabled*	D2	1	T/F
4f	*Multiple persons involved*	D2	1	T/F
4g	*Age was a factor*	D2	1	T/F
5	Factor contributing to ignition	D3	2	A/N
6	Fire suppression factor #1	D4	2	A/N
7	Fire suppression factor #1	D4	2	A/N
8	Fire suppression factor #1	D4	2	A/N
9	Heat source	E	2	A/N
10	Mobile property type	F	2	A/N
11	Equipment involved in ignition	G	2	A/N
17	NFDRS weather station ID	H	6	N
12	Weather type	H	2	A/N
13	Wind Direction	H	1	A/N
14	Wind Speed	H	3	N
15	Temperature	H	3	N
16	Relative humidity	H	3	N
18	Fuel moisture stick reading	H	2	N
19	Fire danger rating	H	1	A/N
20	Number of buildings involved	I1	3	N
21	Number of buildings threatened	I2	3	N
22	Total acres burned	I3	9.1	N
23	Primary crop burned #1	I4	15	A/N
24	Primary crop burned #2	I4	15	A/N
25	Primary crop burned #3	I4	15	A/N
26	Property owner at area of origin	J	1	A/N
27	Percent acres burned: Undetermined	J	3	N
28	Percent acres burned: Tax paying	J	3	N
28	Percent acres burned: Nontax paying	J	3	N
30	Percent acres burned: City,town,village,local	J	3	N
31	Percent acres burned: County or Parish	J	3	N

Order	Field	Block Letter	Size	Type
32	Percent acres burned: State or province	J	3	N
33	Percent acres burned: Federal	J	3	N
34	Percent acres burned: Foreign	J	3	N
35	Percent acres burned: Military	J	3	N
36	Percent acres burned: Other	J	3	N
37	Federal agency code	J	5	A/N
38	NFDRS fuel model at origin	K	2	A/N
39	Person responsible for fire	L1	1	A/N
40	Person involved gender	L2	1	A/N
41	Age of person involved	L3	3	N
42	Activity of person involved	L4	2	A/N
43	Horizontal distance from right of way	M	2	N
44	Type of right of way	M	2	A/N
45	Elevation	N	5	N
46	Relative position on slope	N	1	A/N
47	Aspect	N	1	A/N
48	Flame length	N	2	N
49	Rate of forward fire spread	N	3	N