A Geographic Database Design for Humanitarian Assistance & Disaster Response

Introduction
The international humanitarian community responds to a wide variety of crises and disasters that are challenging in their variability, scale, timelines, resources, and politics. Significant challenges exist concerning the design of a standard geographic database framework and information resources that can be delivered to a humanitarian relief effort quickly. It has been recognized that the humanitarian community is not harnessing the full potential of modern information management capacity and that major requirements such as the timeliness and updating of information and standardization have not been met.

A geographic database model, or Geodatabase, will be developed for the intended implementation by international organizations (IOs) within the humanitarian community for disaster response and recovery activities. The Geodatabase will be delivered by the host organization directly and/or indirectly through a WebGIS website that will be accessible to the humanitarian community to support field activities.

Solution Proposal
The personal geodatabase model has been selected to illustrate the utility of a relational database for storing and sharing geographic information in an efficient and intuitive manner. The Geodatabase will serve as a “proof-of-concept” application for a local department-level GIS application and can be expanded in the future using ESRI’s ArcSDE software to develop a more robust and versatile multi-department enterprise system. A future enterprise-wide system will allow the organization’s members to access and integrate the Geodatabase across several departments within a humanitarian organization. A Geodatabase can add needed analytical capacity to the information management capacity to support decision-making in emergency response and recovery operations and encourage information sharing between humanitarian assistance organizations. Additionally, the Geodatabase supports a portable information environment as recommended in emergency response situations.

Project Work Flow

Geodatabase Design Process

The geodatabase design process can be summarized in ten general steps. This process has been used to develop the Project’s Geodatabase framework through the conceptual, logical, and physical model design stages. The logical model is a specification for the database schema and is more detailed than the conceptual model. The key task in developing a logical model is to precisely define the set of objects of interest and to identify the relationships between them. The physical model is built from the logical model and is ready for implementation, prototyping, review, refinement, and deployment.

Logical Model

Physical Model

Geodatabase Schema Diagrams: Domains and Subtypes

The fundamental design and implementation of the Geodatabase utilizes the functionality of coded value domains and subtypes which more accurately ensure data consistency and improve data organization.

Geodatabase Data Dictionary

A data dictionary is the file that defines the basic organization of an aspect of the database. The data dictionary serves as a repository for information about the feature classes and raster datasets and exists in the Geodatabase as a nonspatial database table called DATA_DICTIONARY. The data dictionary will not connect any actual data from the database, only bookkeeping information for managing it.

The importance of the data dictionary is to provide access to a glossary of the predetermined emergency types that exist in the Geodatabase. It holds the definitions and valid values of which feature classes and raster datasets are assigned to what emergency type.

Data Dictionary Application

Using the WebGIS website application, a user can instantly query and activate the data layers associated with a specific emergency type of interest. This will provide greater efficiency for generating a thematic map than a traditional metadata server that usually only searches for specific attribute values, resulting in a potentially disorganized and voluminous selection. Data dictionaries allow a knowledge base to be predefined within the Geodatabase.

WebGIS Website

An ArcGIS WebGIS website will be designed for the intended use by an audience of government agencies, emergency responders, humanitarian community international organizations, and NGOs. The WebGIS website will provide remote access and analysis capabilities to the Geodatabase geographic information resources when the physical geodatabase cannot be delivered. Non-GIS users will be able to easily identify tools, data layers, and analysis processes and specific data standards of the humanitarian community.

WebGIS Website Application Examples