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CVEN689 Applications of GIS to Civil Engineering

GIS Data Basing and Modeling of Emergency Planning Information for Robertson County, Texas Emergency Services Association and Local Emergency Planning Committee

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The Emergency Services Association (ESA) and the Local Emergency Planning Committee (LEPC) of Robertson County, Texas have been formed to collect emergency data and to plan and prepare for potential natural and manmade disasters and situations that present a danger to the population. Among their duties is to locate and monitor the location, quantity, type, and use of all hazardous materials in the county; plan for natural disasters such as flood, severe weather, HAZMAT spills, terrorist actions, large scale emergencies, and fire dangers.

These efforts will be greatly aided by the spatial database ability of GIS. Through GIS the ESA and LEPC will be able to catalog and quickly create maps to locations for emergency water supplies, HAZMAT locations, preapproved MediVac helicopter landing zones, pipelines, oil and gas well locations, fire department resources, gas stations, and areas likely to be flooded during period of heavy rain such as was experienced on May 13, 2004.

In addition, numerous functions of GIS available with the basic and advanced software packages, as well as in add-ins from the EPA, will allow for modeling of hazardous chemical releases into the air and water, relocating traffic and resident from the dangers of such spills, large wildland fire behavior, flood plain modeling and planning, emergency resources planning and allocation, and planning of protocols for response into emergency situations.

INTRODUCTION

The scope of this project is to create a database of all pertinent emergency related planning and coordination data for Robertson County, Texas. Robertson County is located just north or Brazos County, and is essentially the center point for much of the state, being that it is located equidistant from Houston, Dallas, Fort Worth, and San Antonio. The emergency data in this database will include, among other things, hazardous materials storage, production, and transport facilities; oil and gas pipelines and wells; and fire department and emergency services resource locations, quantities, and capabilities.

The LEPC is a federally mandated organization charged with maintaining emergency data and making it available to the public. It is also responsible for informing the public to what actions they should take in the event of a dangerous event such as a hazardous materials spill.

The planning phase of the project will allow users to model the projected fire weather over the hot summer and input the various characteristics which determine the severity of the upcoming wildland fire season up to 7 days in advance. This advanced warning will allow fire department and county personnel to prepare by enacting burn bans, public notification of the fire danger, and requisition of additional resources from the state to combat the fires when they arise.
In addition to fire weather planning, GIS will allow users to model flood situations based on local topographic, geologic, and land use characteristics through the application of PrePro storm water modeling software.

**LITERATURE REVIEW**

Federal, State, and Local emergency associations have applied GIS databasing and modeling in the past. For instance, California and Alaska both have modeling programs to predict the potential for damaging wildland fires. This prospect is very time consuming and labor intensive as much of the local data is inaccurate or not available from online sources. The uses of this project are not new by any means, but they have yet to be implemented in the region of Robertson County. This project is simply to do for my county; where I live and participate with the ESA, LEPC, and Bremond Volunteer Fire Department; what has been done for so many other counties and regions across the U.S.

**METHODOLOGY**

The methodology of the study includes creating a geodatabase for Robertson County to include existing data (roadways, oil & gas wells, rail lines, city and county boundaries, etc.) as well as manufactured data (locations of fire hydrants, emergency fire water supplies and equipment, pipelines, load zone bridge locations, etc.). Programs such as PrePro (storm water modeling), ALOHA CAMEO from the EPA (plume modeling), and GIS shapefiles from accuweather.com professional (rainfall accumulation and fall rates) will allow us to plan for upcoming potential disasters by preparing the necessary supplies and plans; and remediating stormwater channels or facilities to reduce the amount of danger posed by their unique characteristics.

**APPLICATION**

By rastering the data accumulated by the local emergency agencies, weather data, land use data, and terrain data, we can calculate a number of factors relating to wildland fire behavior. Among the most important of these are the Keetch-Byram drought index (KBDI), Drought Index (DI), Forest Fire Danger Index (FFDI), and Wildland Fire Danger Index (WFDI).

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\text{KBDI} = [\text{yesterday’s KBDI}] + ((800 - [\text{yesterday’s KBDI}]) \times (.968 \times \exp(.0486 \times ([\text{Yesterday's Max Temp. C}] \times 9 / 5 + 32)) - 8.3) \times .001 / (1 + 10.88 \times \exp(-.0441 \times [\text{Annual rainfall mm}] / 25.4)) \times .254)
\]

\[
\text{DF} = (.191 \times ([\text{current KBDI}] + 104) \times ([\text{Days since last rain}] + 1) ^ {1.5}) / (3.52 \times ([\text{Days since last rain}] + 1) ^ {1.5} + [\text{last rainfall mm}] - 1))
\]

\[
\text{FFDI} = 2 \times \exp(-.45 + .987 \times \log(\text{DF} + .001) - .0345 \times \text{Relative Humidity} + .0338 \times \text{TEMP} + .0234 \times \text{WINDSPEED})
\]
CONCLUSION

Through the application of GIS software which is now available to the Robertson County LEPC as part of an emergency planning/response to terrorism grant from the Department of Homeland Security, we are now able to implement the aspects discussed in the above report. It is my belief that within one year, we will have compiled data to locate all hazardous materials storage locations, all new and existing oil and gas pipelines and wells, and will have made significant headway in developing a flood water mitigation program to help prevent some of the devastation that followed the flood of May 13, 2004.

REFERENCES

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