

University Campus Emergency Evacuation Plan

Problem Overview

Emergency preparedness has long been a concern for planners and people professionally involved in its pre- and post-planning and relief efforts. The ability to respond effectively after a disaster has occurred, natural or man-made, hinges whether an emergency preparedness plan exists. This plan would have protocols, logistical coordination, and contingency of effective ways to assess and mitigate the chaos that is imminent during the few hours afterwards.

Problem Statement

UC Berkeley is an internationally renowned academic institution that attracts thousands of students and faculty around the world to this picturesque campus by the bay. There are over 33,000 students and 8,000 staff and faculties on the campus¹ during the 2005-2006 year. Given this concentration of population at any given time on campus, how do you effectively evacuate this population when disasters occur? In an emergency, the University's goals are to protect life and safety, secure critical infrastructure and facilities, and resume teaching and research activities as quickly and safely as possible.

I have been tasked to develop an Emergency Evacuation Plan for the UC Berkeley campus. The project client is Tom Klatt, Manager in the Office of Emergency Preparedness, who is in charge of all emergency planning and service for the campus. Tom wants a strategic plan on how to quickly and safely evacuate the students and staff population off campus if/when a disaster takes place.

During the initial interview with Tom, he conveyed that the campus tried to evacuate the entire campus population for an emergency drill in early 2000. This trial of getting students and faculty off campus in an orderly and safe fashion proved chaotic. Some of the problems that resulted from this drill scenario showed Tom and campus officials that the vulnerabilities in the campus Emergency Preparedness Plan are in the areas of logistical, coordination, communication, and relief efforts.

To develop a thorough evacuation plan, the scope of different types of disasters that can occur on campus will be narrowed down to ones that are manageable and feasible. A plausible imminent danger that can affect the campus is a wildfire from the Oakland/Berkeley Hills or a fire caused by an explosion in one of the many laboratories on campus. This scenario played out in the early 1990s when the Oakland hills wild fire almost reached the campus borders.

¹ www.berkeley.edu

History/Literature Review

Emergency preparedness planning is an important issue that can impact people lives. If planned properly and implemented quickly, it can save hundreds or thousand of human lives and mitigate some of the economic losses in effected areas. However, if planned poorly or not implement in a timely manor, the consequence can be dire and cost human lives.

In recent years, there has been a spate of catastrophic natural- and man-induce disasters that has created havoc and economic strife to people effect by it. Armageddon scenarios, once thought implausible, are quickly unfolding in this dynamic global world. Massive tsunami waves that can wipe out several countries materialized during the late winter months in 2004-2005. This tsunami struck South East-Asia and caused catastrophic damages. The aftermaths were thousands of human lives were lost and paralyze a billion dollar economy for months; reconstruction is still undergoing currently. Several months later in 2005, a major earthquake measured 7.8 magnitude struck Kashmir, a poor providence in the country Pakistan. The official human death counts were over 87,000 and caused over \$5 billion (USD) in damages.² Here in America, Hurricane Katrina exemplifies the severe unwanted consequence of what can occur where there is lack of emergency preparedness and post-disaster planning. In August 2005, Category 5 Hurricane Katrina struck US soil and flooded several Gulf-Coast states -- Louisiana, Mississippi, Alabama, and Texas. The city of New Orleans, Louisiana experience the most severe economic and structural damages and displaced thousands of people in a predominately poor region. Katrina is responsible for \$75 billion (USD) in damages and killed 1,600 people.³ Many of the lives lost did not result from the direct hit of Katrina, but attributed to the non-existence of emergency preparedness plan. Worsening the relief efforts was the government slow and incompetent coordination of providing services – such as rescue operations, shelter, providing essential foods, and maintaining civil order – to people adversely affect by the hurricane. Hurricane survivors spent days trap on houses rooftop, pack in over crowd sport stadium, and importantly did not have access to basic necessity as clean water and food. Hundreds of people died after the hurricane past from panic, lack of water and hunger, and sanitation.

Relevant to this project are disaster scenarios where fire is involve and result from either the Oakland/Berkeley Hills or a lab explosion on campus. Since the 1920's over 5,000 structures have been lost in numerous of fire in the hills east of the San Francisco Bay. This area is prone to fire-induce disaster event because of the dry vegetation and terrain. During the fall of 1991, a wildfire scenario was evident and came in close proximity to the densely populate UC Berkeley campus when school had been in session. The October 1991, wildfire from the Oakland Hills quickly burnt everything in its path and had the risk of coming down the hill and engulfing the campus with flames, endangering the

² http://en.wikipedia.org/wiki/2005_Kashmir_earthquake

³ http://en.wikipedia.org/wiki/Hurricane_Katrina

heavily populate student and facility area. Fortunately the fire was contain in time before it had a chance to reach the campus boarders, but it did destroyed over 1,500 acres of land and 2,700 structures in Oakland and Berkeley in its aftermath. Afterwards, a study was conducted to examine integrating fire models and data inputs within a GIS to map potential firestorm risk.

The Oakland Hills fire prompted government officials to plan for fire hazard more comprehensively, and thus the California legislature passed Bates Bill (AB 337) was in 1992. This bill required the California Department of Forestry (CDF) to work with local fire authorities to map fire hazard severity zones within Local Responsibility Areas (LRAs), which usually consist of areas susceptible to wildfire hazard that are within incorporated city boundaries. The intention of creating these maps is to enforce and regulate roofing and vegetative clearance requirements, as well as serving as the basis for disclosure statements in real estate transactions under AB 1195.

The application of Geographic Information Science (GIS) tools can play a critical role in mapping and documenting areas that needs relief efforts. Emergency personnel and aid workers can use information produced in GIS to best coordinate post-disaster planning to affected areas. GIS application can be applied to fire scenarios, then subsequently predicting its course, analyzing alternative fire-fighting strategies, and directing tactics and strategies in the field.

Solution

Goal: To use cutting edge mapping and database technologies to implement a modeling system that will yield relevant information such as egress paths, circulation flow, and occupancy data to safety evacuate the campus population during a disaster scenario. This information should be convey in a communication format that is accessible to all people who wish to access it in critical times.

Data Collection: To develop a emergency evacuation plan, I will need to obtain the follow data set. Ideally this data should be rich in content and provide enough information to compile a dynamic modeling system of best access paths to evacuate the campus.

- Level of occupancies
 - Building and residents hall
 - Class schedule on periodic time intervals (i.e. every one hour during a normal school week and hours)
- Emergency egress and access routes
 - Accessible routes for people with disabilities
 - Vehicle egress
 - Capacities of pathways
 - Physical barriers

- Landscape and terrain
 - Vegetation
 - Soil composition
 - Fault lines
 - Riparian/water-shed
- Emergency Management Areas (EMA)
 - Police/fire stations
 - Personnel
 - Policy/procedures in place

Constraints: The imminent impediments to this project are both exogenous factors 1) time and 2) data resources. The onset date when the project was commission, allows for approximately 6 weeks to complete. This time frame must includes gathering necessary data sets, interviewing and meeting with campus officials to get their inputs, data aggregation and analysis, and creating a model. The second hurl is acquiring the relevant data needed to develop this model. Because Emergency preparedness planning is a new issue many agencies are beginning to face, data for such information are limited or not in existence. In addition, this model will use a multi-facet analysis that will require obtaining data from different campus departments and political jurisdictions.

Methodologies: Using knowledge learned in the classroom and technical skills, I will develop a model that seeks to meets the client needs. This will be done using tools and applications as ESRI ArcGIS/ArcINFO/ArcWorkstation, FarSight, and Microsoft Excel to execute all of the modeling and calculation in this evacuation model.

FARSITE, a stand-alone fire growth simulation model, is a good example of such a model. This software is compatible several GIS software programs (ArcInfo™, ArcView® GIS, or GRASS) and is used to simulate wildland fire growth and behavior under complex conditions of terrain, fuels, and weather.

Results

The Emergency Evacuation Plan model will be presented to the client in two scenarios a Wildfire and a Lab fire. Under each scenario, two constraints will be apply simulate how evacuating the campus population would unfold. The two constraints will be

- 1) Wildfire coming from the Oakland/Berkeley Hills.
 - a. Fire is fast approaching the campus from the East to North-East of direction.
 - b. The North and West direction is blocked by ragging flames and dense smoke plume, egress from the campus is only allow to the South.
- 2) Lab fire at one of the science buildings on campus.
 - a. A explosion occurred at lab in the center of campus, Le Conte Hall.

- b. Egress off-campus can be at all direction, but an phased evacuation plan is implemented.

While the model attempts to simulate two emergency evacuation plans, the model can be applied to most disaster events that warrant a mass evacuation of the campus population. Recognizing that when a disaster strike the campus, effective and accessible emergency information will need to be disseminate quickly. Therefore, the Emergency Evacuation Plan will be produce in varying communication formats that is accessible to all users' abilities and technical competency. This means that key evacuation plan will be in print map form, audio medium, and website. Having emergency plan in different format also allow data to be access in different situations where telecommunication is not available.

Conclusion

The final Emergency Evacuation Plan will serve as a tool and resource for UC Berkeley's Office of Emergency Preparedness to use during situations that required the mass exodus of the campus population. The model will yield best egress path and procedures with the information and parameters that is inputed.

Ideally, the Emergency Evacuation Plan can be incorporated into other campus emergency preparedness policy. Cornell University and other major universities currently model their emergency plan after UC Berkeley⁴.

⁴ <http://web.cornell.edu/Emergency/CEP.Public/>

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