IPRO 317
Spring 2008
Design & Build Chicago Scale Model for Dynamic Disaster Simulation

General Information:

The objective of this project is to design and construct a 3-D, reduced scale model for a portion of downtown Chicago. The model will be primarily used to test and simulate the likely performance of fire defense strategies in case of fire or other catastrophes related to public health.

The problem includes design and building of the Chicago City scale model. The basic concept for the model is a modular, acrylic structure sitting atop a rigid base with opaque sides. The components of the model will be base, streets, city blocks, and buildings. The highlight of the model will be lighted by a projector with the use of mirrors and lenses built into the base structure, which will illuminate the various acrylic features of the model based on input from a computer interface.

Description:

Base:
The base of the model is to be constructed of durable wood or aluminum. The base should be entirely opaque at the sides and bottom, so that light from within does not suffer interference or leakage, which would undermine the presentation quality of the model.

Street System:
The street system will form the primary organizing and spatial system of the model. As downtown Chicago is a relatively stable and highly built environment, it is not foreseen that any substantial changes to the roadway system will occur during the lifetime of the model. Roads and alleys thus will be affixed permanently, and will give order and rigidity to the other elements.

City Blocks:
The city blocks within the model scope are to be built to fit within the street and alley system affixed to the model base. The blocks will be constructed of double-thick, clear acrylic. The bottom layer will be uncut, providing a stable base. The top layer will be identical, but will have cutouts to accept the model buildings that are to be placed on the model. These cut-outs will stabilize the buildings and will prevent buildings from shifting when the model is in use.

Buildings:
Individual buildings will be constructed of acrylic. The acrylic is to be laser-cut, and joined together at edges with typical means. Care should be taken to not mar the surface of the acrylic with adhesives, as the model buildings will remain unpainted.

When Disaster Strikes:

How will I know there's an emergency?

There are 112 sirens, located one to two miles apart, in Chicago's Emergency Warning System. These can be activated individually, by zone, or citywide. **A three-minute rising and falling tone** indicates a major disaster or emergency; the all-clear signal is one continuous blast.

How long would it take to evacuate downtown?

Two to three hours to evacuate the downtown Chicago area. That would mean transporting some 600,000 workers and 31,000 residents, not to mention an untold number of visitors, on an average weekday out of the city's center.

Where would people go?

City hall has reportedly negotiated "disaster agreements" with the CTA, park district, and Chicago Public Schools, preemptively identifying dozens of designated mass-care facilities. The city won't specify exact locations now but concedes that high-capacity facilities like **McCormick Place** and the **United Center** would likely be used.

How would all those cars get out of the city?

The city's highway system can handle about 40,000 cars an hour. In addition, the city will install up to 80 manually operated, **crash resistant barriers** over the next few years. Designed to seal off inbound interstate lanes, the barriers could keep lanes free for rescue personnel, or open up lanes to outbound traffic in an evacuation.

All of these statistics are taken from March 2007 Chicago Magazine under "When Disaster Strikes"- http://www.chicagomag.com/Chicago-Magazine/March-2007/When-Disaster-Strikes/

YOU SHOULD KNOW:

In case of a major evacuation or disaster, the city would activate its emergency information line, **877-745-INFO**, for event-specific information such as road closures and areas to be evacuated (you can also call **311**, the city's non-emergency line). Visit www.alertchicago.com for comprehensive information on emergency preparedness in Chicago-and sign up for the city's 911 call-back system, which can be used to deliver 30-second recorded messages and is capable of making 1,000 calls a minute.

Quick Facts:

60 % of downtown workers use **public transportation** to commute.
3,000 people took part in Chicago's voluntary mass **evacuation drill** last September. Chicago was the first major U.S. city to stage such an event.
$4 million-Construction cost of the **City Incident Center**, one of two places under the city's "Operation Virtual Shield" program, which lets officials monitor emergency situations in real time through a network of cameras. Chicago's chief emergency officer, **Cortez Trotter**, would coordinate the 30 or so various agencies that could be involved in a disaster response.

Architectural Process

Defined scales, so that the selected downtown area would fit within a reasonable-sized model that is portable.

Checked tolerances of materials on various equipment such as: laser cutters and CNC milling machines

Methodology/ Brainstorm/ Work Breakdown Structure

To effectively work on the model, different teams were designated to perform different tasks regarding the various aspects of the model.

Scenario: Team will explore the disaster scenarios and inquire with proper city departments on determining safety procedures.

Model Team: Team will define the physical characteristics regarding
scale, sizes, orientation, and various material choices and costs. This team will also be heavily involved with the actual construction of the model.

Equipment Team: Team will develop scheme to properly portray computer simulated disaster scenarios using the project lights on the base of the model.

Scenario Information:

For this particular arrangement, only the fire scenario in 3 different levels of severity will be depicted.

For future prospects the following scenarios will be simulated:

Attack on Water Facilities: The primary water facilities for Chicago and many suburbs lie within the model area.

Bomb: These devices would likely be triggered downtown, possibly near mass transit. Various targets such as those with high tourism draw or iconic level of various strengths

Fire: The spread of flame and / or smoke. Localized and un- localized of various causes and levels of Intensity

Large-scale Evacuations: Time-varying analysis of evacuation strategies and potential conflicts.

Utilities: Many critical power utilities are within the downtown area.