

## Directional Sound Evacuation in buildings



Complex routing was tested in a deserted school building. A complex route was devised which would test the directional sound evacuation beacons to their fullest, including many directional decision making points and also staircases (Figure 1). Subjects in these trials included sighted, visually impaired individuals and children. Having completely filled the school with artificial smoke, each subject was taken to a starting point on a first floor location. They were taken to the start point via an external emergency escape staircase. By doing this the subjects had absolutely no idea of the route they were about to go through. In addition, they had no prior knowledge of the sound of the evacuation beacons. Once ready all beacons and the building's fire alarm were activated and each subject, or group of subjects, entered into the smoke. Essentially, the whole route was marked by only 4 beacons placed at strategic points (mainly above fire doors) on the way. At one point on the route, there was a small flight of stairs which led upwards to a mid-level in the building, and a beacon was designed that, as well as having rapidly pulsing broadband noise, also included an upwardly sweeping "melodic" complex which denoted to the subject "go up the stairs". At another point en route, there was the main staircase that descended to the final intended exit. Similar to the "up sweep", a "down sweep" was designed into this beacon giving the impression of "going down the stairs". As beacons progressed from the starting point of the experiment to the final exit, their pulse rate increased. This concept relies on human intuition with regards to faster events signalling nearing a final goal; the same concept that is used on rumble strips when approaching a roundabout.

Once again, the effectiveness of the beacons was unquestionable. None of the subjects in any of the trials took a wrong turning or ended up in any room that they were not supposed to enter. All subjects reported that the implementation of the melodic complexes denoting "up" or "down" information, informed them not only of the presence of a staircase but also of the intended direction of travel. As previously mentioned, they were not briefed as to the meaning of such tonal sweeps but intuitively understood the "associative meaning" within the sound. Finally, evacuation times were reduced close to the travel times that would have been expected under ideal visual conditions with prior knowledge of the building. Indeed, it was interesting to note subjects' responses when the building was eventually cleared of smoke and they were asked to progress through it once again. Without the aid of the evacuation beacons and with full visibility, several subjects got lost en route. Even though they had been through it only a few minutes earlier.

From these studies, it is clear that the directional sound evacuation beacons proved themselves to be a crucial aid for all users under such visually impaired conditions. By providing directional information the beacons remove the need for having prior experience

with the environment, reducing hesitancy and totally eliminating way-finding errors. Overall evacuation time was reduced substantially (by more than two thirds in many cases).

Figure 1:

