

## THE NEED FOR AN EVIDENCE-BASIS FOR EARTHQUAKE SURVIVAL TIPS

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If you took the time to read Douglas Copp's "Earthquake Tips" advice and you thought it might have some merit, or if you passed it on to anyone else, please read this and pass this back up or down the lines. If you haven't, and just want a few good tips for earthquake safety you can skip all the way to #5 and #6.

### **#1 THE MYTH OF ANTICIPATING THE "TRIANGLE OF LIFE"**

If Douglas Copp has gotten your attention about earthquake safety, I'd like to address some of the claims he makes that may have piqued your curiosity - because it's always good to hone our ability to think critically - and there are things you can and should do to be safer from earthquakes.

Yes, it is correct that there are places that after a building collapse are called "triangles of life". These "life safe voids" are the first places that search and rescue workers look for survivors. It's generally true that the larger the object and stronger the less it will compact. But don't be fooled. The force of earthquakes moves large and heavy objects. We don't know a) whether it is possible to anticipate where the life safe voids will be before the collapse, and b) whether it is possible to get there during the strong shaking of an earthquake. What we don't know in advance (but is worthy of research) is the expected collapse patterns in particular buildings or where these life safe voids will be when the shaking stops. If your building tilts in one direction, the "large and heavy object" that you are near, could crush you against the wall....

Douglas Copp maintains that "People inside of their vehicles are crushed when the road above falls in an earthquake and crushes their vehicles" and that in the Loma Prieta earthquake everyone killed would have survived if they had been able to get out of their cars and sit or lie next to them, because of the life-safe void nearby. This assertion is completely unscientific. Observing a crushed car with a life safe void next to it doesn't mean much. The car itself may have moved after the shaking started. There is a lot of evidence of cars and truck overturning in strong shaking. If everyone got out of their cars and got down next to them, a lot of people would be dead or seriously injured from the weight of the car jumping or sliding on top of them.

The evidence used for some of these tips are the so-called Turkish "experiment" that Douglas Copp says he was involved with. Unfortunately, unbeknownst to the others involved, this was not an experiment at all, but rather a voluntary organization's search and rescue exercise. My colleagues in Turkey corroborate that a building scheduled for demolition was used as a search and rescue training opportunity. They did decide to put the mannequins in different spots to see what would happen. And indeed they reported finding mannequins unharmed next to large and heavy objects.

What is the problem with this? Simply this: To collapse the building, they rammed the columns, causing the building to pancake. They did NOT simulate an earthquake. Earthquakes come in waves. They cause lateral shaking. They cause a variety of different kinds of damage. Since this experiment didn't produce anything resembling shaking it really doesn't tell us anything at all about

what would happen during an earthquake. It could be that the large and heavy furniture would end up at the other end of the room, nowhere near where it began. Assuming even for a moment that an experiment could be done to support the hypothesis, the reality is that the particular results from a pancake collapse, while certainly the most fatal, represents the least common type of reinforced concrete building collapse. There are at least 4 other major types of collapse. Less than 3% of damaged buildings in the 1999 Kocaeli, Turkey earthquake were pancaked. So these results would tell us precious little about what might happen to people in all the other buildings... the other 97% of damaged buildings as well as the many undamaged buildings. Formulating the questions in order to advise EVERYONE about what to do when the shaking starts is much more complex than the evidence in front of one individual rescue worker's eyes.

## **#2. The "IF I CAN SAVE ONE LIFE" FALLACY.**

Search and rescue workers desperately want to save lives. In reality, worldwide their experience is of bringing out at least 98 dead bodies to 2 live ones. Some would like to turn the one life they saved into a cautionary anecdote for the other millions of people who were potential victims. There is a place for these stories, but extrapolating to the millions is not scientific. It really doesn't matter if one or if ten people are found alive next to a refrigerator, unless you look at 100 or 1,000 refrigerators after an earthquake to see what might have happened to people who might have been near them at the time of the shaking. When you give advice to people about what to do during an earthquake, you are basically advising everyone who feels the shaking.

In Kocaeli we would have loved to be able to advise the 20,000 who died so that even a few lives could be saved. But remember that in order to save any of them, we would have to advise all 15,000,000 people who felt the shaking and were in a position to take some action. Suppose that our advice could save 1,000 people from death in pancaked buildings (highly unlikely) but if it also put .00007 percent of all the people who felt the shaking at risk of death and serious injury we would have done more harm than good. In other words, the behavior that may save someone in a particular collapsed building may put more people at more risk in other buildings.

When I show Californians pictures from Turkish publications with people crouched down next to refrigerators and kitchen counters, instead of under the nearby kitchen table, their jaws drop in horror. Obviously these people are in danger from the refrigerator sliding and toppling and emptying its contents, the hot things on the stove, the appliances on the counter and the packed contents of the cabinets overhead. Obviously they should be under the kitchen table, or outside the kitchen door. But this is exactly the lunacy that these kinds of "I found one person alive here" anecdotes can lead to. Some people in Turkey will die in the next earthquake because of this.

Please note that only a few lives have *ever* been saved by taking other actions (running out, jumping out of windows). Most people who will be killed by their buildings will never have a chance to do anything at all. *The only solution to unsafe buildings is not to build them and not to occupy them. Retrofit those that can be made safe and tear down the rest.*

Having said that, most of my scientific colleagues and I have come to the uneasy compromise that IF people are occupying a self-built adobe structure with a heavy roof, and with no seismic-resistant design measures, and if they are on the ground floor and can run out quickly to a safe and open place outside, they should do so when the shaking begins. Otherwise, they should still drop, cover and hold on. Adobe collapses are much more survivable when the roofing is of lightweight material.

But the reality is that protection from earthquake deaths takes place way before the shaking begins. It will take a lot of well-designed research to learn if there is, in fact, ANY behavior that is better than luck in saving someone from a building collapse, and that can be guaranteed not to endanger more people than it helps! As with other helping efforts: "First, do no harm."

### **#3. OUTRAGEOUS ERRORS**

Douglas Copp makes lots of outrageous claims for which there is no research, like "Everyone who simply "ducks and covers" WHEN BUILDINGS COLLAPSE is crushed to death -- Every time, without exception." "Everybody who gets under a doorway when buildings collapse is killed." At best these are extreme statements that are hypotheses to be tested. It would be great for search and rescue workers and social science researchers to get together to investigate hypotheses like these.

He also says "Get Near the Outer Walls Of Buildings Or Outside Of Them If Possible...because of the greater the probability that your escape route will be blocked." There is no evidence of this. A contrary hypothesis suggests that especially in concrete building with infill tile walls, the tiles fall out and so could you. This is also a good subject for research, but at present it's nothing more than an untested hypothesis.

Please understand that even the best scientific methods don't always provide perfect or even helpful results. Nevertheless, scientific methods should be used to investigate our hunches. There are many important questions that we haven't begun to answer - but absolute claims like this are just total rubbish and no substitute.

### **#4. HALF TRUTHS**

Douglas Copp's Earthquake Tips recommends the "fetal position" in order to "survive in a smaller void". The idea of being small is fine. Getting down low prevents falling injuries, and making yourself a smaller target means there is less to be hit. However, when we tried this informally in Turkey on an earthquake simulation shake table, the "curled up in a ball" fetal position made us prone to rolling around. This didn't actually feel safe to us. What felt much safer was to get down as low as possible on our knees and shins so that we had some control over our movements and could still crawl to a more secure place.

Indications from research in Kocaeli is that the advice to get down "next to a sofa, next to a large bulky object that will compress slightly but leave a void next to it." is supported by a random sample of survivors in the most hard-hit areas. Many Kocaeli survivors would agree that this would have been both possible and safe in that earthquake. This is a good hypothesis that should be further investigated.

Also correct is the statement that "Wooden buildings are the safest type of construction to be in during an earthquake." They're also the worst in case of fire after an earthquake. So while those in wooden homes can take some comfort, be prepared to put out fires when they are still small with fire extinguishers and blankets.

However another piece of advice "If you are in bed during the night and an earthquake occurs, simply roll off the bed." is contradicted by scientific research findings. Actually, the safest people in earthquakes in both California and Turkey were those who stayed in bed. (Shoaf et. al, 2000. Petal

2004). If the building tilts and the bed moves, the foot of the bed may not be the best place to be.

Some observations may be accurate but the solutions highly impractical. For example, the discovery "while crawling inside of collapsed newspaper offices and other offices with a lot of paper, that paper does not compact." Sure, large voids are found surrounding stacks of paper. This might be good information for the grocery store, but only if the shelves are bolted to the floor or ceiling. Frankly if you live in a building that you think is a collapse risk, ethically the only good advice is to suggest that you find another place to live, rather than to rely on a pile of paper or a container of books in every room to save your life. This may seem pathetic, but at least 3 different publications in Turkey have photos of people crouching down next to enormous containers of paper products in the middle of their living rooms. Let's get real - our job is to live with earthquakes. This kind of advice makes the tasks of public education and preparedness harder than it already is.

The advice: "Never go to the stairs." is good.

### **#5. SO WHAT SHOULD YOU DO? AND WHY DO WE TEACH “DROP, COVER, AND HOLD ON”?**

- Think through personal scenarios in the places you live and work. What spots seem safer than others?
- Make your environment safer by fastening tall and heavy furniture and audiovisual equipment,
- Move heavy objects down low.
- Keep shoes and flashlight in a plastic bag tied to the end of your bed
- During the shaking, drop down to the ground. Cover your head and neck. Hold on to your cover or something stable. In other words, “DROP, COVER and HOLD ON”.
- After the shaking stops, look around for anyone injured. Spend 2 seconds to survey the damage and exit the building carefully. DO NOT stay anywhere near a seriously damaged building or even garden wall – it may collapse in an aftershock.

Why do we persist in saying these things? What is the proof? Research into the causes of deaths and injuries in several countries has now shown several important patterns: a) Fatalities are almost always associated with head, neck and chest injuries. These are the most vulnerable areas of the body that need to be protected. b) Many injuries are caused by falling. If you get down yourself, or brace yourself, you can avoid falling. c) A huge proportion of night time injuries are to feet and legs... even in places with minor damage.... picture frame on floor, no shoes, no lights, parents/children trying to find each other in the dark.... d) At least half of all injuries are from non-structural objects. Many of these injuries are serious, made more so by the intense demand on limited medical resources. We can't be complacent about any unnecessary injuries when limited medical resources will be needed to save lives. e) The smaller target you present to falling objects the less chance there is of something hitting you.

### **#6. AND NOW THAT YOU'RE THINKING ABOUT IT...**

Urban earthquake mitigation requires all of us to be involved in three major activities: assessment and planning, reducing our physical risks, and developing our ability to respond.

#### **ASSESS & PLAN**

(Think and act now.)

- Sit down with your family and discuss possible scenarios.
- Decide on meeting places inside and outside of your neighbourhood.
- Identify an "out-of-area contact" for quicker communication and peace of mind.
- Designate others nearby to pick up your child from school in case of emergency, and make a meeting plan with them.

### **PROTECT YOURSELF PHYSICALLY**

(Take measures to reduce your physical risks.)

- If you aren't sure about the structural soundness of you home, workplace or school, have it assessed by a qualified engineer.
- Retrofit where possible. Move out, and tear down where not possible.
- Fasten large and heavy furniture.
- Secure water heaters.
- Have a fire extinguisher on each floor and have it serviced regularly.

### **DEVELOP YOUR ABILITY TO RESPOND**

(Be ready to be part of the solution.)

- Have enough water, food, and prescription medications for a week.
- Keep a first aid kit.
- Check your "Go Bag" in your car and by your door.
- Learn first aid, fire suppression, wireless communication skills, and organizational skills for disaster response.

Disaster preparedness is not accomplished overnight. It takes place in a series of small steps taken at home, at work, at school, in your neighborhood and in your region. It is accomplished by actions by individuals, families, organizations, institutions, and government.

Reflecting on the most recent tragic earthquake, and the grief felt by survivors should lead us all to wonder what we can do to avoid such needless destruction. This is a good time to make yourself a promise, and take one of these small steps today.

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