

In Search of Stability



AN INTERVIEW WITH **JON TUNG**,
STRUCTURAL ENGINEER WITH
KEAST AND HOOD ENGINEERS

LEFT MASON FOREMAN JOE ALONSO AND
ENGINEER JON TUNG INSPECT THE DAMAGE
PHOTO J. STRUHLREHER

RIGHT CREWS FROM UBS INSTALLING
THE MASSIVE SCAFFOLDING AROUND THE
CENTRAL TOWER PINNACLES
PHOTO C. STAPERT

CA WHAT DO YOU SEE IN THE DAMAGE AS AN ENGINEER?

TUNG For decades and decades, including when this building was originally constructed, no one took seismic concerns into consideration. And like a lot of older historic buildings here—such as the Washington Monument and the memorials—the building’s an unreinforced masonry structure, which means that its mass holds it in place. This works great in compression. But when you deal with seismic considerations, it doesn’t: buildings with greater mass move more during seismic events. As the building moves and deforms, the weak spot becomes the pinnacles, which are at the top. From what we’ve seen, the Cathedral behaved fairly well in the earthquake. It’s just that a lot of the finials ended up getting dislodged and cracked mainly because of the amount of horizontal movement induced by the earthquake.

CA HOW DO YOU SECURE THE STONE ON TOP OF THE CENTRAL TOWER?

TUNG The intermediate finials were initially tied

back with stainless steel cables as a temporary measure to keep them stable. Now the concept is to add steel beams on all sides of the central tower and to cantilever these steel beams out beyond the edge of the roof. We can then build a scaffold system around all the central tower grand pinnacles, and that scaffold system would stabilize them. It would also provide access for the masons so they would be able to take apart the smaller pinnacles and put them back together.

CA THE BUTTRESSES EXHIBIT SPALLING, CRACKING, AND LOOSE STONES—HOW DANGEROUS IS THIS?

TUNG The buttresses act as lateral bracing for the building. As wind pushes against the building in one direction, the buttresses help resist that force. Wind that pushes against the west face will translate the load all the way to the east—where there is cracked and missing stone in the flying buttresses—putting the buttress into compression. As long as that stays constant, those loose stones and cracks shouldn’t present a problem. The biggest worry would be another seismic event of similar magnitude.

CA CAN THE CATHEDRAL BE "EARTHQUAKE PROOFED?"

TUNG That is a tough question. There are ways to earthquake-proof unreinforced masonry buildings, but people usually don't like the solutions (to add reinforcing to many walls). As for the pinnacles, we still have to get to them and take them apart to figure out how to put them back together. Our hope is to reinstall them with more dowels and connectors to hold the individual stone pieces together more securely—and have no one the wiser that there's reinforcement in there that keeps them stable. We want it all to look exactly the same as it did before the earthquake.

CA HOW DOES THE TIMELINE LOOK?

TUNG It's primarily focused on stabilizing the components that could pose a fall hazard. Right now the focus is the central tower, because one of the goals is to open the Cathedral to the public. We'll have folks rappel off the west towers—a rope survey like at the Washington Monument—and go over every inch of the building making sure that there are no loose stones that would pose a danger to the public as potential overhead hazards.

Addressing the pinnacles along the buttresses on the north, south, and east sides of the building is obviously going to take longer because of access issues. There's a security barrier completely surrounding the Cathedral now, which will stay in place during work to prevent the worst-case scenario: if a stone falls, we want to make sure that no one is injured. We'll continue to restrict public access to the outside of the building on the north, south, and east sides until we can access those finials and either temporarily remove them or stabilize them in place.

CA HOW LONG MIGHT THE SCAFFOLDING REMAIN?

TUNG It's being designed to stay in place for an extended period of time if necessary. I think a lot of what's going to dictate how long is going to be available funding to do the actual repairs. Each individual piece of stone is unique and hand carved, and there are a fair amount of pieces that simply have to be replicated.

It's going to be a time-consuming process: Joe Alonso has said that for the west towers, they generally fabricated stones two to three years prior to erecting them. I hope we can do a little better than that, but I think a lot of is going to be funding-driven. It's going to be a costly effort to do all these repairs for the central tower alone. We'll also have to address each buttress.

CA WHAT IS THE BIGGEST CHALLENGE?

TUNG Access is the hardest thing about this project. There's a gargoyle head hanging off a small copper pipe

that we physically can't get to. We know it's there, but we just can't physically access it. We've seen issues like that all around the building, and that's a big reason why we plan on keeping the security barrier up. We need a clear space around the majority of the building, and we need to provide overhead protection (through our netting and cover walkways) in case a piece of stone ever falls.

