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SHAKEN BUT STILL STANDING

Washington's Legislative Building—Survivor of Three Major Earthquakes

By Heather Lockman

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On the morning of February 28, 2001, beneath the soaring dome of Washington's Legislative Building, four state capitol tour guides were squiring 100 fourth-graders through the elegant precincts of the State Reception Room. At 10:54, for some reason, Susan Chickering paused for a moment before going on with her tour. "That's when the grinding started," she says. "It sounded like a freight train rumbling under the floor."

Chuck Waiste, tour supervisor, was greeting groups at the north portico when he heard what he thought was construction noise in the parking garage below. Then, as the ground began rolling, the massive bronze door behind him flew open and tossed him out of the building onto the granite front steps.

Sandy DeShaw, visitor services manager for the capitol campus, was attending a meeting across the street when the earth started to move. "All I could think when the shaking stopped was, 'Please, let that dome still be standing. Those are my friends in there.'" DeShaw ran as fast as she could back to the Legislative Building, fearing the worst. Instead she found capitol tour guides calmly vacating the premises with school groups and seniors in tow. Not only was the fabulous dome of Washington's statehouse still standing, everyone inside the building had escaped without serious harm.

The Nisqually earthquake of 2001, a 6.8 magnitude temblor centered deep under Anderson Island, was the Puget Sound region's biggest quake in more than 50 years. Though only one death—a heart attack—was directly linked to the earthquake, more than 400 people were hurt in the Northwest's first major seismic event of the 21st century. Buildings and roadways crumbled throughout western Washington, especially older structures constructed under less-stringent building codes.

The city of Olympia, 17 miles from the epicenter, was hit particularly hard. Parapets fell from historic storefront façades onto streets and sidewalks; bits of the old Fourth Avenue Bridge sloughed off into Budd Inlet. In the South Capitol neighborhood, a National Register historic district behind the capitol campus, chimney bricks danced off the rooftops of more than 200 homes. But it was the Legislative Building, perched at the edge of the bluff above town, that worried the public most. "People all across the state feel very attached to that building," says Patricia McLain, a project director with the state's Department of General Administration. "Even legislators from eastern Washington were swamped with calls from constituents asking if it was okay."

In a stroke of great good fortune, the state was already planning a full-scale rehabilitation of the historic Legislative Building when the Nisqually earthquake hit. As part of that project, a team of

experts—architects, planners, and engineers—had just spent six months documenting every inch of the building. Within hours of the earthquake those experts were back, combing through the structure again to find out how it had fared.

"If we had to have an earthquake," says Andy Stepelton, a senior property manager with the Department of General Administration, "the timing couldn't have been better."

Amid the dust and debris the team found smashed plaster, cracked marble, wrenched columns, and loosened blocks of exterior sandstone that threatened to crash to the ground. But there was no damage where it counted most—in the primary structural elements that hold up the walls, roof, and dome. Although the repairs would be challenging, everything could be fixed.

Structural engineer Michael Wright, a principal with the firm Swenson Say Faget who has worked on the consulting team since 1998, commented:

Lots of people have said that the building came through remarkably well. But using the word 'remarkably' implies that we're somehow surprised. It suffered significantly less damage this time, compared to previous earthquakes, because of a very good basic design and because of three major seismic upgrades done to it over the years.

When the plan to build a state capitol was first discussed (and then postponed) in the early 1890s, the subject of seismic safety never even came up. There had, of course, been earthquakes in the Olympia area. Indian peoples all along the Northwest Coast told of an ancient battle between Whale and Thunderbird that made the very earth tremble and sucked up the waves of the sea. Hudson's Bay Company workers were shaken in 1833 by an earthquake at Fort Nisqually, a dozen miles up Puget Sound from where the capitol stands today. But most early Washington citizens were recent arrivals from other places with no firsthand experience of a major regional quake.

On December 14, 1872, a series of earthquakes and aftershocks jolted Olympia. "No damage has been done in this vicinity," wrote newspaper editor John Miller Murphy in the *Washington Standard*, "the bank and county jail—the only brick buildings—not showing a crack, and not even a chimney has been overthrown." Not quite a decade later, on the last night of April 1882, Olympia rocked again. "Half-clad women and crying children poured forth in the streets like bees from a great hive," Murphy reported this time. A few chimneys tumbled, but that was all. Earthquakes made good newspaper copy but seemed to do little real damage in a largely timber-built town.

By 1911, when the state of Washington revived the idea of building a new capitol, one major West Coast city had already suffered terrible losses in a colossal quake. But the 1906 earthquake in San Francisco seemed distant and irrelevant to residents of the Northwest. The centerpiece of the winning design for a "capitol group of buildings," submitted by New York architects Walter R. Wilder and Harry K. White, was a monumental domed structure of clay brick, marble and stone. No one seems to have given much thought to how this huge pile of masonry, completed in 1928, would ride out a seismic event. As late as the mid 1920s Professor Collier Cobb, a well-known East Coast geologist, assured the Seattle Chamber of Commerce that deep glacial drift gave Seattle a natural "shock absorber which makes the city immune from disaster from quakes."

In the late morning on April 13, 1949, the strongest earthquake in Washington's brief recorded history—measured by seismologists at magnitude 7.1—rumbled like thunder beneath the

Nisqually Delta, northeast of Olympia, causing the deaths of eight people and injuring 65 others across western Washington. From his office on the capitol campus, Harold D. Van Eaton, the state's director of public institutions, saw chunks of stone raining down from the nearby Insurance Building and thought for a moment that he was seeing "the last days of Pompeii. Then I looked over at the capitol and saw the keystones of the cupola falling out," he later told a reporter, "and thought [it was] the Day of Judgement."

Two other eyewitnesses outside the Legislative Building claimed that the birdcage-shaped lantern on top of the neoclassical dome bounced so violently during the quake that they could see daylight beneath it. What they couldn't see inside were seven terrified Cub Scouts and their chaperone, Nancy Flynn, hanging on through the ride of their lives.

"I actually saw one of the columns break loose at the base and swing out into space," Flynn remembered later. "Why it didn't fall out, I'll never know." When the shaking stopped she rushed the boys into a dust-choked stairwell and down to the colonnade level, high above the rotunda, where loosened plaster was popping and crashing down to the floor far below. The elevator was useless because the power was out. Unable to make themselves heard in the chaos, the Cub Scouts wrote desperate messages—using Nancy Flynn's lipstick—and tossed them over the railing into the yawning rotunda. Within half an hour rescuers showed up with candles to usher them down.

Damage to the Legislative Building appeared at first to be minor, especially compared to other state offices in Olympia. But within a few days inspectors found that the 180-ton lantern on top was teetering dangerously. Held in place solely by gravity, without any structural ties to the dome, its bricks and stone had been wracked out of line when the earthquake whipped it around. It would have to be taken down, gingerly, to keep it from toppling over.

"The state capitol dome is being scalped," reported the local newspaper one month after the quake, "and whether or not it will ever get a new cap remains a matter of much off-the-record controversy." One camp favored rebuilding a lighter, less vulnerable lantern that looked as much as possible like the original. The other side balked at the public cost and thought a stout railing would do. A handwritten postcard from one taxpayer, still tucked in the files of the State Archives, blasted Governor Arthur B. Langlie for two pricey projects at once.

"Why isn't \$135,000 for a capitol cupola another waste of tax money," grumbled William R. Colby, Jr., "as is the \$845,200 for the dead-end UW approach?" Despite Colby's objections, both the repairs to the capitol and the construction of Campus Parkway, the boulevard at the western edge of the University of Washington campus, proceeded that year as planned.

In the end, the cost of replacing the lantern (not counting demolition) ran close to \$155,000. First a new steel skeleton was erected on top of the building and bolted to an existing steel structure within the masonry dome. Then the salvaged blocks of stone were hollowed out and reassembled, piece by numbered piece, around the new steel frame. In the biggest visible change to the original design, the cupola's stone roof and finial were replaced with a similar cap and ball made of a lightweight nickel alloy. By early November, when the project was finished, the elegant lantern on top of the dome had shed about 70 tons.

When another major earthquake struck the Puget Sound region on April 29, 1965—killing five people and registering magnitude 6.5—the reconstructed lantern came through the quake "beautifully." But this time there was bad news regarding the cylindrical structure below. The series of walls and buttresses that actually shoulder the weight of the dome had cracked and

shifted noticeably, while exterior sandstone had pulled away from the brick framework underneath. Until the dome supports could be strengthened, engineers recommended limited use of the house and senate chambers and no public access at all to the central rotunda. The playing of organ music, a tradition in the rotunda, was stopped for fear that the booming chords would shake things up even more.

"They probably came very close to losing this part of the structure in 1965," notes Michael Wright. "According to the guys who worked on it then, there were cracks in the walls of the colonnade that you put your arm through."

Though the eye is fooled into thinking that it is a single grand dome, the crown of the Legislative Building is actually three domes in one. The outer dome is the great stone shell, perched on Corinthian columns, that rules the Olympia skyline. The inner dome is the one that visitors see from within the rotunda, its soaring brick ceiling and sturdy steel pillars concealed behind plaster and paint. In the hollow space between the two domes stands a conical "third dome" of structural steel built to support the decorative lantern on top. Similarly disguised from view, encircling the round tower below is a set of massive brick buttresses that helps hold the whole thing up. It was here that extensive damage was found after the 1965 quake—compounded, almost certainly, by damage that had not been dealt with in 1949.

The solution this time was to stiffen the drum and colonnade of the dome with a thick coat of sprayed-on concrete applied to the inner walls. An interior collar of "shotcrete," 60 feet high and about a foot thick, added real strength and stability to the sixth and seventh-floor levels. Unfortunately, some key design features were sacrificed in the process. Fourteen of the 22 windows that circled the colonnade were blocked up with concrete panels; 32 decorative columns were lost to make room for the fortified wall. But in terms of seismic protection, the scheme was a clear success.

"That concrete wall is the principal reason that we didn't have more damage to the structure in 2001," says Wright. An attempt to secure the exterior sandstone by pinning it from the inside, though not completely effective, also helped hold things together when the earth shook again.

By the early 1970s, seismic research was making great strides. The San Fernando earthquake, which rocked southern California in 1971, marked the first time that the actual performance of buildings during a major earthquake was measured and evaluated in a significant way. The data confirmed what Nancy Flynn and her Cub Scouts already knew: earthquake motion accelerates in the upper floors of a building. When a structure is hit by an earthquake, the top of the building moves around more than the part down near the ground. If the building is made out of flexible steel, it can sway back and forth without breaking. If it's made out of clay brick and mortar, it cracks and shifts under the stress.

Identical in magnitude to the quake the Northwest had just weathered—but wreaking far more destruction and causing 65 deaths—the San Fernando earthquake caught the attention of Washington's lawmakers. In 1972, just six years after funding substantial seismic repairs, legislators ordered a full structural review of the Legislative Building to determine how it was likely to fare in future serious quakes.

The resulting report praised the structure's historic seismic performance but warned that earthquake damage tends to be cumulative. Unreinforced masonry walls (commonly used in the 1920s but no longer permitted in new construction under the Uniform Building Code) were seen as especially vulnerable to additional seismic shocks. "Even though the building has withstood

two major earthquakes," structural engineer Victor Gray concluded, "it does require additional strengthening if it is to stand for an extended period of time."

By 1976 nearly every brick interior wall of the Legislative Building, from its foundation up through the galleries of the house and senate chambers, had been frosted like a bakery cake with thick, reinforced concrete. The porches, rotunda, and flanking wings were also bolted together to keep them from smashing into each other when the ground trembled again. Within the span of a decade the state had spent \$9.6 million preparing the big domed building to ride out the next major earthquake.

"It was an incredibly good investment," says Wright, one that would pay off handsomely 25 years down the road.

Amy Rose Derby, 15 years old in 2001, was serving as a senate page on the day the Nisqually earthquake slammed the capitol campus. Like everyone else inside the Legislative Building, she'll always remember the sound. The rumble of 169 million pounds of masonry and marble sounded to her like "triple the noise" of a playoff game in the old Kingdome, when all the fans were screaming, yelling, banging, and stomping their feet. For Mindy Chambers, communications manager in the Office of the State Auditor, the roar of the earthquake was followed by an even eerier sound: "Once the shaking was over," she says, "it felt as if the whole building let out a giant sigh."

Surely no one could blame it. The force of the 30-second quake had been so great on the lower floors that the four bronze fire pots in the rotunda, freestanding lamps weighing 3,000 pounds each, had traveled more than two inches from where they'd stood before. The cylindrical drum beneath the dome had wobbled and slithered on its supports, shifting the entire upper structure as much as three-fourths of an inch. According to David Boyer, who has helped to maintain the Legislative Building for more than 20 years, "People who watched from outside say the top lantern went back and forth like a dog wagging its tail."

The most visible wound to the building was an ugly gash in the exterior colonnade that holds up a heavy stone gutter around the rim of the dome. Although it looked dramatic, the crack affected only a section of decorative stone veneer and posed no risk at all to the dome's stability. It did, however, present a real threat to anyone standing below it. Five blocks of sandstone as big as bathtubs were leaning away from the building, attached by a fragment of mortar less than four inches square.

Ten exterior columns, held in place solely by gravity, had also been knocked out of plumb. At the peak of the earthquake the upper dome had rocked around on its colonnade in much the same way that a spinning coin flops on a tabletop. Briefly freed from the weight of the dome, the columns had shifted slightly before the lid clamped down again. Although they continued to do their job once gravity was restored, they had the potential to tumble out if bumped by another big quake.

Permanent repairs could wait until the overall rehabilitation of the Legislative Building got under way, as planned, in the summer of 2002. But short-term fixes were needed before visitors and state workers could safely go back inside. Legislators were forced to set up camp in adjacent buildings, meeting in makeshift chambers for the next seven weeks. Capitol tour guides scrambled to accommodate scheduled tour groups, moving shop temporarily to the nearby State Capital Museum. Meanwhile, work crews got busy stabilizing cracked finishes, strapping down crooked columns, and shoring up loosened stone.

When employees were finally allowed to return at the end of April they found their beloved building still very battered and bruised. Chunks of plaster were missing from the opulent molded ceilings of the house and senate chambers; scaffolding still leaned against the base of the injured dome. House staffers worked out their post-earthquake jitters by covering the badly damaged wall behind the speaker's rostrum with quirky visual puns: a portrait of actor Ray "Wall-ston" a sketch of a "wall-eyed" pike, a publicity shot of that 1970s television family, the "Wall-tons."

Emergency repairs to the Legislative Building cost more than \$1 million, much of it covered by grants from the Federal Emergency Management Agency (FEMA). The cost of permanent repairs, also largely funded by FEMA, are expected to run in the neighborhood of \$10 million more. Another roughly \$6.5 million worth of seismic reinforcement, designed to prevent future damage, will also be included in the larger rehabilitation project. "We're planning for an earthquake roughly 50 percent bigger than the one we just had," says Wright—the kind of quake that comes along every 400 years or so.

Most of the work involves pinning or binding elements of the upper structure together so that everything moves as one unit the next time the dog wags its tail. The primary goal is safety. In the event of a catastrophic quake, the seismically upgraded Legislative Building should stand its ground staunchly enough to protect the lives of the people inside and allow them to get out unharmed. Repairing the structure afterwards may not be feasible, but any steps taken toward strengthening it now will give it a better chance.

Few people take more pride in the Legislative Building, or grieve more when it is ailing, than those who guide the public through its marble corridors. Having the structure thrashed by an earthquake, says tour supervisor Chuck Waiste, was "like a good friend having a stroke." All of the guides look forward to seeing their old friend restored to health and to resuming tours of the building when its doors are reopened in late 2004.

Veteran guide Karen Swanson was leading a tour of Methodist seniors up in the senate gallery when the Nisqually earthquake struck. "Don't panic," she shouted above the noise. "Just sit there, hold on, and pray!" Bouncing against the railing, she feared for a moment that she might be tossed down onto the senate floor. But she never thought for an instant that the Legislative Building she loves would come crashing down around her.

"I have so much faith in that building," she says. "I just knew it was going to pull through."

Heather Lockman writes about history and historic preservation from her 1920 bungalow in Olympia's historic South Capitol neighborhood. Her work includes interpretive videos for the visitor centers at Deception Pass, Fort Columbia, and Ginkgo Petrified Forest State Parks.