Studies shake up Metro quake planning Shaking greater than thought due to ground composition

BY MATTHEW ROBINSON AND VIVIAN LUK, VANCOUVER SUN, THE CANADIAN PRESS JANUARY 21, 2014

New research is shaking the entire notion of what could happen to Metro Vancouver during an earthquake, indicating the area would rock harder and longer from a quake than would other areas given the shape and composition of the ground on which it rests.

Two studies published Monday in the Bulletin of the Seismological Society of America show seismic waves would be amplified as they pass through the Georgia Basin, the deposit of softer sedimentary rock that lies partly beneath Metro Vancouver. The findings have officials assessing the earthquake readiness of infrastructure throughout the region.

That amplification could make the ground shake three to four times harder than it would in a different region.

The researchers ran eight separate scenarios and found that a major quake near Metro Vancouver would most likely register a seven on the Modified Mercalli scale, which measures earthquake intensity on a scale of 1 to 12.

The damage to well-designed buildings in the area would be negligible in an earthquake of that intensity, while older structures would be hit hard, according to the U.S. Geological Survey.

But a different region standing on solid ground would experience an earthquake of the same magnitude as just five on the scale, meaning dishes and windows could break and pendulum clocks may stop.

"The shaking in (Metro) Vancouver would be greater because of the presence of the Georgia Basin, especially when the earthquake occurred to the south or southwest," says lead author Sheri Molnar, with the University of B.C.'s civil engineering department.

The Georgia Basin is shaped like an elongated bowl and lies beneath the Georgia Strait, encompassing southwestern B.C., the eastern half of Vancouver Island and northwestern Washington. It is one in a series of basins along the Pacific coast of North America, and is filled with layers of silt, sand and glacial deposits. The effects of an earthquake on a basin in Canada had not been studied until now.

Molnar compared the Georgia Basin to gelatin surrounded by a hard block of cheese.

"We're bringing the earthquake up through the cheese, and then it's suddenly hitting the Jell-O mould and starting to slosh around and bounce around within that Jell-O."

British Columbia sits on what's known as the Cascadia subduction zone, where earthquakes tend to occur either within the Juan de Fuca plate or the overriding North America plate. Big subduction earthquakes, like the one that struck Japan in 2011, also occur in the Juan de Fuca plate.

Molnar's studies examined the potential impact of deep earthquakes, with a magnitude of 6.8, that occur 40 to 50 kilometres beneath the surface, as well as shallow earthquakes of the same magnitude.

Scientific research had already suggested that softer ground would create worse shaking than bedrock during an earthquake, said Greg Smith, a director of IT and emergency management at Metro

Vancouver, who said he did not yet have a chance to see the study.

"We have done work based on ground types and shaking," said Smith, who added that his team was now working on maintaining communications between municipalities in the event of a quake.

But Natural Resources Canada researcher John Cassidy, who supervised Molnar's study, said the work shows the basin could also influence the duration of rippling felt above. "Essentially what the basin is doing is producing stronger shaking and producing longer-duration shaking," said Cassidy. "Instead of perhaps feeling strong shaking for 10 seconds, you might feel strong shaking for 20 or 30 seconds."

Cassidy says the model showed that the area beneath the Georgia Strait shook the most.

When earthquake waves hit the southeast part of the Georgia Basin before reaching Metro Vancouver, southwestern areas such as Delta, Ladner and Richmond experienced tremors three or four times what they would be if the Georgia Basin were not there.

However, if the waves hit the northwestern or northeastern part of the basin, they took a different path and either did not affect the Vancouver area or did not cause a significant increase in motion.

The duration effect is important, said Graham Taylor, a member of the seismic peer review committee of the Association of Professional Engineers and Geoscientists of B.C., who helped develop the seismic retrofit guidelines for B.C. schools. He said buildings are

pushed to their limits when the shaking keeps going.

"It's good research," he said, adding it will be considered when the Ministry of Education produces the next version of the guidelines. "This is going to just more keenly focus the need ... on looking at the duration effect even more."

But he said the guidelines are already designed for very strong earthquakes and the new research doesn't mean newly retrofitted schools are now out of date or the guidelines should go out the window.

For Patti Bacchus, the head of the Vancouver school board, the studies underscored the importance of getting work started on the nearly 50 schools she said are cited as being at high risk of structural damage in an earthquake.

"We have to make this a priority," she said. "I can't think of a more important job to get done."

She applauded the province for promising money for upgrades, but said thousands of students would still be at risk until the work was done.

Frank Huber, a Metro Vancouver manager of water projects, said he couldn't comment directly on the newly released study, but added that the region was still a decade or two away from completing its necessary infrastructure upgrades.

"We're partway there, but not 100 per cent," said Huber, who noted the area's major dams were already seismically upgraded, but work remained on pipes under the Burrard Inlet that carry water from the North Shore.

He said the Greater Vancouver Water District now has about half of its pumping stations and reservoirs able to resist a major earthquake, but the rest are not yet ready.

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