

HODGSON, E. A., 1925. The St. Lawrence earthquake February 28, 1925: Seimological Society of America. Bulletin, v. 15, No. 2, 84-103.

Quebec - The damage in the city of Quebec was confined to the section known as lower town, bordering the St. Lawrence or St. Charles rivers where the depth of soil is considerable. The damage in the rocky section of upper town was nil.

The C. P. R. station is a fine building' of steel construction with brick filler walls. The north wall of this station is not far from the St. Charles River. The soil is alluvial. The top rows of bricks on this north wall were thrown down into the main waiting room. It may be noted that this seems to indicate a sharp movement to the north. There was perhaps a wagonload of bricks displaced but the top third of the wall had to be rebuilt. It is strange that no one was injured. The skylights in the entrance rotunda were broken as well.

Not far from this station at the mouth of the St. Charles River stands one of the most important' of the harbor works, the grain galleries, ship cargo receiving sheds, and grain elevator. The picture (Figure 2) shows the relative positions of these. The shed is 1,000 feet long and 100 feet wide, running north and south on the west bank of the St. Charles River near the point where it empties into the St. Lawrence. This shed is supported by steel I beams which extend beyond the roof of the shed at a height of about thirty-five feet, through a distance of about fifty feet, with no encasing walls, and on up through about thirty five feet of encased "grain galleries," as they are called. These sheds and grain galleries are cased with sheet metal but have ceilings of concrete, and the galleries have also floors of concrete. The whole thus forms an inverted pendulum in the sense that there is a very heavy mass at the top of a stretch of steel columns. The rigid bracing of the steel framework prevents oscillation. The sheds stand on the filled land sixty-six feet deep and within a hundred feet of the river.

The sheds were empty at the time of the earthquake. The movement of the earth to the north and west and the shaking caused the fill to settle and a crack about an inch and a half wide opened between the sheds and the edge of the wharf in the then frozen earth. Inside the building a similar crack ran for several hundred feet, parallel to the length and about twenty feet from the north wall. This split the two-inch plank flooring as if the west end of each of the planks running along the crack had been grasped by giant hands and pulled until they split up from the west end, some the full length of the plank, others only part way. At the same time, part of the concrete ceiling fell in and the west wall leaned out to the extent of about two inches at the height of the ceiling.

As the ground settled the building swung to the north at the top. The columns on the north side were sprung in at the bottom, the shift to the south on the pier tops being from two to three inches (see Figure 3). They pulled out from two one-inch bolts holding each of them to the pier. The foot of each column is twenty-five inches square. They had bolts only at the north side. The south side was braced by backstops. The backstops were bowed as the feet of the columns swung in. Then the elasticity of the frame took up the strain and the heavy superstructure swung back, kicking in to the north the foot of each of the columns on the south side of the building. The columns are twenty feet apart and every column for the west 550 feet of shed was displaced on the north side of the building. Not so many were displaced on the south side in the rebound but where they did move the shift was from two to three inches.

The shed is tied in, by grain galleries running north and south, to a heavy reinforced concrete grain elevator with over a hundred massive cylindrical bins about a hundred feet high and sixteen feet in diameter, and with a "workroom" two hundred feet high, a hundred feet long, and sixty feet wide. The top hundred feet of this section projects beyond the height of the bins and stands clear with four stories of floors in it. High in this upper section is a battery of scales for weighing the grain. These are immense affairs, each capable of handling sixty tons of grain. These scales were thrown off their pivots, all falling south. The counterweights, formed of plates of iron about two inches thick and eighteen inches square, built up into a mass five feet high by means of two bolts seven-eighths of an inch in diameter, were swung so violently that the bolts were sheared off and the plates flung to the floor five feet below. Four automatic scales which could not be thrown off pivots swung to and fro in the steel plate enclosures, banging on the doors until the latter were battered as if made of lead, showing the projecting points of the swaying scales.

The whole upper section swayed with the heavy machinery so that practically all of the reinforced concrete columns about the outer walls were cracked at the point where the superstructure met the top of the main building. These were not simple cracks. Some had ground back and forth until great sections of concrete were ground out of the face several feet long, a foot into the wall and a foot to eighteen inches wide on the face. The reinforcing irons, rods about half an inch in diameter, were in some cases worked out through these cracks. No one was in the building at the time. The noise and the swaying would surely have been terrifying'.

Less than half a mile from the elevator and shed stands the Chateau Frontenac, the great Canadian Pacific Railway hotel. It is on the rocky cliff supporting the central part of Quebec. Some in this building did not hear the earthquake at all. No one was greatly alarmed by it. The difference between the effects observed at these two spots so close together is due entirely to terrain. The buildings at the harbor are very well constructed. Had they not been they must have been wrecked. They were built where the need required, beside the river. The soft ground was the cause of the damage rather than proximity to the epicenter.

The damage to the harbor works at Quebec has been dealt with at some length because it shows the dangerous nature of filled ground for heavy buildings, the comparative immunity of steel construction under severe strain (the damage to the columns in the sheds can be readily remedied) and the inability of massive reinforced concrete work to resist earthquake shock.

It may be noted in passing that the scales fell south and that this would indicate a movement of the earth in a direction approximately north.