

What is the Affect of Earthquakes on Urban Areas?

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Introduction

In 1964, a massive earthquake shook the state of Alaska causing catastrophic destruction and extreme fear. (Fig. 1) In the 40 years following, many of the affected areas have been rezoned and built upon. Now there is a plan to construct a 21 story high rise right in the middle of several of the most affected areas. According to Dilley and Dilley, earthquakes such as this occur approximately every 600 to 900 years. So the question arises, "Is this really the best place to build a building that could be toppled quite easily and will cause massive destruction if it does so?"

We have set out to answer this question. Our base is Central Middle School of Science, located at N 61° 12.514' and W 149° 53.363'. We are about 6 miles from the inactive Boarder Ranges Fault at the base of the Chugach Mountains. From here we will spread out to 61.33°N, 149.33°W, 61°N, and 150.33°W in order to seek an answer.



Figure 1. Top of 4th avenue slide.

Materials and methods

Earthquake data for our study site was extracted from the Alaska Earthquake Information Center database and used to create a GIS map which shows earthquakes and their magnitudes. Seismology and surficial geology shape files were overlaid on a land satellite aerial photo of Anchorage. GPS points showing impact of past earthquakes were recorded and overlaid on maps. Historic aerial photos were analyzed and digitized.

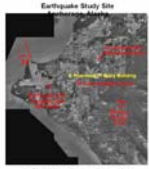


Fig. 2. Earthquake study site with location of proposed 21 story building, Central Middle School, Government Hill slide of 1964, and Earthquake Park Turnagain slide.

Data

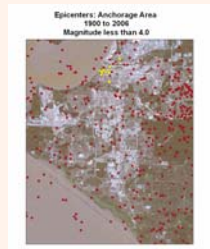


Fig. 3. Epicenters

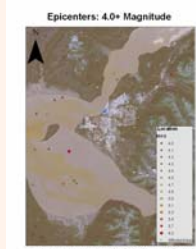


Fig.4 Epicenters 4.0+

Earthquakes have occurred all over the Anchorage area over the past 100 years. (Fig. 3) Only a few of the earthquake epicenters in our study area have had a magnitude greater than 4.0. (Fig. 4) These earthquakes have different effects on areas depending on the area's surficial geology. (Fig. 5) The effects can vary depending on how easily the surficial geology falls apart (colluvium, alluvium of Anchorage plain, alluvium: abandoned stream beds, bootlegger cove clay, manmade fill, and landslides of 1964 earthquake). Based on the surficial geology and past earthquake effects, hazard zones have been determined. (Fig. 6) If you look at both figures, you will notice that the some areas of the highest level hazard zones match up with the the extremely unstable soils on the surficial geology map.



Fig. 5. Surficial geology of Anchorage



Fig. 6. Earthquake hazard zones of Anchorage



Fig. 7. This is the Surface Geology and Seismic Hazard Zones on the same map. This map shows how the different types of soil in the anchorage bowl are interestingly lined up with certain hazards zones.

Discussion

There are always going to be earthquakes, no one can stop them. Some soils are less hazardous than others (fig. 7) but if an earthquake is big enough, it just wont matter any more (as we saw in the 1964 Earthquake). We should all be aware of them, have plans and safety supplies just in case one does happen. We can't predict them very early so we always have to be on our toes.

The City of Anchorage should also take into consideration the fact that there will be earthquakes and we should build tall, tall buildings at sites of a slide or where the earth cracked. We don't want another side of a building falling especially if people aren't aware of the dangers. That would be horrible.

We need to be careful and aware in Alaska because of the chance of catastrophic or even minor earthquakes we have. We can not have construction workers that don't know the history of the earthquakes and where the disaster was the greatest or we might have another government hill and not be as lucky.



Fig. 8 & 9. (above) this is the Government hill school after the '64 earthquake. It got split in two, but luckily there was no school that day. (right) That is the L St. Apartments this is at the toe of the 4th avenue slide from the '64 earthquake. They had to remodel the place after the earthquake.



Conclusions

In conclusion, we have found out that the building of the 21 story structure would be an very bad plan, if not for the fact that another earthquake of sizable magnitude is not expected to occur for another several hundred years by which time the building would most likely not be standing anyways. We have also concluded that 4.0 and greater epicenters do not occur very often in our study area. 4.0 and less, on the other hand happen more often.

Lastly, we have concluded from looking at the maps that the area of the landslides from 1964 is the most dangerous place to live in earthquake terms. All areas of town obviously have some earthquake risks, it just depends on where you live.

Literature cited

- Earth Revealed, Earthquakes. Annenberg Media, copyright 1992.
- Dilley, L.M. and Dilley T.E., Guidebook to Geology of Anchorage, Alaska, Alaska Science and Technology Foundation, 2000.
- There have been others, these are the biggies.
- What about the earthquake website?

Acknowledgments

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