Critical Staging Multi-Criteria Suitability Analysis

For West Portland during the Cascadia Subduction Zone Earthquake Matthew Hart and Allison Lawler

Suitable Location



Hazards and Resources



Study Area



Source:
1.) Roads, City Boundaires: City of Portland, 2014. Available at Civicapps.org at http://www.civicapps.org/datasets/city-boundaries#comment-form
2.)Landslide: Madin, J., and Burns, W. Ground motion, ground deformation, tsunami inundation, coseismic subsidence, and damage potential maps for the 2012 Oregon Resilience Plan. 2013. 0-13-06.GDB. http://www.oregongeology.org/pubs/ofr/p-O-13-06.htm
3.) Grocery store, community center, hospital, fire station, vacant land: Metro 2008-2010, Available on PSU shared I drive
4.) Unreinforced Masonry Building: Portland Bureau of Planning and Sustainability, 2016. Special e-mail request.

Research Question:

According to the Oregon Resilience Plan, Portland has a low resilience rating and is expected to face severe damage due to liquefaction, ground shaking, ground instability, and possible landslides under the worst case scenario of a 9.0+ magnitude Cascadia Subduction Zone earthquake (OSSPAC 2013) In a Cascadia Subduction Zone scenario, the east and west sides of Portland could potentially be separated as there are only two reinforced bridge structures and therefore, we focused our research specifically on the west side of Portland. The Portland Bureau of Emergency has identified an action plan to set up emergency staging areas in Portland Parks as they are open spaces embedded within separate neighborhoods. The intent of this analysis is to validate PBEM's plan and identify with a suitability analysis the most appropriate open space area for critical staging and mass care in relation to hazard debris and existing critical resources.

Methods:

The analysis was conducted within the city limits of Portland, West of the Willamette River. We used a Multi-Criteria Suitability Analysis to select optimal sites for staging response and recovery. We prepared an assessment of the hazards the study area is predicted to face during the CSZ earthquake including landslides and Unreinforced Masonry buildings that are estimated to collapse due to ground shaking. Then, we gathered data on existing resources needed for mass care during a natural disaster such as access to roadways, grocery stores, fire stations, and community centers. We classified these into four categories: 1–Unacceptable Location: Very High risk for landslide and not closely located to critical resources, 2–Not acceptable Location: High risk for landslide and not closely located to critical resources, 3–Somewhat Acceptable Location: Moderate risk for landslide and moderately close to critical resources, 4–Acceptable Location: Low risk for landslide and close to critical resources. The weighted overlay tool was used to weigh the criteria in order of importance with landslide, masonry, access to streets, hospitals, grocery stores, fire stations and community centers, respectively. The results were then overlayed with open spaces data to find the most suitable location.

Limitations:

Time—We would have liked to have analyzed vulnerable populations and their relation to existing resources and the suitable locations but this would take significant statistical work and there were time constraints.

Access—Portions of West Portland are also susceptible to liquefaction, especially the reclaimed waterfront areas along the Willamette River. We would have liked to analyze the risk of liquefaction and ground shaking but these files were not accessible and open for public use. Another risk is tsunami inundation, but this data was only found for coastal communities in Oregon.

Conclusion:

At the outset of the hazard map, it is clear that there is very little space that is not at risk in the event of a major earthquake. Since the west side of Portland is bordered by the west hills, the west flank of the city is susceptible to mass wasting while the east side of downtown is susceptible to liquefaction. The existing PBEM maps emphasize areas in downtown as well as open areas close to Forest Park, which are both at very high risk. While there will need to be mass care locations in different areas throughout the city, our map validates the best suited locations are in the southwest area which PBEM has designated for BEECN locations, staging areas, and helispots. Further research should be considered for a strategic partnership between Portland and Beaverton due to the fact that these staging areas and evacuations will highly affect daily operations for the city of Beaverton.