



Virtual Earthquake Reconnaissance Team (VERT): Phase 1 Response to M7.0 Anchorage, Alaska Earthquake, November 30, 2018

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Topic #1: Earthquake Characteristics

VERT Immediate Response for:
Anchorage, Alaska M7.0 Earthquake

Earthquake Characteristics

Date: November 30th 2018 17:29:29.206 UTC

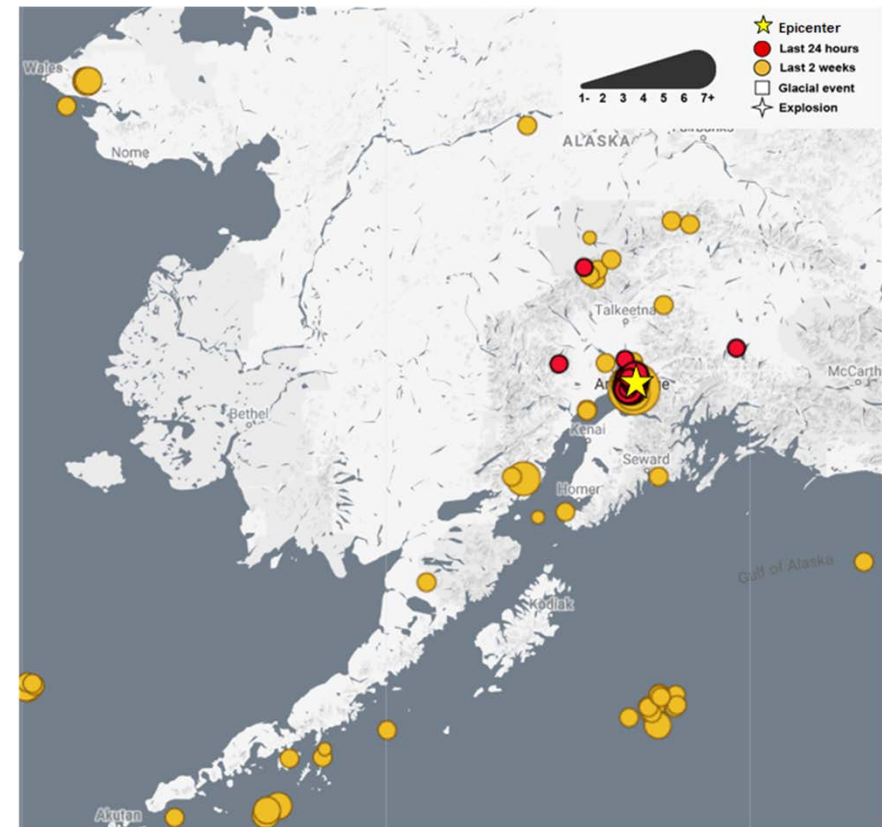
Magnitude: Mw 7.0 (USGS).

Location:

- Epicenter located 12 km North of Anchorage
- 61.323°N latitude and 149.923°W longitude

Depth: 44.1 km (USGS).

The figure on the right shows the epicenter of the earthquake along with aftershocks of magnitude equal or higher than 3.0 (figure modified after Alaska Earthquake Center).



Note: Epicenter located for reference only (not actual coordinates).

Source: <https://earthquake.alaska.edu/earthquakes>



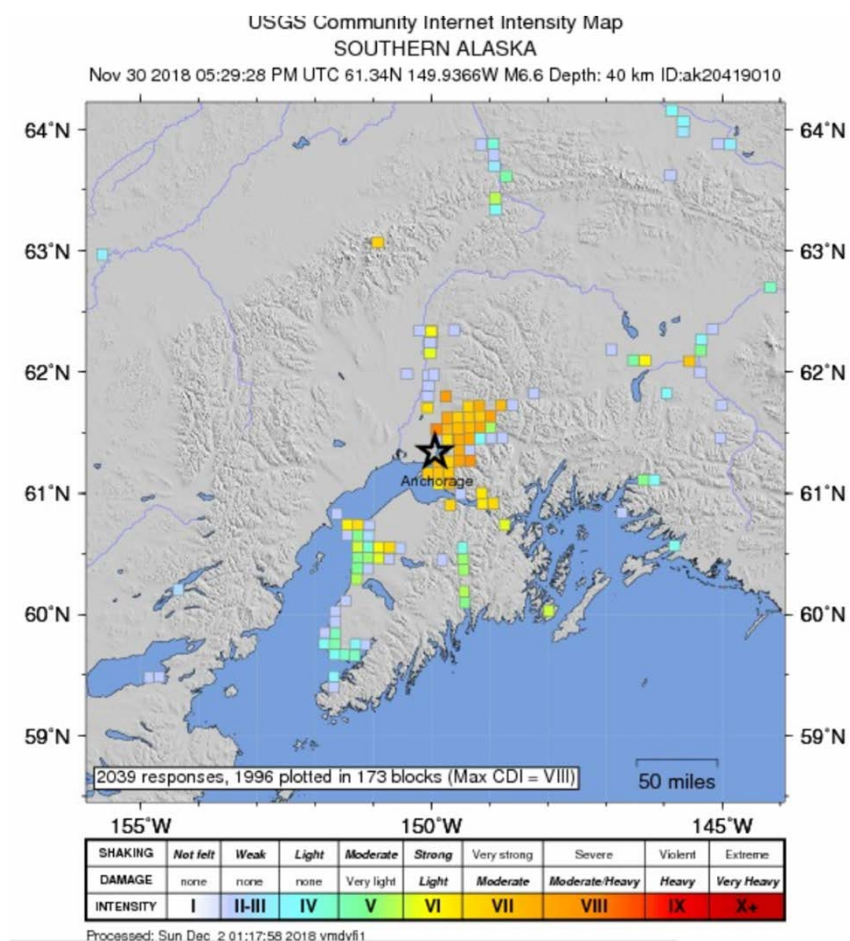
Summary of Location, Fatalities, Fault Mechanism, and other Statistical Data

Fault Mechanism:

- The earthquake resulted from a ruptured occurred on an intraslab fault within the subducting Pacific slab (USGS).
- Maximum Slip 1.6m (USGS)

Max Intensity: VII Severe shaking, Moderate/Heavy damage

<https://earthquake.usgs.gov/earthquakes/eventpage/us1000hyfh/dyfi/intensity>





Summary of Location, Fatalities, Fault Mechanism, and other Statistical Data

Aftershocks:

- 67 magnitude 3 or higher earthquakes
- 9 magnitude 5 or higher earthquakes, which are large enough to do damage

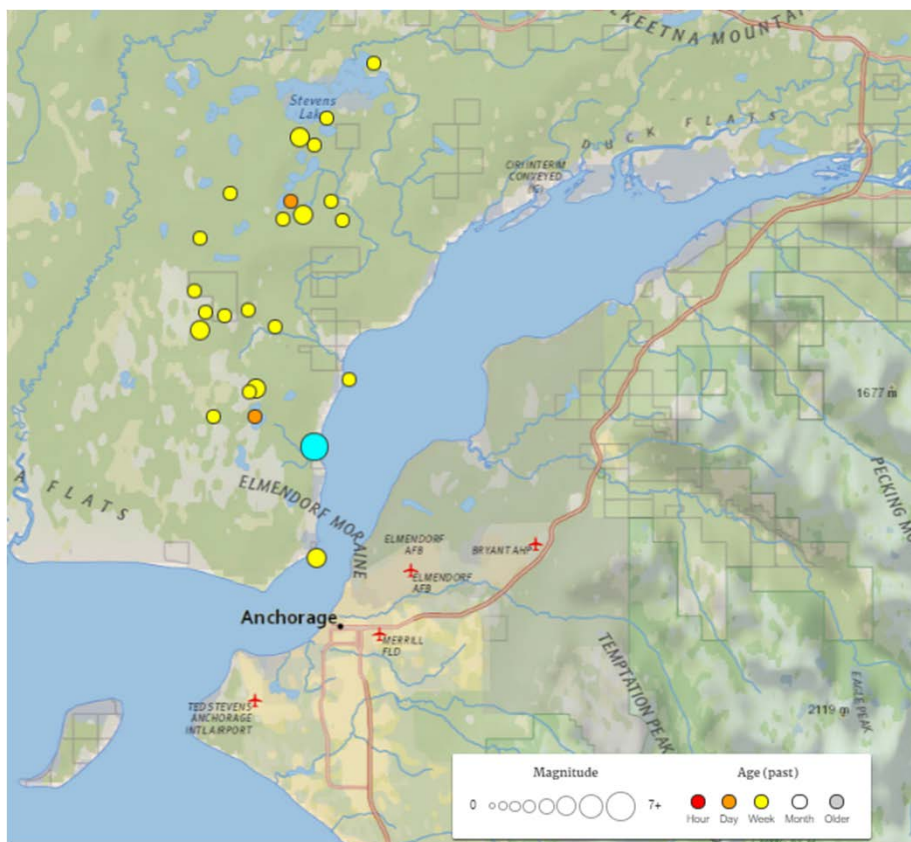
Aftershock Forecast: within the next 1 Week until 2018-12-08 02:00:37 (UTC)

- The chance of an earthquake of magnitude 3 or higher is > 99 % (expected 84 to 610)
- The chance of an earthquake of magnitude 5 or higher is 88 % (expected 0 to 8)
- The chance of an earthquake of magnitude 6 or higher is 24 % (expected 0 to 2)
- The chance of an earthquake of magnitude 7 or higher is 3 %, such an earthquake is possible but with a low probability.

<https://earthquake.usgs.gov/earthquakes/eventpage/ak20419010/oaf/commentary>



Summary of Location, Fatalities, Fault Mechanism, and other Statistical Data



(left) Map of aftershocks

Blue = Anchorage Earthquake

<https://earthquake.usgs.gov/earthquakes/eventpage/us1000hyfh/executive>
ANSS Comcat



Summary of Location, Fatalities, Fault Mechanism, and other Statistical Data

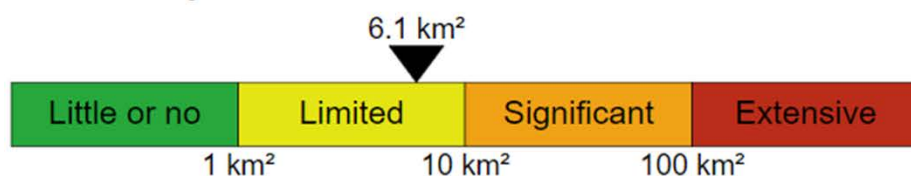
- USGS estimates suggest a low probability of fatalities, however damage is likely to be significant and potentially widespread (<1% of the GDP of the US) (<https://earthquake.usgs.gov/earthquakes/eventpage/us1000hyfh/pager>).
- No fatalities or serious injuries reported directly caused by the earthquakes. Only minor bruises and cut wounds from falling objects and furniture.



Summary of Location, Fatalities, Fault Mechanism, and other Statistical Data

Landslides

Estimated Area Exposed to Hazard



Landslides triggered by this earthquake are estimated to be limited in number and (or) spatial extent.

Estimated Population Exposure

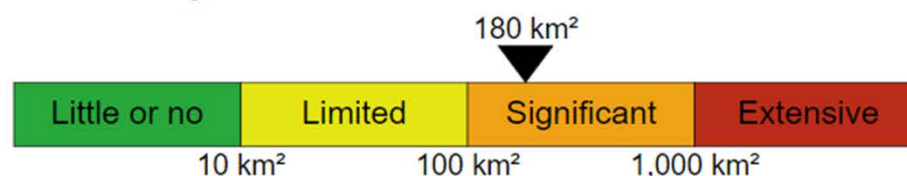


The number of people living near areas that could have produced landslides in this earthquake is low, but landslide damage or fatalities are still possible in highly susceptible areas. This is not a direct estimate of landslide fatalities or losses.

[VIEW LANDSLIDES MAP](#)

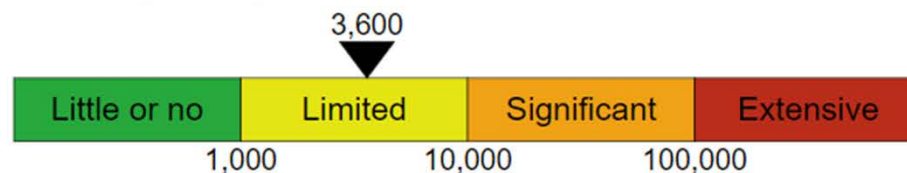
Liquefaction

Estimated Area Exposed to Hazard



Liquefaction triggered by this earthquake is estimated to be significant in severity and (or) spatial extent.

Estimated Population Exposure



The number of people living near areas that could have produced liquefaction in this earthquake is limited. This is not a direct estimate of liquefaction fatalities or losses.

[VIEW LIQUEFACTION MAP](#)

<https://earthquake.usgs.gov/earthquakes/eventpage/us1000hyfh/ground-failure/summary>



Topic #2: Tsunami Warning

VERT Immediate Response for:
Anchorage, Alaska M7.0 Earthquake



Summary of Tsunami Warning System, Location of Impact

- A tsunami warning issued for the Cook Inlet and southern Kenai Peninsula regions was later cancelled (<https://www.bbc.com/news/world-us-canada-46403405>).
- Tsunami cancellation was not properly announced through phone network providers.

United States Department of Commerce
NOAA / National Weather Service
U.S. Tsunami Warning System

Home News Organization Search for: [] NWS All NOAA Search

No Tsunami Warning, Advisory, Watch, or Threat

Earthquake:
Magnitude: 4.6 Origin Time: 12/1/2018, 8:52:15 PM
Depth: 17 mi. Lat: 61.3° N Lon: 149.9° W
Location: 35 miles SW of Palmer, Alaska

NWS Tsunami Alerts @NWS_NTWC

CANCELLATION: M7.0 005mi N Anchorage, Alaska
0829AKST Nov 30: No tsunami observed

#NTWC

688 10:59 AM - Nov 30, 2018

632 people are talking about this



Summary of Tsunami Warning System, Location of Impact

- A tsunami warning system exists but there is an overlapping issue that cause residents of some parts of Anchorage who are not at a high risk of tsunami to receive unnecessary warning. Those were trying to evacuate randomly without following particular evacuation route or signage.
- Tsunami evacuation signage do exist downtown Anchorage.
- Seems warning system issues need to be resolved and more education to the public on the actual tsunami risk is much needed.

Some field observation by Wael Hassan



Topic #3: Aftershocks

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Anchorage, Alaska M7.0 Earthquake



Overview & and how it affected various regions

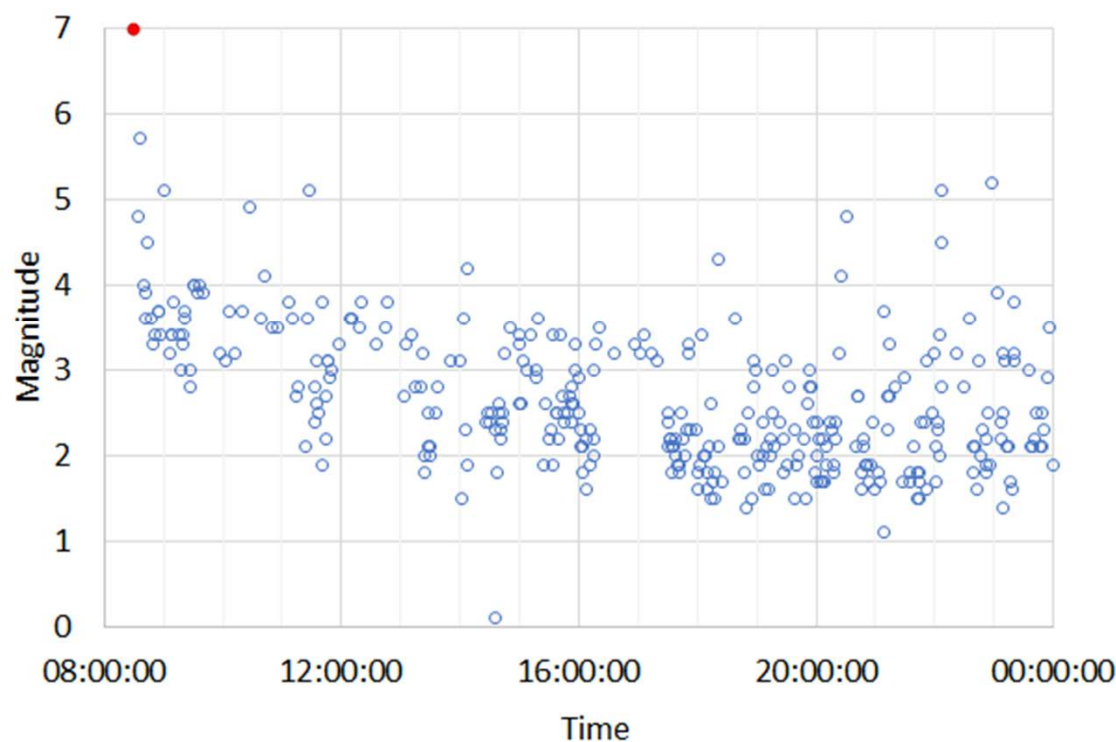
According to the AK Earthquake Center, 600+ aftershocks have been reported

[<https://twitter.com/AKEarthquake/status/1069010063849750529>].

These include several magnitude 5 or larger events based on available data from the USGS

[2].

Aftershocks in Alaska since main earthquake:
30-Nov-2018 Only

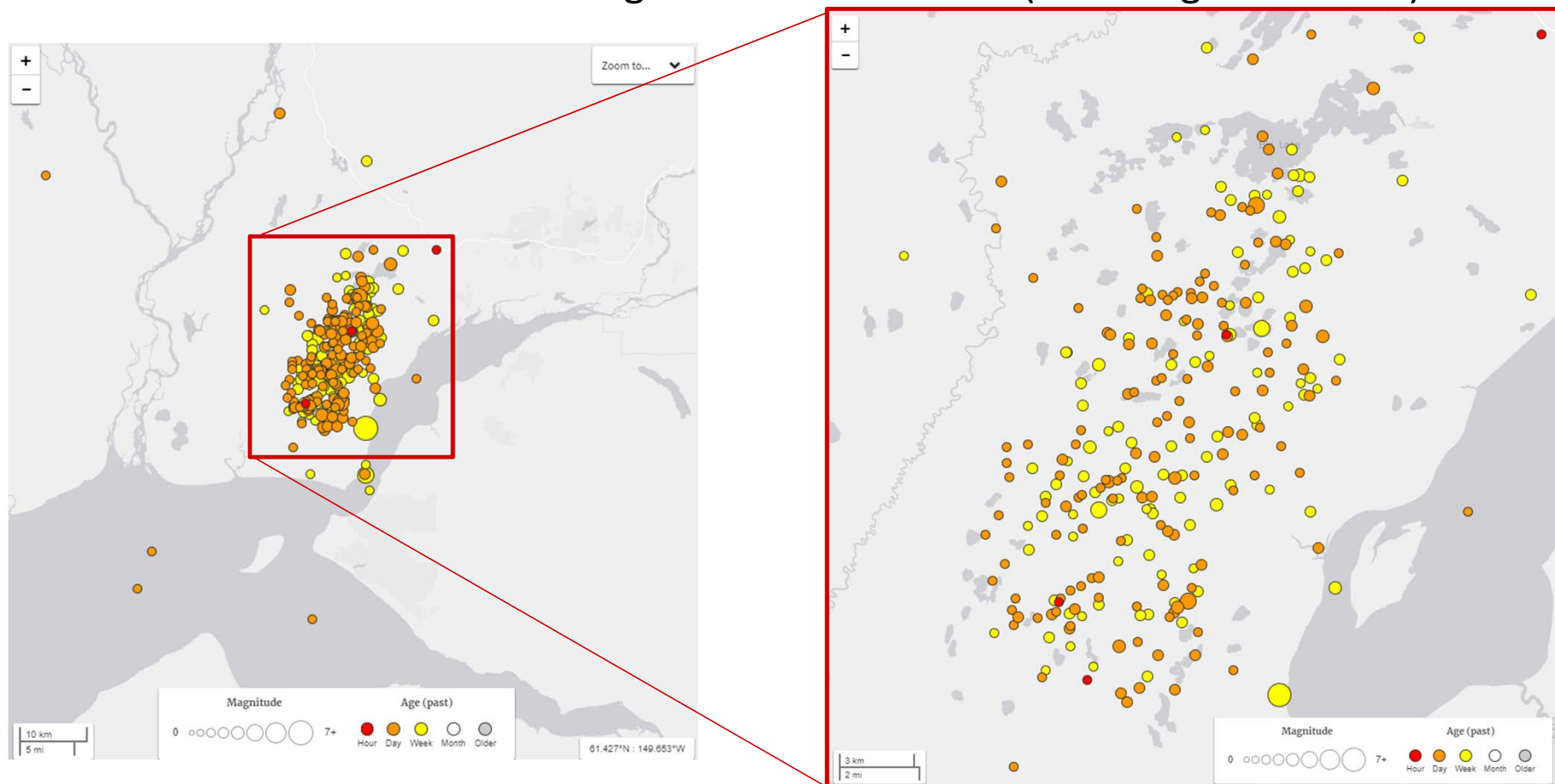




Overview & how it affected various regions

USGS maintains a map of M2.5 larger earthquakes [here](#).

Below are M2.5 and larger in the last 1 week (including foreshocks) as of 2-Dec





Overview & and how it affected various regions

The news of aftershocks has been shared widely by media outlets [[1](#),[2](#)]. The number and intensity of aftershocks provoked rumors that an aftershock as big as the main shock was coming at a specific time. This rumor was being shared via Twitter [[3](#),[4](#)].

State seismologists later commented, stating “Anytime an earthquake of this size occurs, there is a low but non-zero chance that another earthquake of similar or larger size could occur.” [[5](#)]

USGS [[6](#)] released information to the public to help them understand what to expect.



Links to key media articles discussing Structural Damage

So far, no damage seems to have been attributed to the aftershocks [[1](#)].

Until Dec 2nd midnight AK time: 17 aftershocks with Mw 4.5 or higher and 9 aftershocks with Mw 5.0 or higher took place.(USGS)



Topic #4: Lifelines

VERT Immediate Response for:
Anchorage, Alaska M7.0 Earthquake



Overview & and how it affected various regions

Lifeline	Status	Slide #
Electric power	Significant initial disruption (~80,000 customers, 70-85% of customers for some suppliers); mostly restored within 24hr	23
Gas	1-2 gas line breaks reported but repaired within 36hr; 700+ reports of potential gas leaks	24
Water	Water main breaks reported, causing some flooding; precautionary boil advisories lifted in most areas	25
Telecommunications/Internet	No known reports of disruption or damage; some entities advised to use text or social media to avoid clogging phone lines	26
Airport	Some damage within airport (ANC) terminal, but no damage to runways; Fully operational by 3:18PM Friday	27
Port	Minor damage; No disruption of service	27
Trans-Alaska Pipeline/Fuel	No damage found; Seven hour shutdown	27
Public Transit	Bus service in Anchorage (Anchorage People Mover) was disrupted on Friday; resumed Saturday/Sunday offering free rides	28



-
- Outage Map**
- Customers Affected
- 10 or less
 - 11-50
 - 51-100
 - 101-500
 - over 500

Saturday morning: We have 10 remaining members without power. Worked through the night and will get them done today. Thank you to Chugach linemen, dispatchers, member services and everyone inbetween for a great response. We have an incredible team. Here's to a calm weekend!



1



1



9



Follow

ML&P is still working about 1,000 outages. We currently have NO issues with substations and feeders. Remaining outages are due to equipment damage on the ground (line slap, overhead and underground distribution system repair).

9:12 PM - 30 Nov 2018

¹<https://www.ktva.com/story/39569541/list-closures-cancellations-power-outages-follow-major-anchorage-quake>

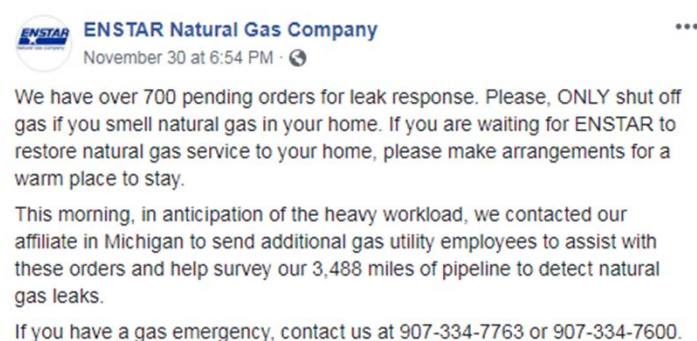
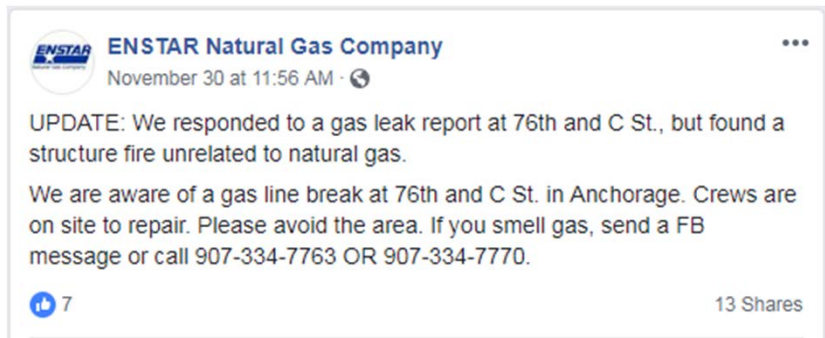
²<https://www.facebook.com/matanuska.electric/posts/1980049832048197?tn=K-R>



Overview & and how it affected various regions

Natural gas

- At 11:56 AM Friday - Enstar reported a gas line break at 76th street and C street in Anchorage¹
- At 6:54 PM Friday, there were approximately 700 leak cases reported to Enstar. At Sunday morning, it was down to 250 pending leak orders.¹
- Enstar has been advising customers to shut off gas only if they “detect a gas smell or hear the hissing of a leak”; it will take time for technicians to turn gas back on following an earthquake²
- Gas line break occurred in Matanuska-Susistna Borough, but has already been repaired as of 12/23³



¹<https://www.facebook.com/ENSTARNatGas>

²<https://www.adn.com/alaska-news/2018/11/30/do-you-smell-gas-or-hear-hissing-heres-how-to-shut-off-your-gas-after-an-earthquake/>

³<https://www.adn.com/alaska-news/2018/12/01/utilities-will-work-through-night-to-fix-widespread-gas-leaks-and-outages-after-70-earthquake/>



Overview & and how it affected various regions

Water

- Water main may have broken at Anchorage Jail¹
- Water main damage caused road flooding²
- In a press conference on Sunday morning, it was reported that previous boil advisory was lifted & city's water system was functioning normally. Residents of Mat-Su complained about water still being "murky".³
- Damage assessment of Anchorage Water & Wastewater Utility (AWWU) reported "Eklutna Water Treatment Facility and at the headquarters building that will require more extensive work, but that is not impeding operations"³

¹<https://youtu.be/DaXMIQVbOv8>

²<https://www.accuweather.com/en/videos/powerful-earthquake-causes-water-pipe-burst-flood-spills-onto-road/t4c2vyzze6lawplegazinfsucrgokgr0>

³<https://www.ktva.com/story/39572413/precautionary-boil-advisory-continues-in-anchorage>

 **Alaska Public Media News**
@AKpublicnews

Follow

Water main break at Tudor and Old Seward. Customers may be without water as Anchorage Water and Wastewater Utility clean up.

6:12 PM - 19 May 2016



Anchorage Water and Wastewater Utility

16 hrs · 🌐

AWWU has issued a boiled water advisory out of precaution; however, there are no known water contamination issues. Our system has remained pressurized except for isolated areas we are in the process of identifying. If you have pressure to your home, you should be fine.

For personal use, create a supply of water for drinking, food preparation, cooking and brushing teeth by bringing water to a rolling boil for 2 minutes. Timing starts when the water begins to bubble. Cool the water then place in clean containers.

We have no plans to shut down the entire water system. We will have isolated outages as we repair broken water mains. To stay updated, "Like" or "Follow" this page or text AWWU to 888777 to receive Nixle alerts to your cell phone.



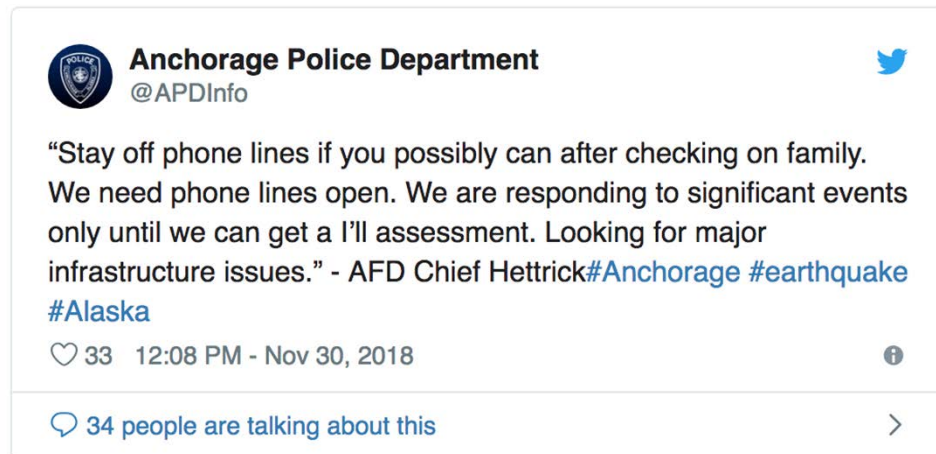
Overview & how it affected various regions

Telecommunications/Internet

- Broadband/IT provider Alaska Communications stated: “We’re grateful all our employees are safe and that we had no major service impacts from the earthquake.”¹
- FEMA and police have advised residents to use text or social media to avoid clogging phone lines²
- FEMA and Police announcement were not made through all cell phone users, only to those presubscribed to APD alerts. Shouldn’t be the case during an earthquake disaster.

¹<https://www.apnews.com/50faee7e7ed64226b8b076acc7a3c433>

²<https://abc11.com/facebook-activates-safety-check-for-alaska-earthquake/4799237/>





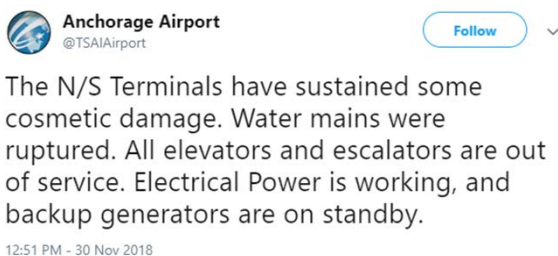
Overview & and how it affected various regions

Trans-Alaska Pipeline:

- The Trans-Alaska pipeline was re-started at 3:30 PM Friday after a seven-hour shutdown. There was no damage found.¹

Airport and Port:

- No damage was found on the runways and taxiways of Ted Stevens Anchorage International Airport. However, there was some damage to windows and burst water mains in the terminal.² The airport was fully operational at 3:18 PM on Friday.¹
- Minor damage was reported in Port of Alaska, but it did not interrupt the operation of the port



¹<https://www.ktuu.com/content/news/List-of-closures-caused-by-Anchorage--501659691.html>

²<https://twitter.com/TSAIAirport>



Overview & and how it affected various regions

Public Transit

- Anchorage People Mover suspended the service on Friday, also AnchorRIDES canceled operating only return trips.¹
- People Mover offered free rides on Saturday and Sunday.¹



Anchorage People Mover

30 de noviembre a las 19:30 · 🌐



Neighbors, as we all work together to recover from the impact of today's earthquake, People Mover would like to offer free rides both Saturday and Sunday, December 1st and 2nd. Thank you for your continued patronage and please be safe.



Anchorage People Mover

30 de noviembre a las 10:30 · 🌐



Attention riders: Due to the earthquakes People Mover is no longer operating service today, Friday, November 30. AnchorRIDES service is also canceled. Only return trips will be operating.

¹ https://www.facebook.com/pg/AnchoragePeopleMover/posts/?ref=page_internal



Links to key media articles discussing lifelines

- <https://www.adn.com/alaska-news/2018/12/01/utilities-will-work-through-night-to-fix-widespread-gas-leaks-and-outages-after-70-earthquake/>



Topic #5: Emergency Response

VERT Immediate Response for:
Anchorage, Alaska M7.0 Earthquake



Overview & and how it affected various regions

- Red Cross of Alaska providing a temporary disaster call line, stating calls returned within 24 hours.
 - Line down at 1 am Dec 1, callers to direct emergency response concerns to 911 instead.
- Anchorage Daily News was manually accumulating emergency response updates through Sunday December 2nd.
 - Collecting reports and tweets from public safety agencies, law enforcement, schools and news media
 - For example, Anchorage Airport tweets out damage to International Airport Road to advice EXTREME caution to any drivers.
 - Providing emergency response tips for individual households, including how to turn off your own gas if you smell gas i



Alaska DOT&PF
@AlaskaDOTPF

Following

Anchorage Shelter Update: The Dena'ina Civic and Convention Center has lost access to utilities. Those that are seeking shelter and cannot reach their home are now advised to make their way to the Egan Civic & Convention Center.

4:13 PM - 30 Nov 2018



FEMA ✓
@fema

Following

If you are trying to contact loved ones affected by the [#earthquake](#) in Alaska, use text and social media to reach out. Phone lines may be overwhelmed and often, texts can make it through when voice calls can't.

NWS Fairbanks ✓ @NWSFairbanks

We are seeing many reports of damage in south central Alaska from the earthquake. The NWS Anchorage Weather Forecast Office is unavailable due to the 7.2 mag earthquake. Please call NWS Fairbanks WFO 907-458- 3708, for updates or to report damage. #akwx #earthquake twitter.com/LaneSadalu/st...



Communication between utilities and the general public through social media to alleviate concerns of rumors



Glen Vinoya Rumor spreading that the whole city will have water shut off. Can you please confirm this is not the plan at this time?

Like · Reply · 1d



Joshua Sopko Agreed, i keep hearing people saying the city may shut off water, but see no news kr announcement for it.

Like · Reply · 18h



Anchorage Water and Wastewater Utility Glen and Joshua: Sorry for the delayed response. We have no plans to shut down the entire water system. We will have isolated outages as we repair broken water mains. The Utility will provide updates as they become available. Follow our page or text AWWU to 888777 to receive Nixle updates texted to your smartphone.

Like · Reply · 16h



- AWWU is using Facebook to communicate with customers.
- Again phone text was not used although they have all customer's phone numbers.



Topic #6: Hospitals

VERT Immediate Response for:
Anchorage, Alaska M7.0 Earthquake



Overview



Alaska DHSS

@Alaska_DHSS

Follow

Municipality of Anchorage is using this website to communicate Southcentral Alaska earthquake updates: muni.org. Cell phone companies are requesting people text instead of calling to keep phone lines open. Only call if it is a current emergency.

8:48 PM - 30 Nov 2018



Alaska DHSS

@Alaska_DHSS

Follow

Southcentral Earthquake Update: The following shelters are open and available in Anchorage, Girdwood and Chugiak.

- Egan Center (555 West 5th Avenue): Main Exhibition Hall
- Girdwood Fire Department (186 Egloff Drive)
- Chugiak Senior Center (22424 Birchwood Loop Rd)

2:26 PM - 1 Dec 2018



Overview & and how it affected various regions

- Providence Alaska Medical Center experienced multiple water leaks and canceled elective surgeries [1]. Staff are evaluating isolated damage [2].
 - A structural evaluation was completed and all damage is believed to be cosmetic [3].
 - Emergency rooms kept open. Evaluating damage and water leaks [4].
- Alaska Regional Hospital remains open while damage is being assessed. All elective procedures through the weekend have been canceled [5]. Heavy water damage at buildings E and A (Dec 2nd)
- Alaska Native Medical Center has cancelled elective and clinical appointments. All available personnel have been dispatched to the Emergency Department to prepare for potential influx of injured patients [6].
- Mat-Su Regional Medical Center in Palmer experienced power outage and gas leak reported [7].
- EERI field Recon team planned hospital preparedness surveys and interviews

References

1. <https://www.bloomberg.com/news/articles/2018-11-30/urgent-the-latest-tsunami-alert-for-southern-alaska-after-quake>
2. <https://twitter.com/ProvAK/status/1068594795734388737>
3. <https://alaska.providence.org/news/2018/11/providence-alaska-medical-center-remains-open-following-earthquake>
4. <https://www.cnn.com/2018/11/30/us/alaska-earthquake-impact/index.html>
5. <https://twitter.com/AlaskaRegional/status/1068613184091652097>
6. <https://fox5sandiego.com/2018/11/30/major-earthquake-rocks-anchorage-prompting-tsunami-warning/>
7. <https://www.ktuu.com/content/news/List-of-closures-caused-by-Anchorage--501659691.html>



Overview & and how it affected various regions

- Emergency operations at 3 major hospital facilities in Anchorage (Alaska Regional Hospital, Providence Alaska Medical Center, and Alaska Native Medical Center) were open Saturday December 1. All three have received patients with earthquake-related injuries. Elective and non-emergency appointments were cancelled at all 3 medical facilities. Fallen ceiling tiles and broken water lines at Alaska Regional Hospital [1].

References

1. <https://www.alaskapublic.org/2018/11/30/emergency-rooms-open-non-critical-appointments-canceled-at-anchorage-area-hospitals/>



Alaska Regional Hospital
Source: [Alaska Public Media](#)



Overview & and how it affected various regions



Alaska DHSS

@Alaska_DHSS

Follow



Here's an update on local hospitals. All three Anchorage hospitals, [@ProvAK](#), [@AlaskaRegional](#) and Alaska Native Medical Center ([@ANTHCtoday](#)) are open and accepting patients. All elective surgeries have been canceled for today. Mat-Su Regional Hospital is also open.

5:48 PM - 30 Nov 2018



Links to key media articles discussing Hospitals / Emergency Response

- <https://www.cnn.com/2018/11/30/us/alaska-earthquake/index.html>
- <https://www.bloomberg.com/news/articles/2018-11-30/urgent-the-latest-tsunami-alert-for-southern-alaska-after-quake>
- <https://www.ktuu.com/content/news/List-of-closures-caused-by-Anchorage--501659691.html>
- <https://fox5sandiego.com/2018/11/30/major-earthquake-rocks-anchorage-prompting-tsunami-warning/>



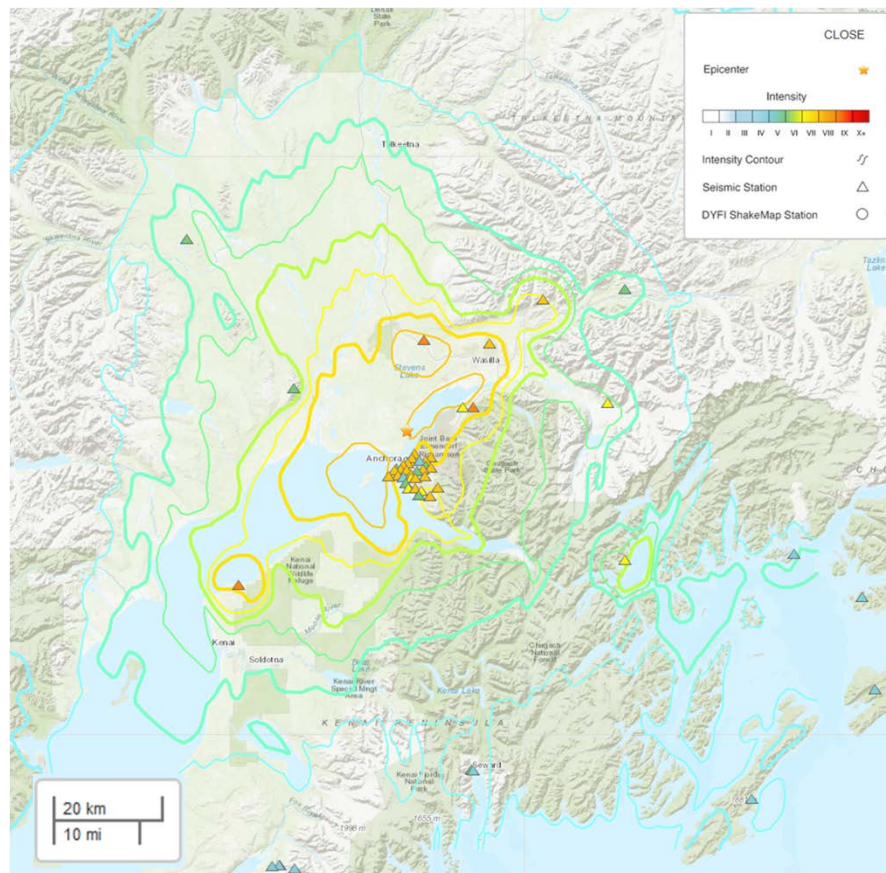
Topic #7: Geotechnical Damage

VERT Immediate Response for:
Anchorage, Alaska M7.0 Earthquake



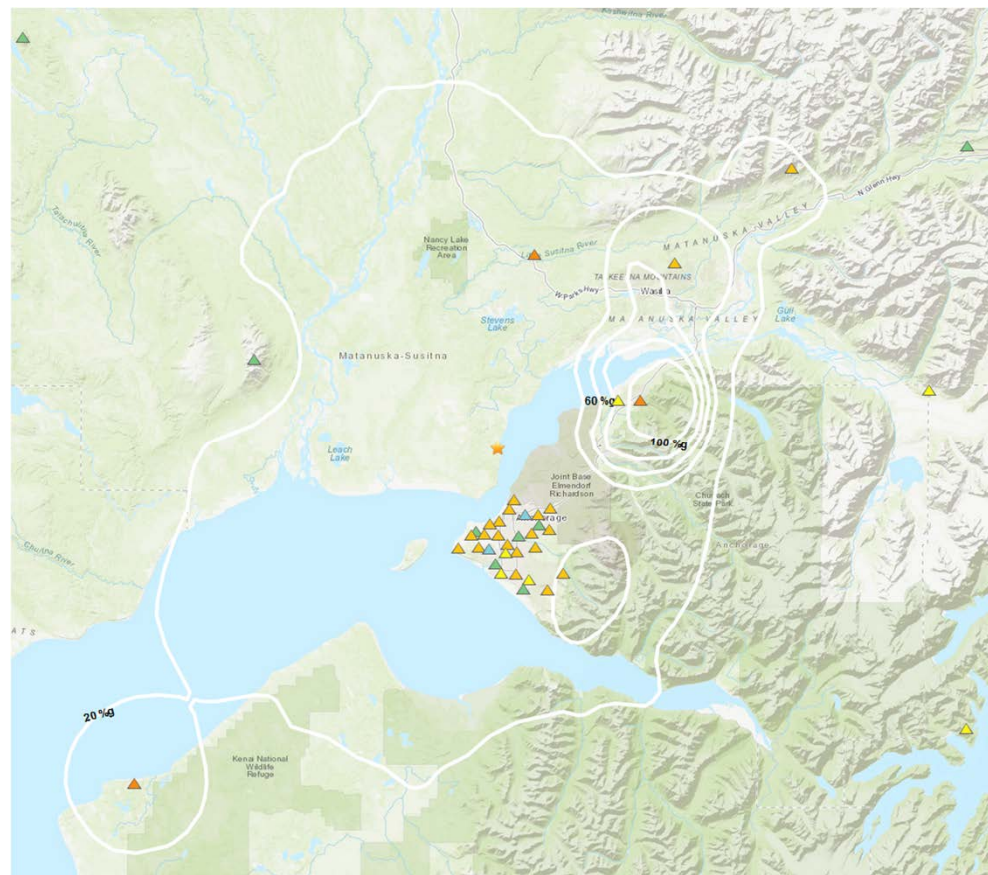
Overview & and how it affected various regions

USGS ShakeMap (MMI)



<https://earthquake.usgs.gov/earthquakes/eventpage/ak20419010/map?shakemap-code=ak20419010&shakemap-source=ak&shakemap-intensity=true&shakemap-stations=true>

USGS ShakeMap (PGA Contours) and Distribution of Stations

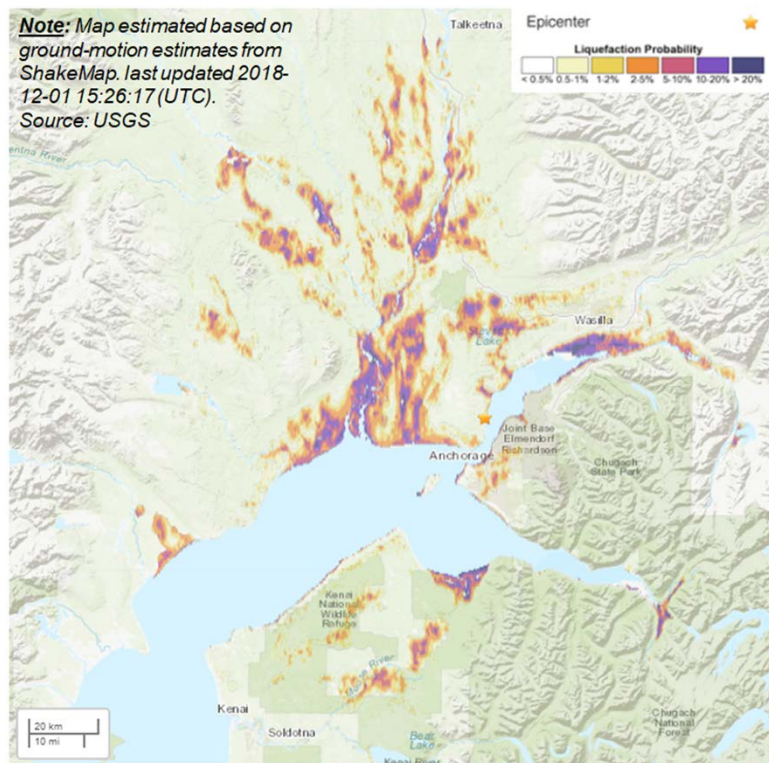


<https://earthquake.usgs.gov/earthquakes/eventpage/ak20419010/map?shakemap-code=ak20419010&shakemap-source=ak&shakemap-intensity=true&shakemap-stations=true>



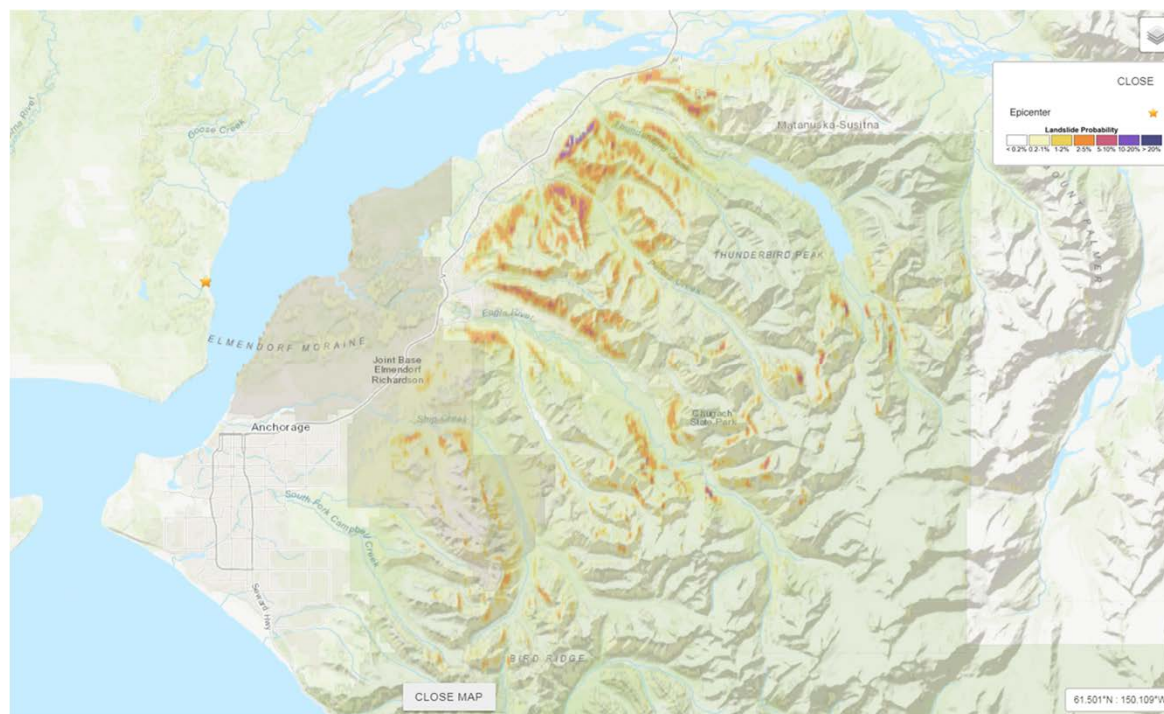
Overview & and how it affected various regions

Liquefaction Potential (USGS)



<https://earthquake.usgs.gov/earthquakes/eventpage/us1000hyfh/map>

Landslide Potential (USGS)



<https://earthquake.usgs.gov/earthquakes/eventpage/us1000hyfh/map>



Links to key media articles discussing Geotechnical damage

Overview of damage identified by media outlets and in social media:

- Collapse of the Vine road between Knik Goose Bay Road and Parks Highway [1].
- Collapse of an exit ramp in Minnesota Road near the airport [4].
Approximate 61.170483, -149.915466
- Damaged roads include Palmer-Wasilla Highway, Pittman Road, Vine Road, and the Parks and Glenn Highway interchange [5]
- Landslide on the Seward Highway by McHugh Creek (Approx. 61.016015, -149.730833) [6].
- Rockslide on Seward highway between Bird Creek and Potter Marsh [6].
- Sinkhole on Glenn Highway southbound lanes between Eklutna and Mirror Lake [7]



Vine Road [2]. Approximate 61.561187, -149.601779



Vine Road [3]

REFERENCES

- [1] <https://www.bbc.com/news/world-us-canada-46403405>
- [2] <https://twitter.com/ZachBruick/status/1068576075981017088>
- [3] <https://twitter.com/RyanHobbsMMA/status/1068672511695511552>
- [4] <https://www.cnbc.com/2018/11/30/earthquake-rocks-buildings-in-anchorage.html>
- [5] <https://www.adn.com/alaska-news/2018/11/30/road-damage-and-gas-leaks-reported-in-mat-su-after-70-earthquake/>
- [6] <https://www.ktuu.com/content/news/BREAKING-Massive-earthquake-shakes-Alaska-501647481.html>
- [7] <https://www.adn.com/visual/2018/12/01/photos-ground-level-views-of-the-earthquake-damage/>



Overview & and how it affected various regions

Vine Road



Approximate 61.561187, -149.601779

<https://twitter.com/RyanHobbsMMA/status/1068580139322171392>

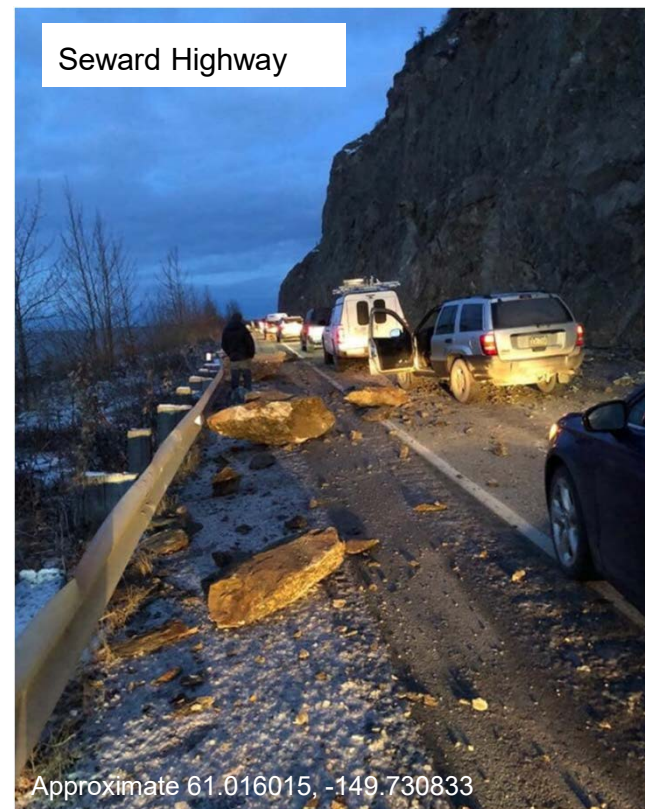
International airport road
ramp from Minnesota



Approximate 61.170483, -149.915466

<https://twitter.com/CBCAlerts/status/1068574193946673152>

Seward Highway

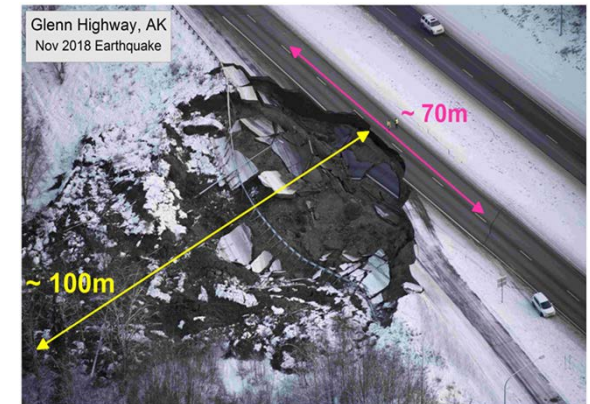


Approximate 61.016015, -149.730833

<https://twitter.com/RyanHobbsMMA>



Overview & how it affected various regions



Massive coseismic landslide (length= 100 m, width =70 m) in Glenn Highway, AK following the Alaska earthquake (photo modified from AP)

https://twitter.com/Mo_Heidarzadeh/status/1068991587768836097/photo/1



All from: <https://www.ktuu.com/content/news/BREAKING-Massive-earthquake-shakes-Alaska-501647481.html>

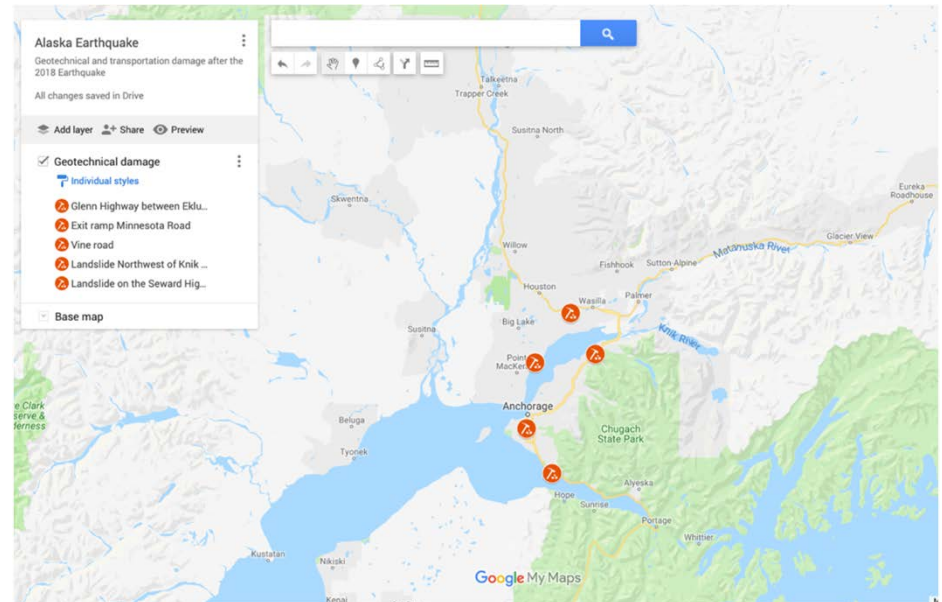
A preliminary list of geotechnical-related damages (AK DOT)

- Bridge abutment failure
- Sinkhole
- Slope failure
- Road settlement
- Earth Retaining wall failure
- Minor liquefaction damage reported at residential building

[Spreadsheet on Google Drive](#)

Reference:

<http://dot.alaska.gov/earthquake2018/docs/Damage-Locations-earthquake2018updated.pdf>



Map on MyMaps

- <https://drive.google.com/open?id=1ICYq0G1SrS-P4dgZ0svJKoOxWpHdTzAu&usp=sharing>

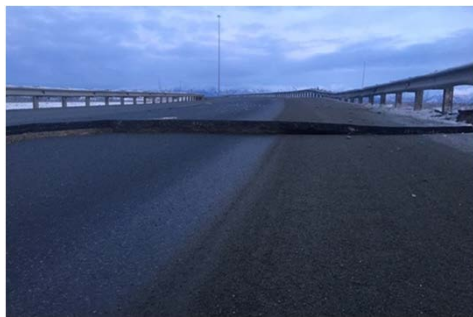


Topic #8: Transportation Networks (including roads)

VERT Immediate Response for:
Anchorage, Alaska M7.0 Earthquake



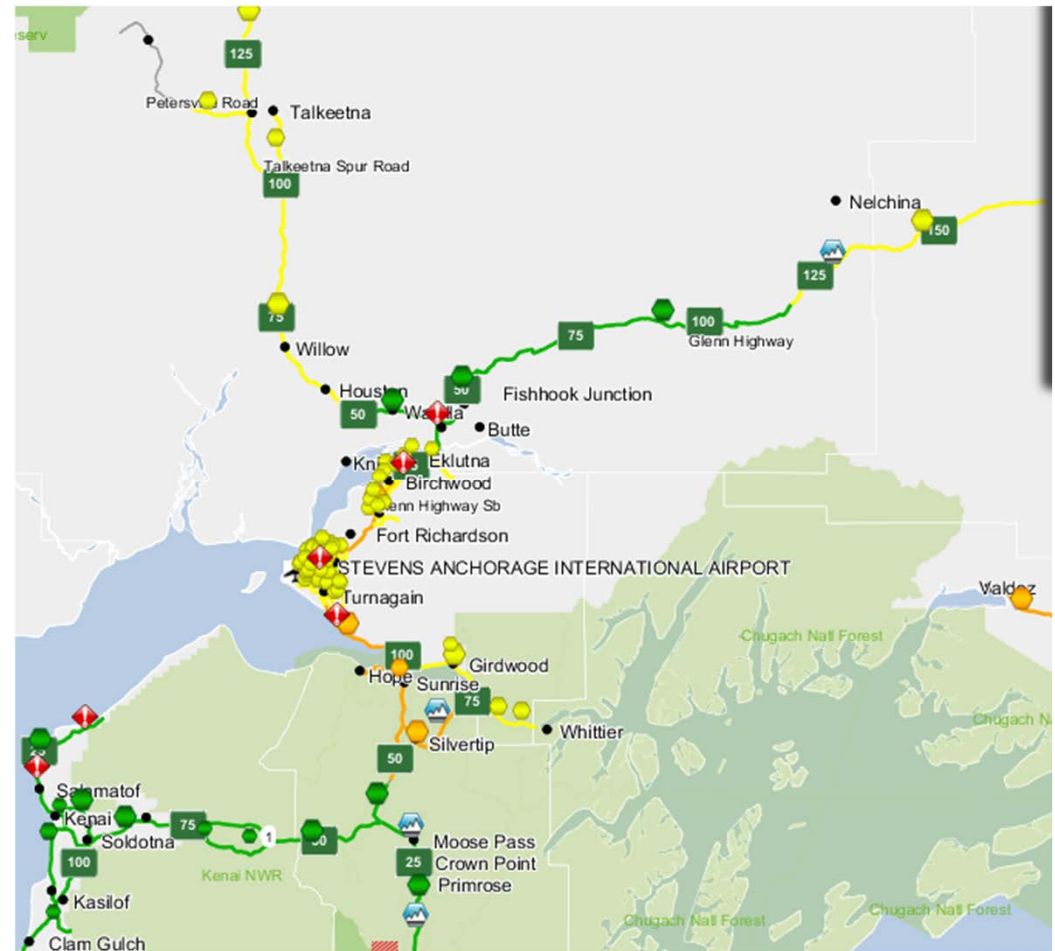
Overview & how it affected various regions



Photos: Alaska DOT&PF [Flickr page](#), [NBC News](#)

Alaska DOT has posted a roads condition map at 511.alaska.gov/alaska511/mappingcomponent/index.

The Anchorage area and Glenn Highway are illustrated in the map to the right. Click the thumbnail to enlarge.



Transportation network of Anchorage and nearby regions [Source](#)



Overview & how it affected various regions

Dec. 1, 2018 8:00 a.m. General Information ([Alaska DOT](#))

- All DOT&PF Bridge inspectors are now in Southcentral Alaska and are conducting technical bridge inspections this morning.
- DOT&PF Maintenance and Construction crews are now actively working the eight major damage sites. Aftershocks are continuing to contribute to settling and additional cracking.
- DOT&PF has documented over 40 damage sites on transportation infrastructure.

Glenn Highway

Glenn Highway North Bound Eagle River Bridge: Highway is closed, but detour is available through Eagle River. Construction crews are actively working on restoring the approaches.

Mirror Lake/Thunderbird Falls: Slope failure on both sides of the highway. AFTERSHOCKS AND SETTLING ARE EXPANDING THE DAMAGE TO DRIVING LANES. Detours are slow. Construction crews are actively repairing slope failures.

Parks/Glenn Interchange: Off-ramp toward Palmer is closed. Use Trunk Road detour via the Parks Highway to access Palmer. Construction crews are actively working to restore the approach/abutment.

Seward Highway

Seward Highway MP 104-114: Rock fall continues in this area with continuing aftershocks and settling. DOT&PF recommends avoiding the area unless travel is absolutely necessary.

Parks Highway

Parks / Glenn interchange has major damage. Off-ramp toward Palmer is closed. Use Trunk Road detour via the Parks Highway to access Palmer.

Bridges and roadways clear from Talkeetna north. All of Parks Highway is passable.

Kenai Spur Highway

Damage at 35.1 and 35.7. Crack in road 150' by 8" wide. Road is passable. Damage at MP19.7. 500' long by 4" wide, still passable. Maintenance crews are actively repairing these sites.



Overview

Inspections:

- The Alaska Marine Highway System inspected terminals and no damage was reported.¹
- The Whittier Tunnel was also inspected and found to be in good shape.¹
- No significant bridge damage has been reported. Alaska bridges are design for seismic activity²

Airport:

- A state official says Ted Stevens Anchorage International Airport is open and operating at reduced capacity with delayed flights following earthquakes and aftershocks.³
- Airport inbound flights were put on hold for a few hours after the earthquake.
- Alaska transportation and public facilities spokeswoman Meadow Bailey said Friday that no injuries were reported at the airport but light fixtures, water pipes and windows broke in the shaking.³

Port of Alaska:

- The earthquake damaged several dock lights and overhead power lines that have been repaired. Inspectors confirmed that the dock cranes and other equipment are ready for regular operation.⁴
- The general cargo docks and trestles have all been inspected and are safe for regular shipping operations.⁴
- There are reported minor expansion joints damage



Roadways damage

The ROADS impacted are as follows (ktuu.com):

Glenn Highway: As of 9 p.m., Glenn Highway is open in both directions, though there are still delays and detours. Detours will continue through the weekend. DOT says to stay off the roads unless necessary.

Seward Highway at Milepost 112 - Highway has been reopened

Glenn Highway - Near the Eklutna exit, a massive sink hole opened up in a wooded area off the highway. Part of the road was impacted. Tractor Trailers or semi-tractor trailers with doubles headed into Anchorage will be stopped prior to Mirror Lake.

Northbound Eagle River Bridge - Damage to the bridge is causing some inaccessibility issues. Avoid this area. There are detours

Knik River Bridge Periodic closures, according to DOT at 3:32 p.m.

Vine Road - A stretch of Vine Road was severely damaged with the road becoming destroyed and uneven from the quake. (Photo below)

Kenai Spur Road at Milepost 35-39 and Milepost 19 - Road remains partially open, but the surface is damaged. DOT says it is passable but advises caution.

Minnesota and International Airport Road off ramp - Damage to the bridge is causing some inaccessibility issues. Avoid this area.

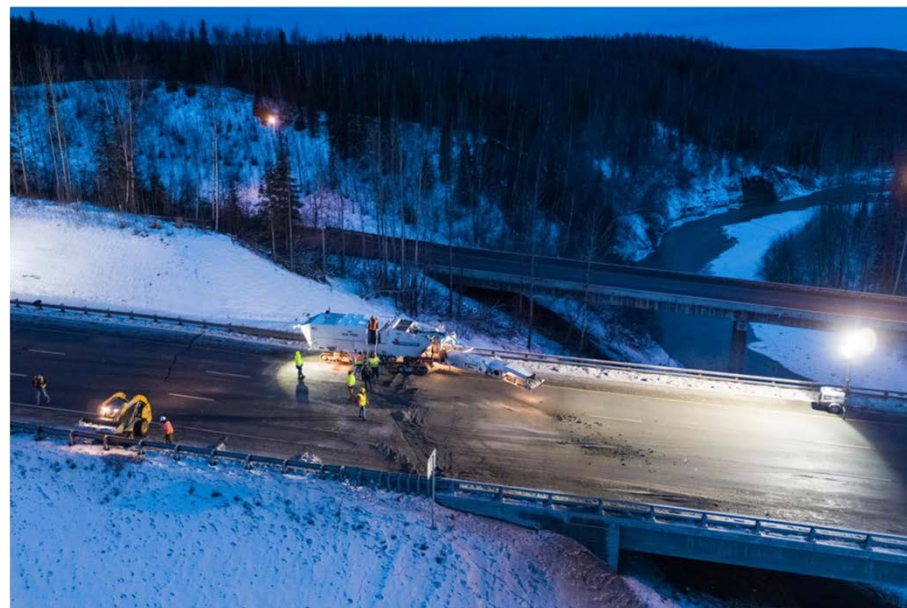
New Seward and 36th Avenue - Damage to the road, avoid the area.

Dimond at Minnesota - Detours

Dowling at C Street - Detours

Eagle River Loop Rd. at Mills Bay Dr. - Detours

Point Mackenzie Road - Damage near Mile 1 - road is still passable, according to Deputy Director of Emergency Services Ken Barkley.



Glenn Highway and Eagle River Bridge ([Source](#))



Bridges and Tunnels

Public Facilities
Yesterday at 5:52 PM · 🌐

#AlaskaEarthquake: Construction crews have reopened the [Northbound Eagle River Bridge](#) to two lanes of traffic. The third (left) lane will remain closed for repairs. Please be aware there is still a bump that will be resurfaced in the upcoming weeks. Speed limit is 45 mph. Thank you for your patience.



Water main that failed under the pedestrian tunnel just to the north of Briggs Bridge over Eagle River
[Source1](#), [Source2](#)



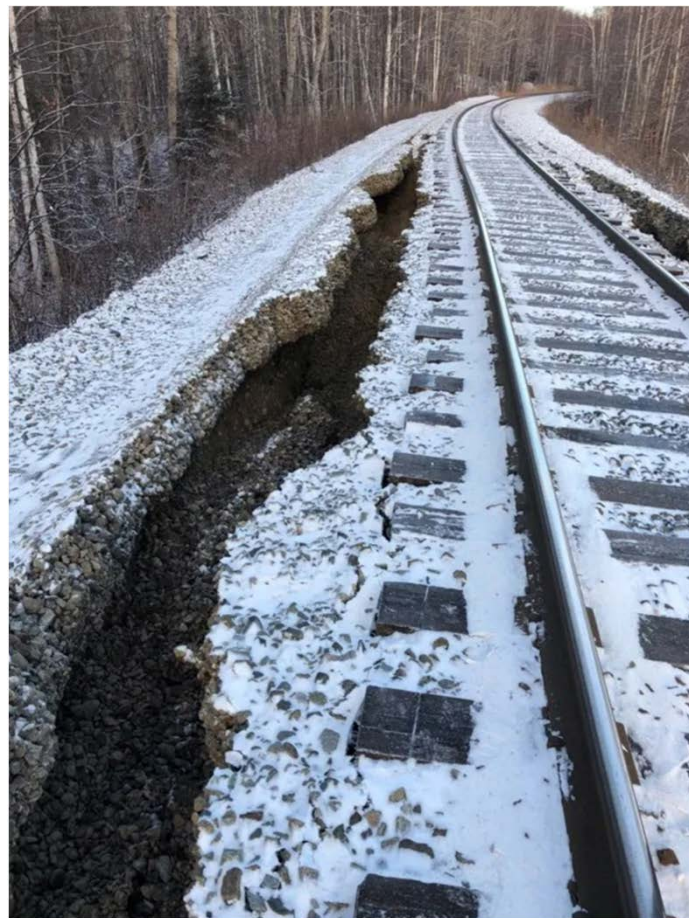
Eagle River Loop Road Bridge is closed. Glenn Highway Northbound Eagle River Bridge has one lane closed with speed reductions. Reported damage includes cracks in both substructures (e.g. abutments), superstructures (e.g. girder), retaining walls, foundation settlement, ([Source](#))



Railroad Damage

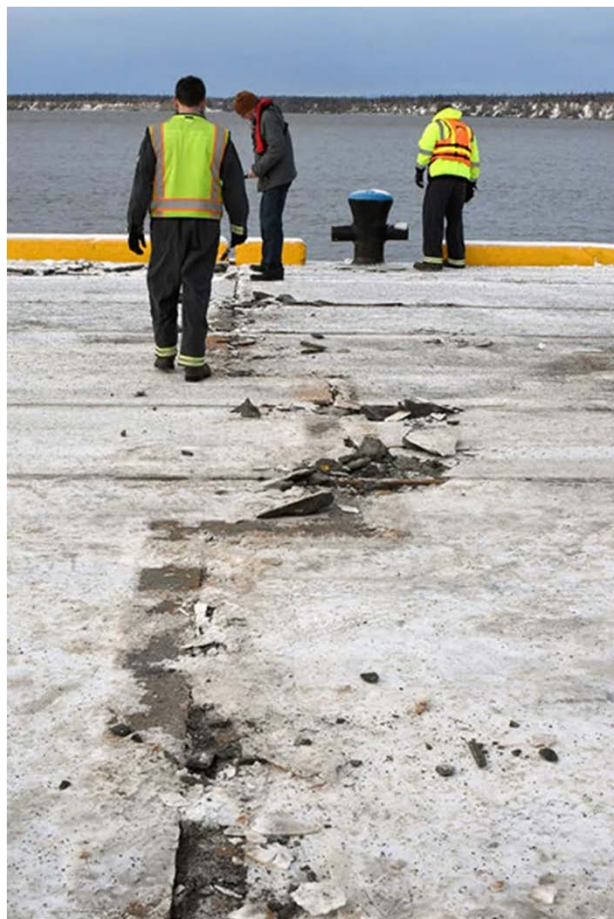
- Railroad spokesman Tim Sullivan said Saturday there are three areas north of Anchorage that are impassible and preventing trains from making the trek between Anchorage and Fairbanks. The trip is 350 miles each way.
- Cracks up to 4 feet wide and 150-feet long have been found on either side of the tracks near Nancy Lake, about 45 miles north of Anchorage. The damage was caused by ground shifting, cracking or sloughing.
- Heavy equipment will be used to repair the tracks over the next few days. However, a complete inspection of the track and bridges hasn't been completed, so Sullivan said officials do not know when rail service to Fairbanks will resume.
- Train service south of Anchorage is scheduled to resume Sunday. Work also continues to clean up extensive water damage the railroad's operation center in Anchorage.

Source: (ktuu.com)





Port Damage



Minor Damages in [Port of Alaska](#)



Links to key media articles discussing Transportation Networks



Federal Highway Admin ✓
@USDOTFHWA

Follow

The U.S. Department of Transportation's Federal Highway Administration today announced the immediate availability of \$5 million in quick release Emergency Relief funds to help begin repairs on roads and bridges damaged by yesterday's earthquake in Alaska.

5:00 PM - 1 Dec 2018

List of Road Damages by KTUU:

<https://www.ktuu.com/content/news/List-of-closures-caused-by-Anchorage--501659691.html>

Photo Slides from Earthquake Damages by Anchorage Daily News:

<https://www.adn.com/alaska-news/2018/12/01/it-will-be-in-the-millions-of-dollars-earthquake-damage-assessments-other-info-for-saturday/>

'Severe delays and detours' on inbound Glenn Hwy as officials recommend working from home:

<https://www.ktuu.com/content/news/Severe-delays-and-detours-on-inbound-Glenn-Hwy-as-officials-recommend-working-from-home-501726981.html>



Topic #9: Other buildings damage

VERT Immediate Response for:
Anchorage, Alaska M7.0 Earthquake



Overview & and how it affected various regions

- “No reports of widespread catastrophic damage or collapsed buildings” source: AP News
- “The Anchorage Fire Department responded to four structure fires as a result of the quake, according to City Hall, and two reports of structure collapse are being investigated. No deaths have been reported.” source NYTimes (<https://www.nytimes.com/2018/12/01/us/anchorage-alaska-earthquake.html?action=click&module=News&pgtype=Homepage>)
- “A lot of drywall cracks and fallen ceiling tiles, but not major structural damage” Anchorage Daily News
- Most damage seems to be infrastructure: roads, lifelines
- Some superficial and non-structural damage was observed: partitions cracking and falling down, windows, ceilings and lighting
- Strong building codes likely prevented damage - and lessons learned from 1964 earthquake
- Large amounts of non-structural damage at the KTVA newsroom
- One collapse: Eagle River home



Overview & and how it affected various regions

- Primary damage in buildings is non-structural, heavier in older buildings and more cosmetic in newer buildings.
- Non-structural damage range from light cosmetic to water/sprinkler system/tanks and piping failure and flooding. Floor acceleration related bookcase and cabinet failure are widespread in all types of buildings. None of these appeared to have any strapping system. False ceiling panel failure is common in many buildings. In older buildings, ceiling railings insufficiently supported. Floor acceleration related heavier ceiling panels fell off although the metal railing system is totally intact.



Anchorage Building Code

- IBC /ASCE7
- Seismic design category D,
- Site Class B
- Spectral acceleration for MCE under short period: $S_s = 1.5g$
- Spectral acceleration for MCE under 1s period: $S_1 = 0.55g$
- Additional provisions and amendments:
 - AO 2015-127
 - AO 2016-52

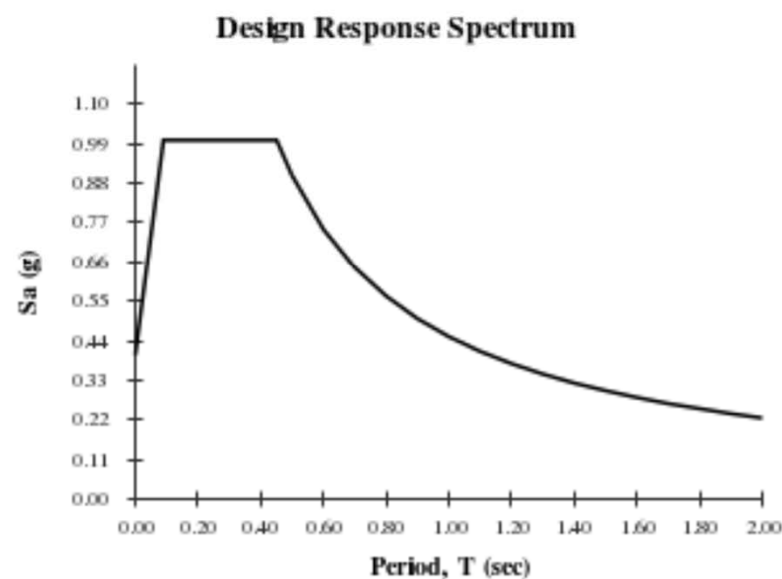
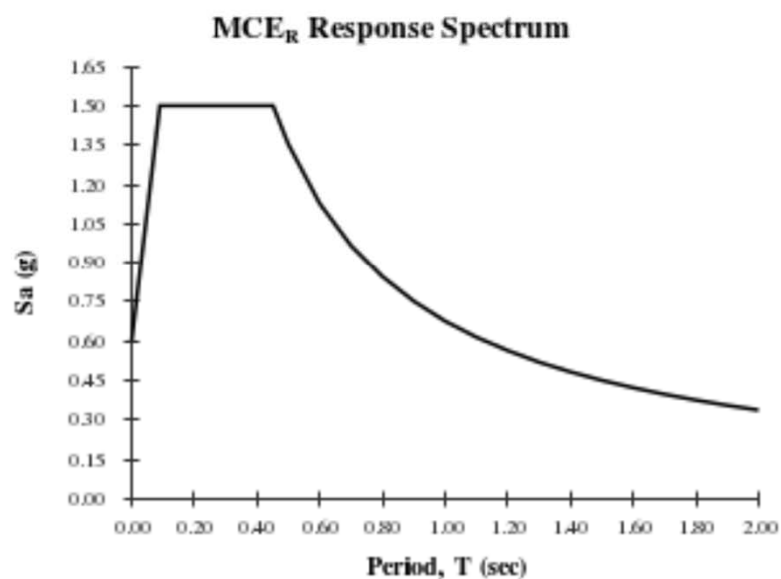


ASCE 7 - MCE and DBE Spectrum

USGS-Provided Output

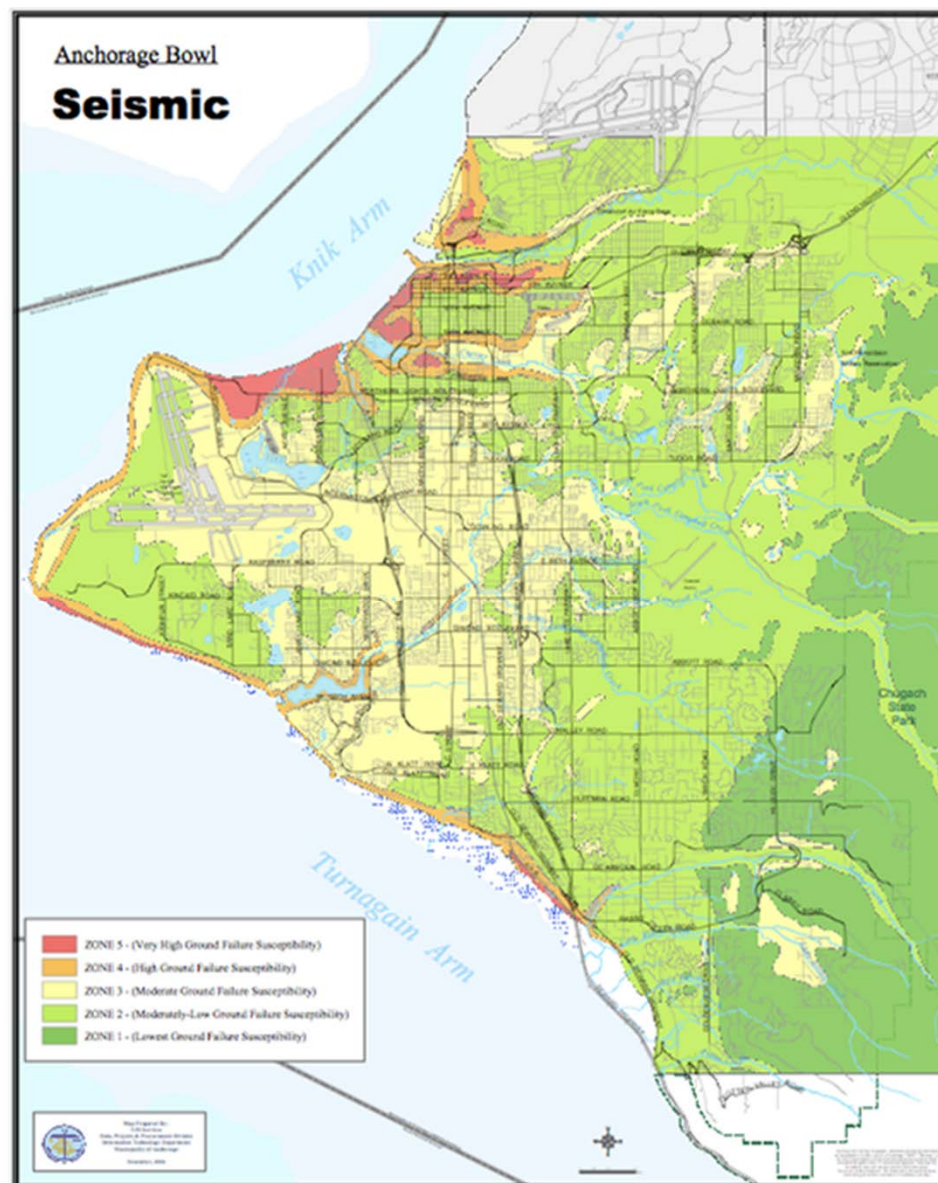
$S_s = 1.500 \text{ g}$	$S_{MS} = 1.500 \text{ g}$	$S_{DS} = 1.000 \text{ g}$
$S_1 = 0.676 \text{ g}$	$S_{M1} = 0.676 \text{ g}$	$S_{D1} = 0.451 \text{ g}$

For information on how the S_s and S_1 values above have been calculated from probabilistic (risk-targeted) and deterministic ground motions in the direction of maximum horizontal response, please return to the application and select the "2009 NEHRP" building code reference document.





Ground Failure Map





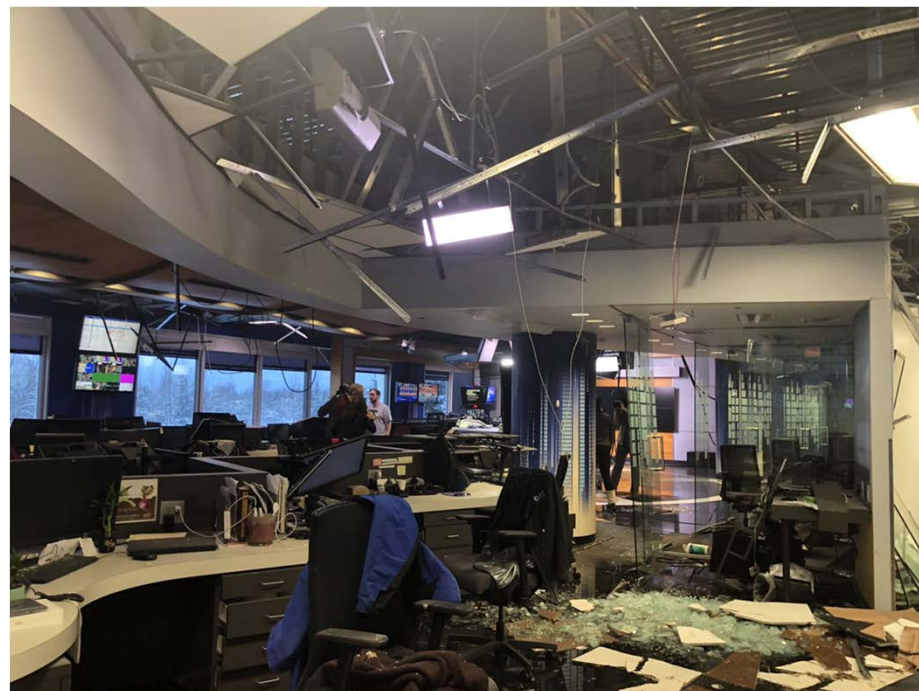
Non-structural Building Damage



Office building damage, Anchorage



Church caught fire, Fairview

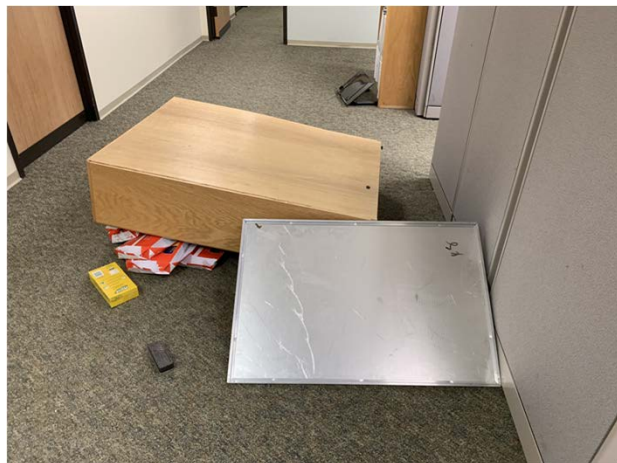


KTVA Newsroom



Atwood Building Sample Damage

Primarily non-structural. Building is yellow tagged.



There was also some water pipe failure and limited flooding on one of the floors



Eagle River Home Structural Damage



Partial collapse



Severe structural damage

Eagle river is 15 miles NE of Anchorage and closer to the epicenter of the earthquake



Links to key media articles discussing other building damage

- https://www.washingtonpost.com/science/2018/11/30/major-damage-tsunami-warning-issued-after-severe-magnitude-earthquake-alaska/?utm_term=.42ae624aabe2
- <https://www.apnews.com/75f4de6bdf7541a0a944e72c9e6edf18>
- <https://www.nbcnews.com/science/environment/depth-alaska-earthquake-likely-prevented-more-damage-saved-lives-n942471>
- <https://www.nytimes.com/2018/12/01/us/anchorage-alaska-earthquake.html?action=click&module=News&pgtype=Homepage>
- <https://www.adn.com/alaska-news/2018/12/01/inspections-underway-across-southcentral-alaska-for-structural-damage-after-earthquake-aftershocks/>

Building Code

- <https://www.muni.org/Departments/OCPD/development/BSD/Pages/Codes.aspx>
- https://library.municode.com/ak/anchorage/codes/code_of_ordinances?nodeId=TIT23BUCO



Topic #10: Schools

VERT Immediate Response for:
Anchorage, Alaska M6.7 Earthquake



Overview & and how it affected various regions

- ([KTUU - NBC](#)) Anchorage School District (ASD) status - Parents were asked to pick up students following earthquake as schools remained open. ASD will be closed Monday and Tuesday to assess facility damage (Closure extended until the following Monday on Dec 1). Buses used for evacuations first and then used to conduct normal routes ([Twitter](#)). Note that KTUU lists 4 shelter locations, none of which are schools.
- ASD states that all schools will be closed until further notice ([Twitter](#))
- ([Twitter](#)) Student evacuation/relocation
 - Eagle River High School students remained on site in buses
 - First Lake Elementary evacuated to MAC Center
 - Government Hill evacuated to AT&T
 - Russian Jack evacuated to East High
 - "Turnagain Elementary" evacuated to Lloyd Steele Park
- All Anchorage schools will be closed for the next week while the district fixes widespread damage and most schools in the Matanuska-Susitna Borough School District will be closed Monday and Tuesday([Anchorage Daily News](#))
- All damage seems to be non-structural but heavy. Confirmation needed from field team.



Overview & how it affected various regions



([Hawaii News Now](#)) Dimond High School - suspended ceilings and building contents



([Twitter](#)) Damage to school floor - school name not yet identified



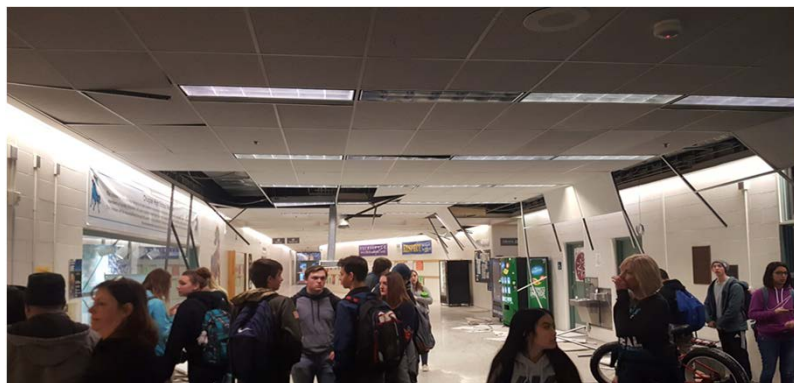
([Anchorage Daily News](#)) Damage to cinder block wall (non-weight bearing) and ceiling at King Tech High School



Overview & how it affected various regions



([Twitter](#)) Chugiak High School - damage to suspended ceilings



([Anchorage Daily News](#)) Failure of ceilings in some classrooms at Hanshew Middle School



([Twitter](#)) Bartlett High School

([Twitter](#)) See Video - damage to suspended ceilings, school unidentified



Links to key media articles discussing Schools

- <https://www.ktuu.com/content/news/List-of-closures-caused-by-Anchorage--501659691.html>
- <http://www.hawaiinewsnow.com/video/2018/11/30/damage-alaska-high-school/>



Topic #11: Housing

VERT Immediate Response for:
Anchorage, Alaska M6.7 Earthquake



Overview & and how it affected various regions

- Building codes are quite followed and enforced in the City of Anchorage although sometimes follow-up is lacking. Thus, most Anchorage residential damage was non-structural.
- No permit requirement is in effect in Eagle River, Chugiak, Peter Creeks, and similar smaller cities and communities in the Anchorage Borough.
It appears that more serious damage is evident in those communities. EERI Field Team to confirm.



Residential Building in Eagle River damaged due to earthquake
<https://www.adn.com/alaska-news/2018/12/01/anchorage-fire-chief-how-to-look-for-serious-structural-damage-at-home/>



Collapsed Masonry walls

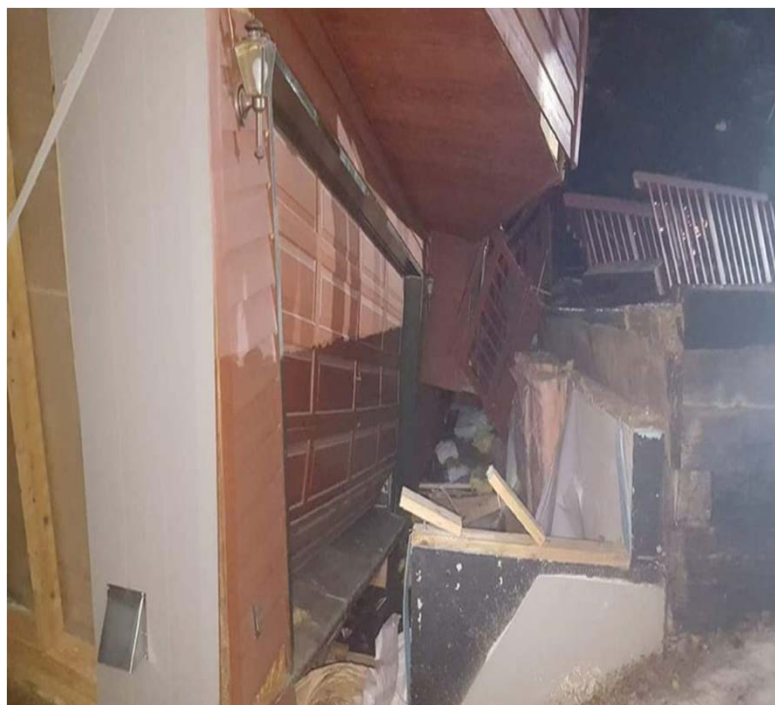


Collapsed Masonry Walls in Eagle River, Alaska

<https://www.adn.com/alaska-news/2018/12/02/the-day-after-alaskans-sweep-up-and-reflect-following-70-quake/#>



Partially collapsed two storey housing



Partially collapsed two story home on Dome Circle in Eagle River

<https://www.adn.com/alaska-news/anchorage/2018/12/03/eagle-river-couple-lucky-after-home-collapses-in-earthquake/>



Major and Minor Cracks



Both Major and Minor cracks were reported by residents at different locations

<https://twitter.com/hashtag/earthquake?src=hash>

<https://www.thealaskalife.com/blog/alaska-earthquake-damage-stats-photos-videos-of-the-aftermath/>

<https://www.usnews.com/news/news/articles/2018-11-30/alaska-surveys-damage-from-major-earthquakes>



Links to key media articles discussing Housing

- <https://www.nbcnews.com/news/us-news/earthquake-hits-alaska-triggering-tsunami-warning-n942256>
- <https://www.adn.com/alaska-news/2018/12/02/the-day-after-alaskans-sweep-up-and-reflect-following-70-quake/#>
- <https://www.adn.com/alaska-news/2018/12/01/anchorage-fire-chief-how-to-look-for-serious-structural-damage-at-home/>
- <https://www.bbc.com/news/world-us-canada-46403405>