Learning from Earthquakes Significant Event Report – VERT Kumamoto, Japan, 28th July 26- Version 1.0

Report Issued: 4th August 2026

Magnitude: **M_J 7.1 (JMA), M_w 6.8 (USGS)**

Depth (km): **10**

Location (Geographical): **Kumamoto City, Kumamoto Prefecture**

Location (Lat/Long): **32.682°N 130.722°E**

Time and date: **2026-07-28 07:27:15 AM (UTC)**

Faulting mechanism: **Shallow crustal – strike-slip**

Maximum Modified Mercalli Intensity: **8.5**

LFE programme interest: **High**

Virtual Earthquake Reconnaissance Team (VERT) Deployment: **Active**

Physical Mission Deployment: **Being Evaluated**

Tsunami alert issued: **Yes, cancelled shortly after no waves were recorded**

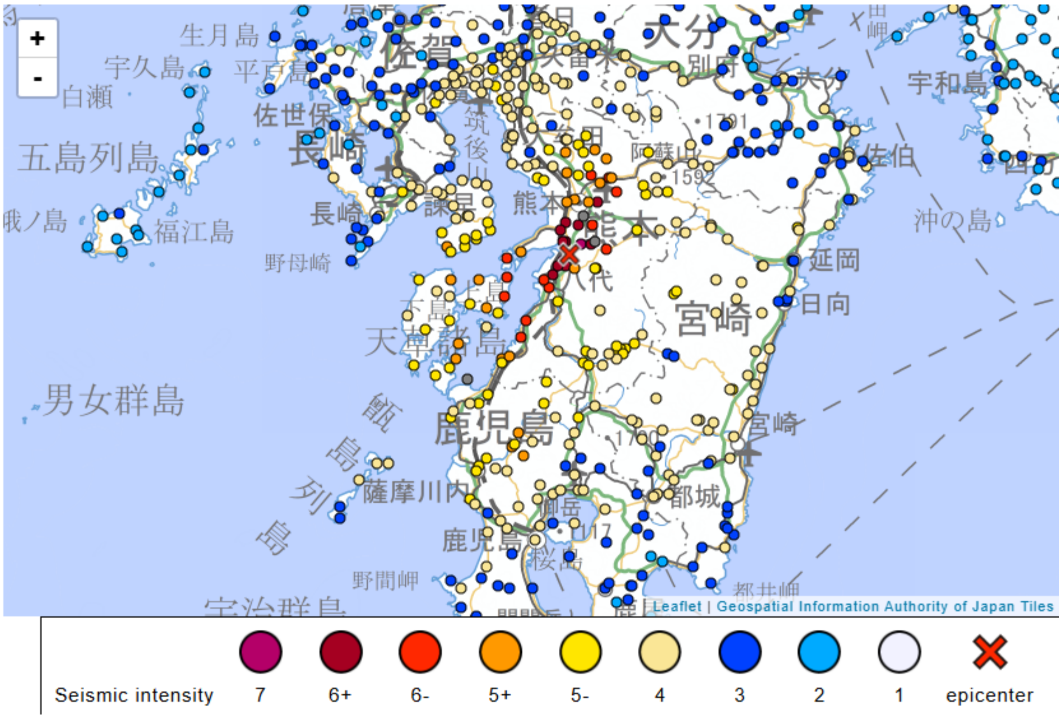

Figure 1. Epicentre Location and shaking intensity accessed[1]

[1] https://www.data.jma.go.jp/multi/quake/quake_detail.html?eventID=20260728163528&lang=en

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Virtual Earthquake Reconnaissance Team (VERT)

This report has been prepared through the voluntary contributions of the following team members:

Name	Company / Affiliation
Ananth Balachandra	Tonkin & Taylor
Ben Exton	Seismic shift
Chin-Long Lee	University of Canterbury
Di Du	Holmes
Dinesh Lakshmanan Chandramohan	University of Waikato
Jitendra Bothara	Resipro International Engineering Ltd
Vishvendra (Jay) Bhanu	Beca
Ke Jiang	University of Canterbury
Ken Yonamine	ENGEO
Kieran Haymes	WSP
Maja Sagaser	Beca
Melody Hong	Beca
Nikoo Hazaveh	Mott MacDonald
Pathmanathan Brabhaharan	WSP
Paulo Alves	WSP
Sean Han	WSP
Subrat Subedi	Tonkin & Taylor

For more information, you may use the link provided in the report. Additionally, the link to the VERT platform is included below for further reference, [VERT 2026 Kumamoto - Verified Sites (Beta)][2], as shown in Figure 2.

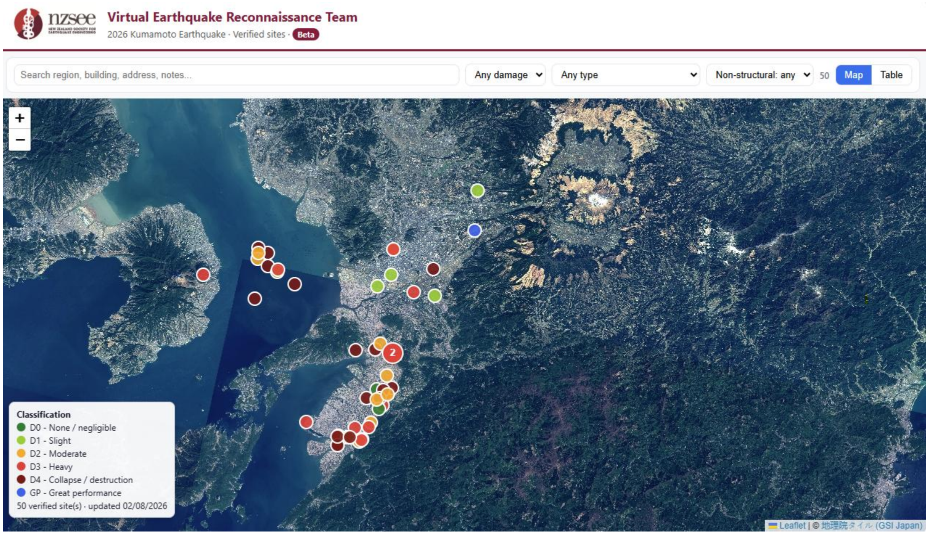

Figure 2. The VERT platform for the 2016 Kumamoto Earthquake

[2] https://www.seismicshift.nz/kumamoto-2026-public/

Introduction

This report presents the findings of a Virtual Reconnaissance conducted by the Learning from Earthquakes (LfE) group of the New Zealand Society for Earthquake Engineering (NZSEE) following the magnitude 6.8 earthquake that struck Kumamoto Prefecture, Japan, on 28th July 2026. The magnitude (Mw) 6.8 shallow strike-slip occurred 5 km east of Uto City at a depth of 10 km. The earthquake affected multiple municipalities across the prefecture, including Kumamoto City, Yatsushiro, Uki, Misato, Mashiki, and Hikawa, and caused widespread disruption to residential areas, public infrastructure, transportation networks, and essential services.

This report highlights observations made during the first week following the event, noting that the disaster was still unfolding at the time of writing. Search-and-rescue operations were ongoing and confirmed casualty figures continued to rise as access to damaged structures improved. Although Japan maintains robust disaster-response systems, early information was fragmented due to lifeline outages, communication disruptions, and the scale of damage across affected communities.

The report has been prepared within a three-day timeframe using the information and resources currently available. The initial findings presented here rely on publicly accessible sources, including official prefectural reports, satellite imagery, social media content, and other online resources used for geolocation and damage observation. These findings should therefore be regarded as preliminary and subject to revision as additional data, further research, and on-the-ground observations become available in the coming weeks and months.

Social impacts

The Kumamoto earthquake caused a sharp and immediate disruption to daily life, leaving communities grieving 120 casualties, including 34 deaths. Rescue operations continued at severely damaged sites such as the Nippon Paper Yatsushiro Plant and Aeon Mall Kumamoto, while residents coped with widespread fear and uncertainty. More than 9,450 people were displaced into 406 evacuation centres, where families faced overcrowding, loss of privacy, and separation from their normal support networks. Lifeline failures—especially electricity outages affecting nearly 19,000 households and 108,100 households without water—made communication difficult and heightened anxiety across the region[3].

Public services, schools, transportation, and healthcare systems were heavily strained. Damage to government offices slowed relief coordination, while school closures interrupted education for thousands of students. Severe railway and bus disruptions limited mobility, isolating communities and complicating access to workplaces, supplies, and medical care. With more than 100 medical facilities and 580 elderly care facilities affected, vulnerable populations experienced significant stress, including multiple hospital evacuations[2]. Elevator entrapment information: 32 cases of entrapment occurred (29 in Kumamoto Prefecture, 1 in Kagoshima Prefecture, and 2 in Fukuoka Prefecture), and all individuals were successfully rescued[4]. Overall, the earthquake created a broad social crisis that will require sustained community support and long-term recovery efforts.

[3] Kumamoto Earthquake Response Report
[4] https://www.mlit.go.jp/common/002014836.pdf

Seismotectonic setting and recent earthquake history

The seismotectonic of Japan and surrounding areas are characterised by the interaction between the North America plate, Pacific plate, Philippine Sea plate and the Eurasia plate (Figure 3). Off the north-east Pacific coast of Japan, the Pacific plate subducts beneath the North America plate at an estimated rate of approximately 80 to 90 mm/ yr (USGS, 2026[5], Mukunoki et al., 2016[6]) with the seafloor expression of the boundary expressed along the Kuril-Kamchatka and Japan trenches. Towards south-west Japan, the Philippine Sea plate subducts beneath the Eurasia plate at an estimated rate of approximately 48 to 65 mm/ yr with the seafloor expression of the boundary expressed along the Nankai and Ryukyu trenches (USGS, 2026).

The relative plate motion is reasonably fast moving. For context, the Pacific plate subducts beneath the Australian plate at an estimated rate of approximately 40 mm/ yr along the Hikurangi subduction off the east coast of North Island, New Zealand. While the relative plate motion is primary accommodated at the subduction zones, the relative movement is also accommodated through active shallow crustal faults within the overriding plate across Japan.

The current fault is considered to have occurred on the southwest-northeast trending strike-slip of the Futagawa-Hinagu fault zone system comprising of Hinagu fault to the south and Futugawa fault to the north[7]. The current rupture may have occurred adjacent to and south of the rupture that occurred in 2016.

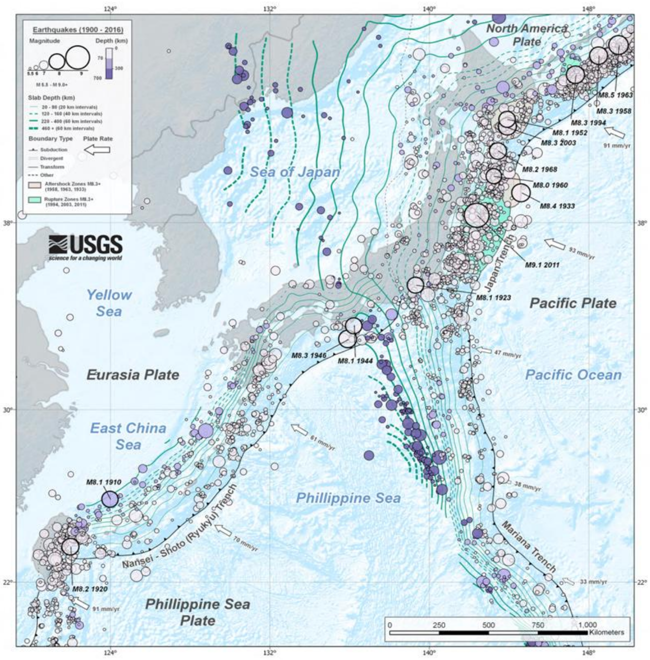

Figure 3. High-level tectonic setting of Japan and surrounding areas accessed on 2 August 2026 from https://earthquake.usgs.gov/earthquakes/eventpage/us6000tgb9/region-info.

[5] U.S. Geological Survey (2026). M 6.8 – 2026 Uto, Japan Earthquake. Accessed on 2 August 2026 from https://earthquake.usgs.gov/earthquakes/eventpage/us6000tgb9/region-info

[6] Mukunoki, T., Kasama, K., Murakami, S., Ikemi, H., Ishikura, R., Fujikawa, T., ... & Kitazono, Y. (2016). Reconnaissance report on geotechnical damage caused by an earthquake with JMA seismic intensity 7 twice in 28 h, Kumamoto, Japan. Soils and foundations, 56(6), 947-964.

[7] Hallo, M.; Asano, K.; Gallovič, F. (2017). "Bayesian inference and interpretation of centroid moment tensors of the 2016 Kumamoto earthquake sequence, Kyushu, Japan". Earth, Planets and Space. 69 (1) 134. Bibcode:2017EP&S...69..134H. doi:10.1186/s40623-017-0721-4

Previous Earthquakes in the region

Figure 4 shows the previous earthquakes in the region since the 1600s, including the 2016 Kumamoto earthquakes, in April 2016.

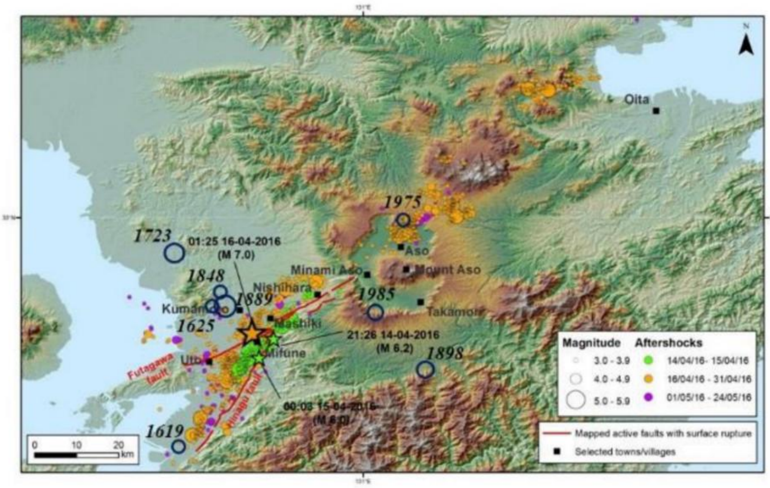

Figure 4. Location of the earthquakes, and their magnitude (Mw) taken from data published by the JMA [4]. Major historical earthquakes occurred in Kumamoto Prefecture[8,9] (from Usami [8]) are also reported for completeness (after Chiaro et al, 2017)

Geological and Geomorphological History

Topography

The topography of the area is shown in Figure 5, which shows the flat coastal strip where the epicentre was located, and the rugged hills and the volcanic terrain to the east. The topographical context indicates where liquefaction and landslides may have occurred in the earthquake.

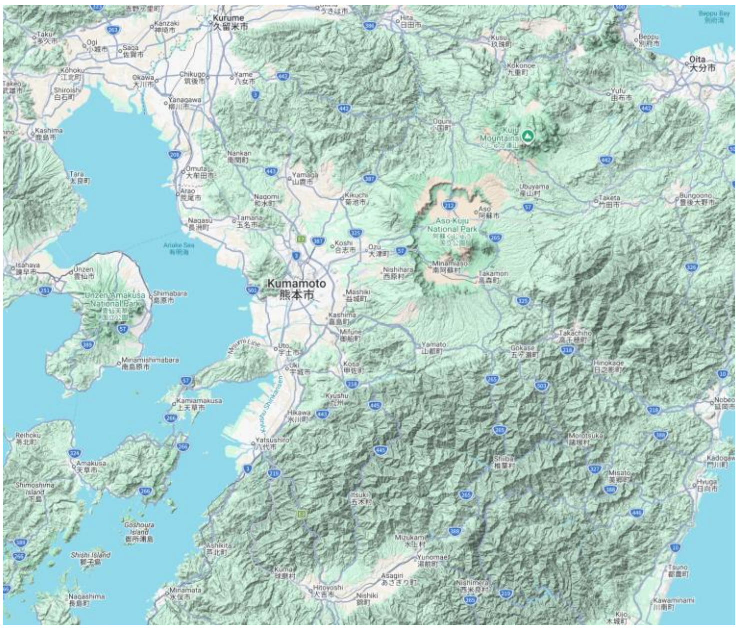

Figure 5. Topographical context of the earthquake.

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[8] Usami T (1987). "Materials for comprehensive list of destructive earthquakes in Japan". University of Tokyo Press, 434 pp. (in Japanese).

[9] Chiaro, G, Alexander, G, Brabhaharan, P, Massey, C, Koseki, J, Yamada, S and Aoyagi, Y (2017). Report on Geotechnical and Geological aspects of the 2016 Kumamoto Earthquakes. Bulletin of the NZ Society for Earthquake Engineering, 50(3): 365-393.

Geology

The geology of the area is shown in Figure 5, which is taken from the 1:200,000 scale geology map produced by the Geological Society of Japan[10]. The volcanic rocks in the area around Minami Aso Township mainly comprise late Pleistocene non-alkaline felsic and mafic volcanic rocks, (ignimbrite, volcanic breccia and some basalt lava flows). Inside the caldera, most of the slopes are covered by volcanic pyroclastic soils (airfall deposits), ranging from a few metres to tens of metres in thickness. These soils are known to be sensitive to pore-water pressure changes and earthquake loading, and there have been numerous past studies on landslides in these materials[11,12,13].

The area affected by the earthquake sequence can be broadly split into three zones based on their contrasting geomorphology (Figure 6):

a. Inner caldera – comprising a series of active volcanic vents. The slopes in this area range from gentle angles (<10 degrees) on the lower slopes, to very steep (>60 degrees) upslope towards the vents. The gentler lower slopes are mantled in volcanic soils (including pumice), which can be many metres thick and underlain by pyroclastic deposits (ignimbrites) and lava flows. The upper slopes are typically formed in rock (lavas and ignimbrites) with a shallow (up to 10 metres thick) mantle of volcanic soil.
b. Shirakawa river valley – comprising a narrow break in the surrounding caldera outer wall on the south-western side, through which the Shirakawa River flows. The Futagawa Fault passes through this valley. The river has incised through the volcanic rocks forming a steep-sided gorge (up to 70 m in height) where it flows out from the caldera wall. The slopes on the southern side of the river are typically steep (>30 degrees to vertical) and formed in rock with a thin mantle of volcanic soil. The northern slopes comprise relatively gentle (5 to 20 degrees) alluvial terraces, slightly steeper fans (fluvial/debris flow) and steeper rock slopes (typically > 30 degrees slope).
c. Outer caldera and alluvial plains – the caldera rim comprise a series of steep (> 30 degrees) “scarp slopes” formed of rock with a thin mantle of volcanic soil, on the eastern side. The “dip” slopes on the western side of the rim are much gentler (< 30 degrees) formed mainly in deep volcanic soils. Further west towards Mashiki Township and Kumamoto City, the slopes become relatively flat and are formed mainly in alluvium.

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[10] GeomapNavi (2016). “Geological Society of Japan”. https://gbank.gsj.jp/geonavi/geonavi.php#latlon/11,32.91054,131.20368 (Accessed 14/5/2016).

[11] Paudel P, Omura H, Kubota T and Inoue T (2006). “Spatio-temporal patterns of historical shallow landslides in a volcanic area, Mt. Aso, Japan”. Geomorphology, 88: 21–33.

[12] Yang H, Wang F, Vilimek V, Araiba K and Asano S (2015). “Investigation of rainfall-induced shallow landslides on the northeastern rim of Aso caldera, Japan, in July 2012”. Geoenvironmental Disasters, 2:20.

[13] Chigira M and Suzuki T (2016). “Prediction of earthquake-induced landslides of pyroclastic fall deposits”. Landslides and Engineered Slopes. Experience, Theory and Practice – Aversa et al. (Eds). Associazione Geotecnica Italiana, Rome, Italy, ISBN 978-1-138-02988-0.

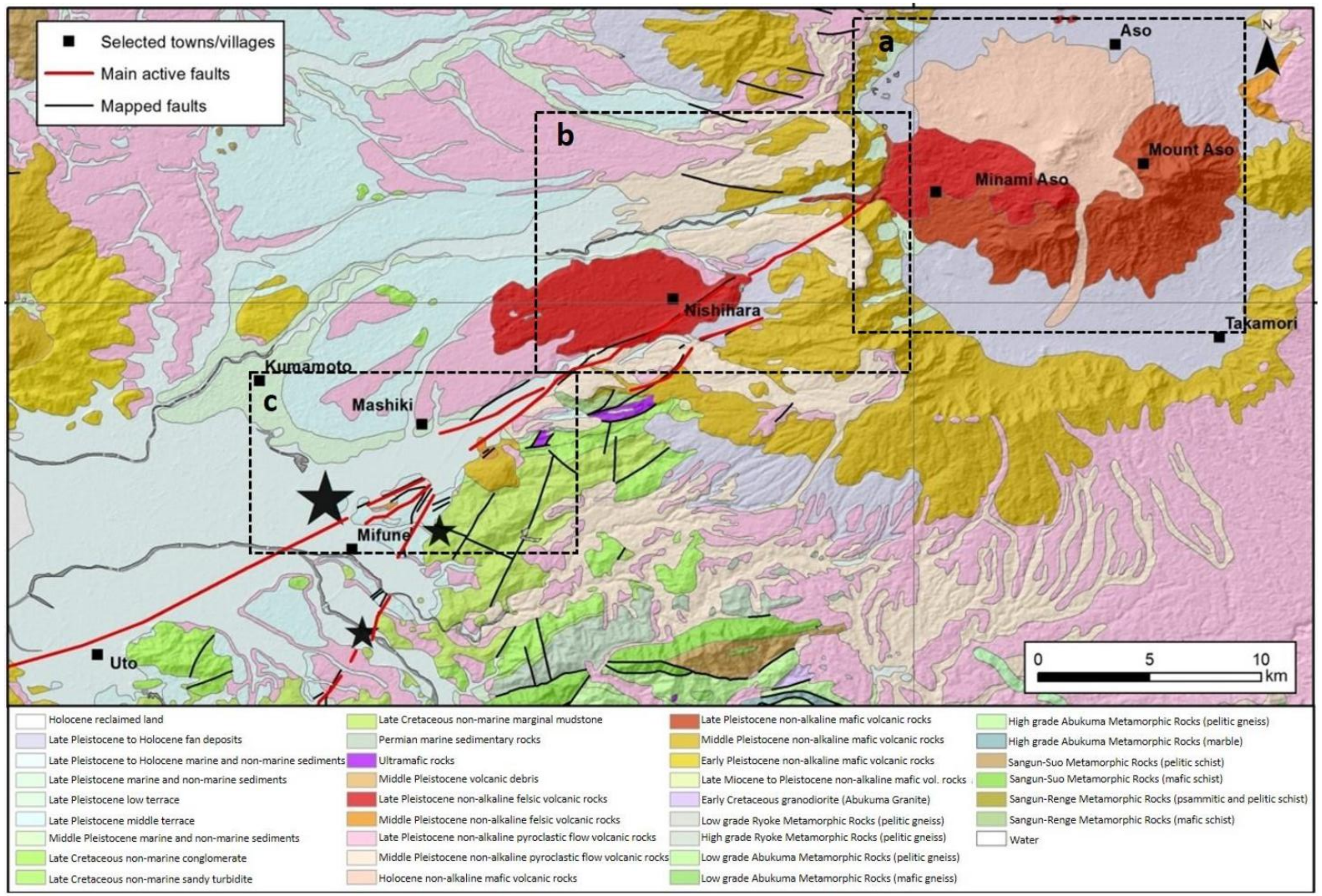


Figure 6. 1:200,000 scale seamless geology map of Kumamoto

Reconnaissance effort following 2016 Kumamoto earthquake

The location of the 28 July 2026 epicentre in relation to the April 2016 earthquakes in shown on Figure 7.

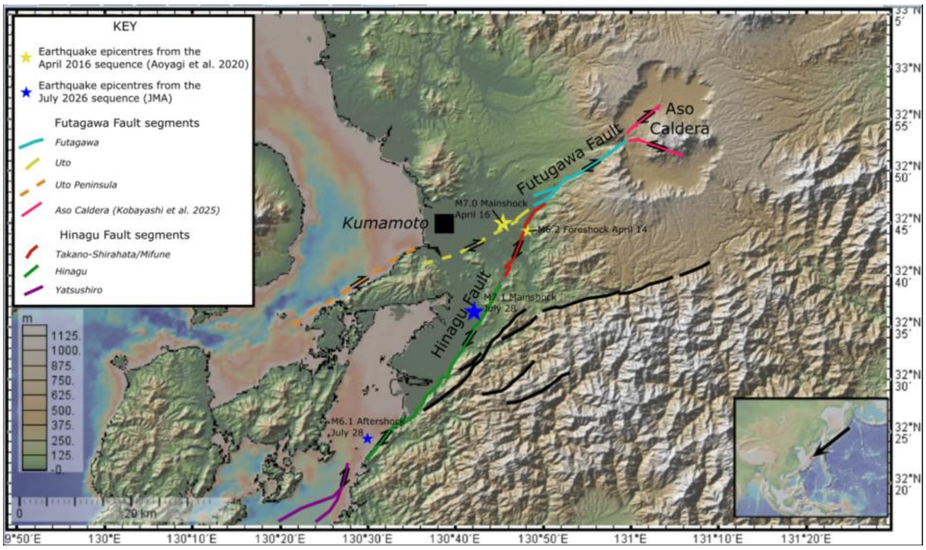


Figure 7. Location of the 28 July 2026 earthquake epicentre in relation to the 2016 earthquakes and related active faults[14]

The New Zealand Society for Earthquake Engineering sent a Learning from Earthquakes mission in May 2016 following the Magnitude Mw 6 to 7 Kumamoto earthquakes in 14-16 April 2016 (Chiaro et al, 2017). This team was focussed on geological, geotechnical and infrastructure damage. A follow up team went to Kumamoto with a focus on building structures.

Figure 8 shows the spatial distribution of shaking intensity and recorded ground accelerations during the 16 April 2016 Mw 7.0 Kumamoto earthquake (after Chiaro et al., 2017). A satellite-derived damage proxy map of Yatsushiro showing areas of potential ground damage is presented in Figure 9, with the regional geology map shown for comparison in Figure 9.

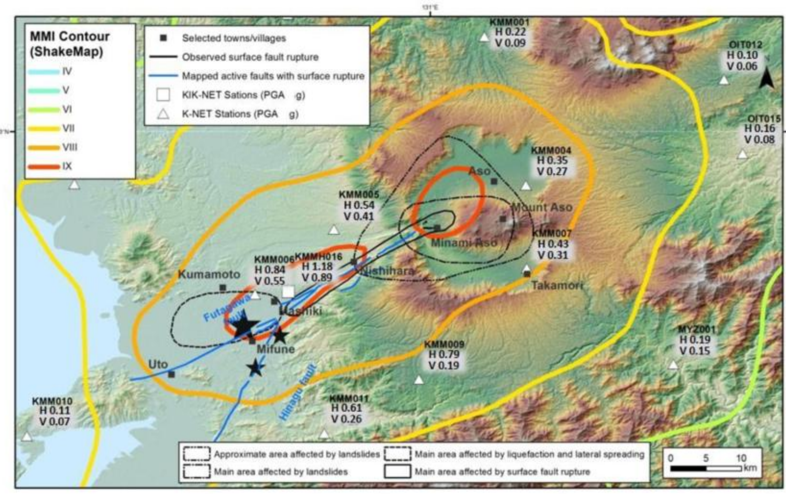


Figure 8. The isoseismal (Modified Mercalli Intensity, MMI) are taken from the USGS Shake Map. Strong motion station's locations are taken from KiK-NET and K-NET. The peak horizontal (H; single component) and vertical (V) ground accelerations (units are in g) shown are for the main Mw 7.0 earthquake on the 16

[14] https://en.wikipedia.org/wiki/2026_Kumamoto_earthquake

April 2016. The values are taken from the KiK-NET and K-NET strong motion network data. (after Chiaro et al,2017)

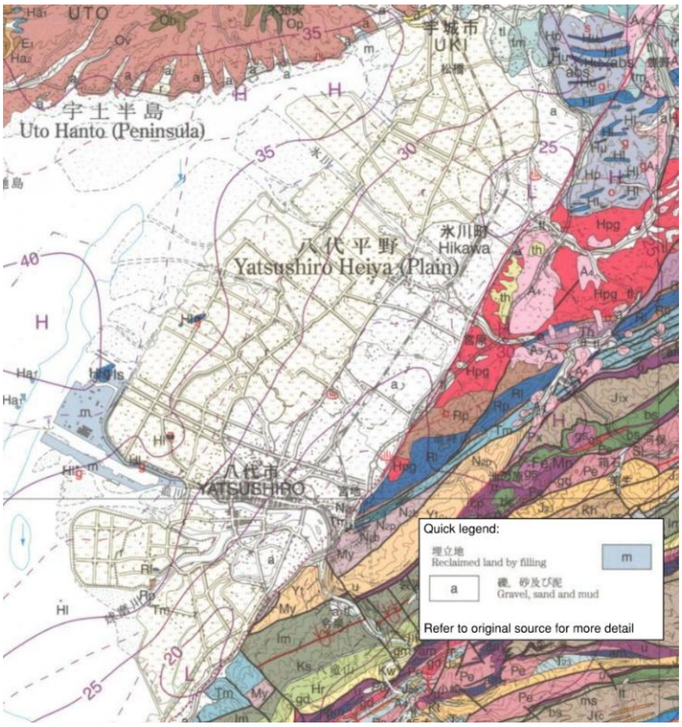


Figure 9. Regional geology of the Yatsushiro area, Kyushu, Japan (Sourced from: Geological Survey of Japan (GSJ), AIST (2010), Geological Map of Japan 1:200,000[15]). The low lying alluvial plain and reclamation areas were mainly impacted by liquefaction, with lateral spread towards the coast.

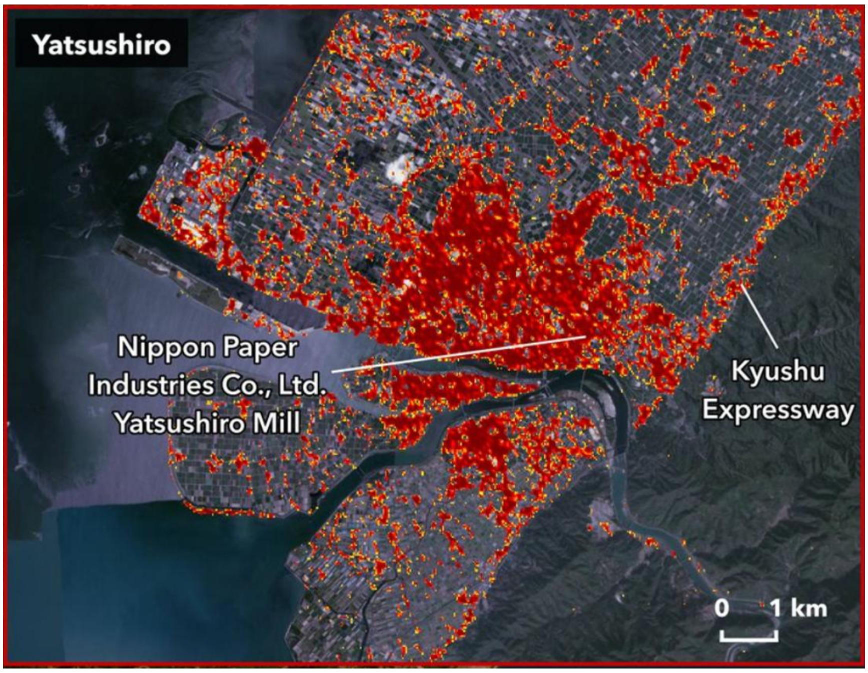


Figure 10. Satellite-derived damage proxy map of Yatsushiro following the 28 July 2026 Kumamoto Earthquake. Warmer colours indicate greater observed surface change. (Source: EOS-RS[16])

[15] Geological Survey of Japan (GSJ), National Institute of Advanced Industrial Science and Technology (AIST), 2010. Geological Map of Japan 1:200,000, Yatsushiro and a Part of Nomo Zaki (NI-52-12,18). Published by the Geological Survey of Japan, AIST, Tsukuba, Japan. Scale 1:200,000. Map sheet NI-52-12,18.

[16] Earth Observatory of Singapore, Remote Sensing Lab (EOS-RS), 2026. EOS-RS Damage Proxy Map: Kumamoto, Japan, Earthquakes, 29 July 2026 (v0.9).

Ground motion recordings

Figure 11 presents peak ground acceleration (PGA) based on network of K-NET and KiK-net strong motion stations[17], and Figure 12 shows the surface ground motion records at three selected stations closest to the epicentre. Of these monitoring stations, KMMH07 (epicentral distance of 14km), which recorded the highest peak acceleration, is located at a relatively competent site (Vs,30 > 750m/s), while the other two (KMMH14 and KMM008 located 6 and 10 km respectively from the epicentre) are located at soil sites. The response spectra for the ground motion recorded at these soil sites is shown in Figure 13.

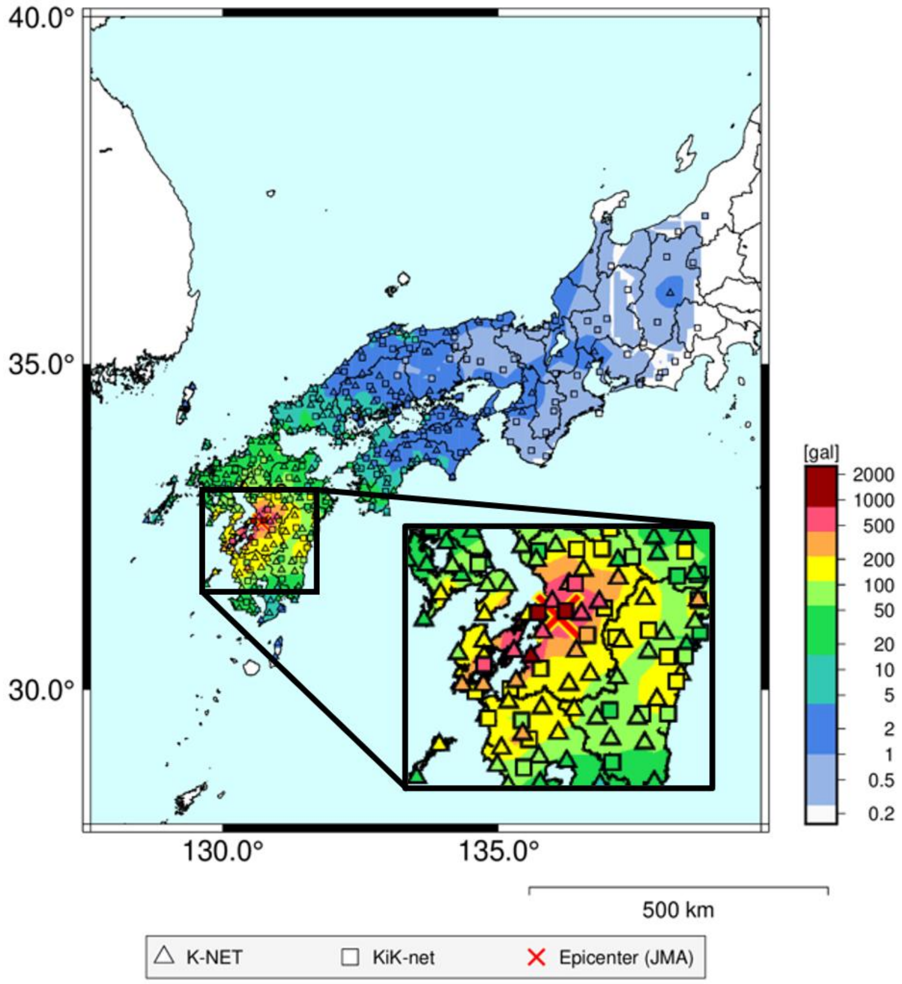


Figure 11 Estimated peak ground acceleration (gal/ cm s-2) based on network of KiK-net and K-NET stations.

[17] National Research Institute for Earth Science and Disaster Resilience (NIED). (n.d.). Download by Earthquake. Kyoshin Network (K-NET/KiK-net). Retrieved August 2, 2026, from https://www.kyoshin.bosai.go.jp/en/eqdownload/

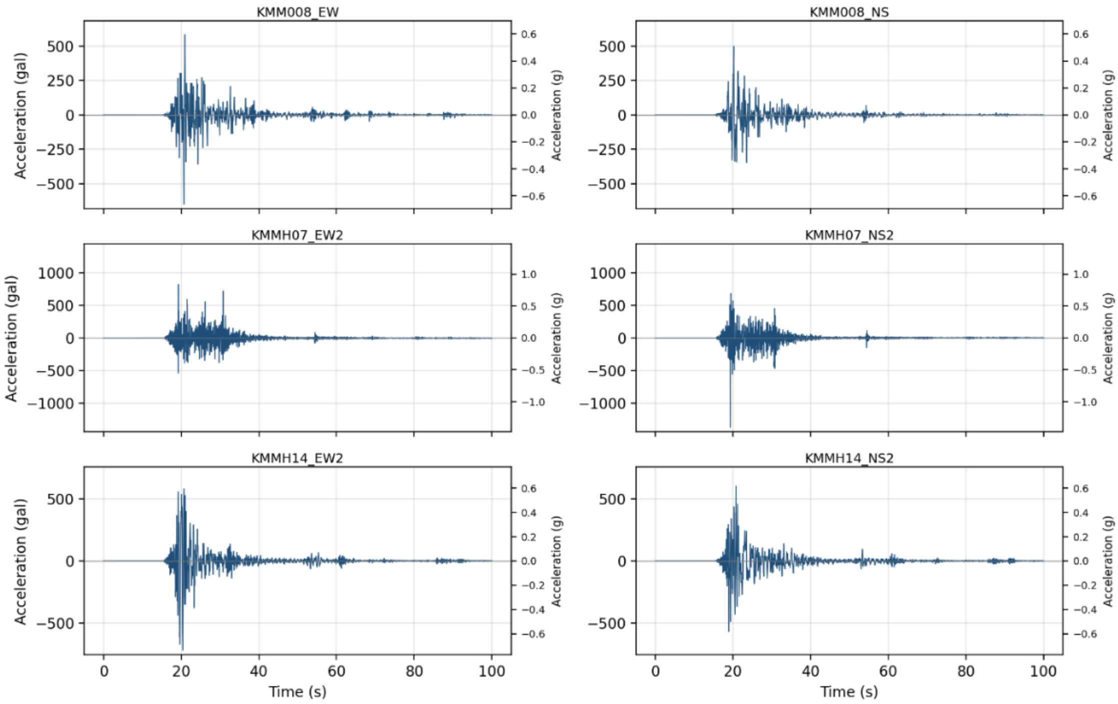


Figure 12. Ground motion records at selected stations[18].

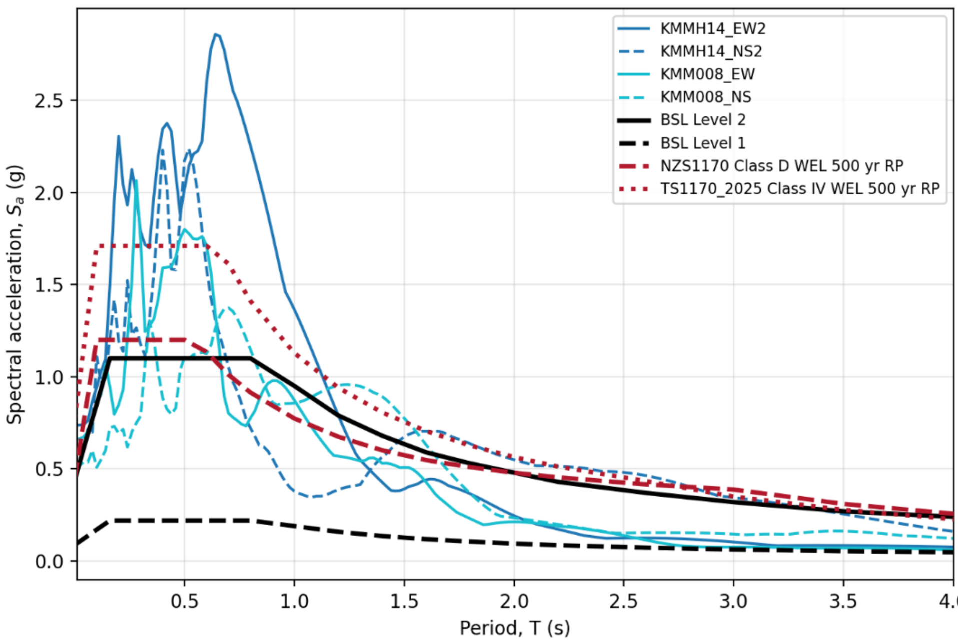


Figure 13. Comparison of the response spectra (damping = 5%) for the observed motion (soil sites KMM008 and KMMH014) agaist Japanese Building Standard Law (BSL) design spectra[19] and design spectra for Wellington (1 in 500 years event)

[18] National Research Institute for Earth Science and Disaster Resilience (2019) NIED K-NET, KiK-net, National Research Institute for Earth Science and Disaster Resilience. https://www.doi.org/10.17598/NIED.0004. First 100 seconds of the total 300s shown.

[19] Spectra calculated for Z=0.9 and medium soil site and is based on Notification No 1457 of the Ministry of Construction dated May 31, 2000. Here Level-1 represents spectra associated with 'rare' earthquakes (corresponding to a damage limit state) and Level-2 represents 'very-rare' earthquakes (corresponding to safety limit state).

Observed ground effects

Liquefaction and Lateral spreading

Liquefaction is reported to have occurred across a large area of southern Kumamoto Prefecture, including the municipalities of Kumamoto, Hikawa, Uto, and Yatsushiro. The low-lying areas in these regions are underlain by liquefaction-susceptible young alluvial deposits and reclamation fills, which are likely to have been triggered during the strong shaking. The liquefaction susceptibility map released by the USGS following the event is shown in Figure 14.

The full extent and severity of liquefaction-related impacts will become clearer as ground-based reconnaissance are undertaken. However, initial reports from social media and news outlets indicate evidence of surface manifestations, including sand boils and ejecta, at several locations such as Minami Ward, Yatsushiro Port (more information in following sub-sections), and Yamaha's manufacturing facility near the Yatsushiro port (refer Figure 15m Figure 24 and Figure 25). Some of these locations, including Yatsushiro Port were reported to have been damaged by liquefaction during the 2016 earthquake as well.

Furthermore, it is likely that liquefaction has contributed to some of the observed building and infrastructure damage within these affected areas, either directly through ground deformation or indirectly through loss of foundation support.

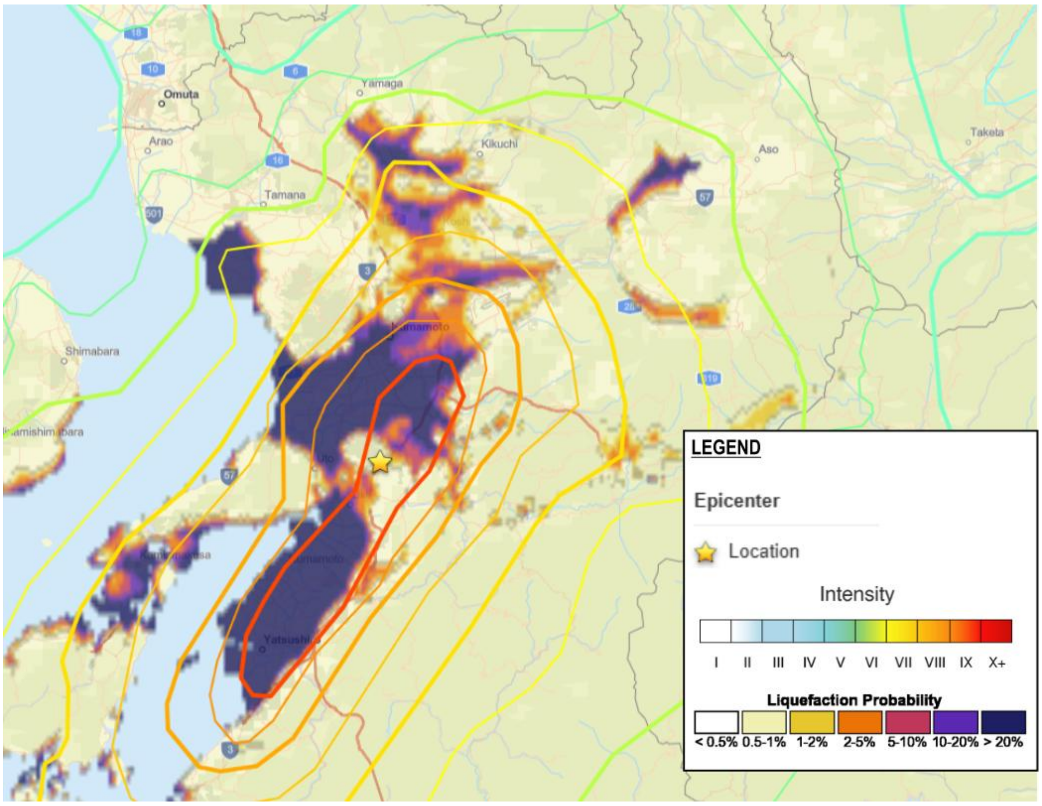


Figure 14. Liquefaction susceptibility map from USGS[20]

[20] U.S. Geological Survey, 2026. Ground Failure Summary for M 6.8 - 2026 Uto, Japan Earthquake. Retrieved 2nd August, 2026, from https://earthquake.usgs.gov/earthquakes/eventpage/attivjdk/executive

Figure 15 Sand ejecta (following liquefaction) observed at (a) Near 149-15 Tomiaimachi Sugijima, Minami Ward, Kumamoto[21] (b) Yatsushiro Castle[22] (c) & (d) Yatsushiro Port[23] (refer Figure 25 for aerial imagery)

Ground displacement (fault rupture, cracking, settlement)

Ground displacement was observed prominently in the Yatshusiro City as a result of the earthquake. Evidence of ground displacement were collected from a combination of established news sources and social media posts. Some were corroborated on the post-earthquake aerial photography or orthophotography supplied by the Geospatial Information Authority (GSI) of Japan. GSI's assessment of the ground displacements following the earthquake (using interferometric SAR data from ALOS-4 and ALOS-2 satellites) showed a relative horizontal displacement of approximately 1m and vertical displacement of approximately 50cm (Figure 16).

[21] Image retrieved on 28th July 2026 from https://x.com/jibansaigai/status/2082606320570757457/photo/2
[22] Image retrieved on 28th July 2026 from https://x.com/jibansaigai/status/2082774233416114575/photo/2
[23] Image retrieved on 28th July 2026 from https://x.com/jibansaigai/status/2082630199393591666

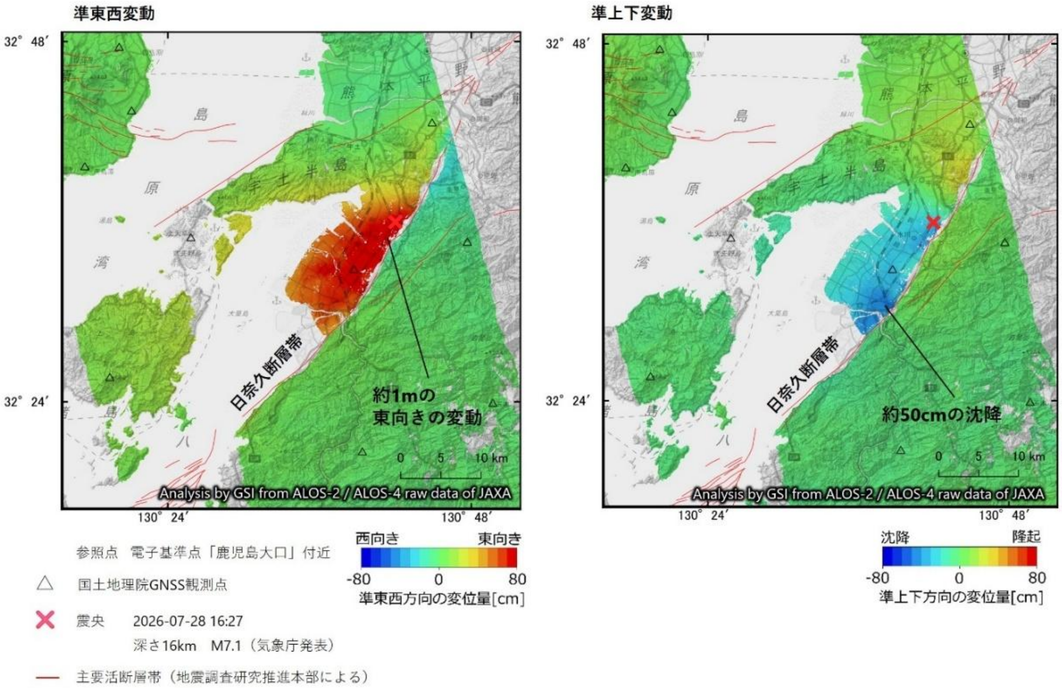


Figure 16. Displacements estimated from SAR interferometric analysis by Geospatial Information Authority of Japan showing east-west displacement (left image) and vertical displacement (right image)[24]

One of them of note was in the proximity of Kyushu Expressway overpass near Ohirayama Tunnel in Yatsushiro City. An aerial photography taken after the earthquake shows a set of cracks likely associated with the fault rupture running through a field onto the road. Note the vertical displacement of the road on the mountain side (Figure 17). This corresponds to area close to the maximum vertical displacement indicated in Figure 16.

Figure 17. (a) Vertical displacement in the Kyushu Expressway overpass in the foreground with cracks in the adjoining farm in the background[25], and (b) vertical displacement of the ground observed in the field (and looking up at the overpass)[26]

[24] Geospatial Information Authority of Japan, 2026. Retrieved on 2nd August, 2026 from https://www.gsi.go.jp/uchusokuchi/20260728kumamoto.html.
[25] Image retrieved on 31st July, 2026 from https://www.yomiuri.co.jp/slides/s/kumamoto202607earthquake/
[26] Still shot of video from All-Nippon News Network's official Youtube Channel. Retrieved on 31st July, 2026 from https://www.youtube.com/watch?v=To6BLXzJuhU.

Figure 18. Aerial photography for the case in Figure 17 [27]

A road crack on the Kyushu Expressway running parallel to the above cracks was also observed approximately 250 m away (Figure 19b).

a.

b.

Figure 19. a) A close up of the rupture in Figure 17 and 18[28] b) A crack by the Ohirayama Tunnel entrance, 150 m from the site at Figure 19a

More cracks were observed along the fault zone at Ryuho Primary School in Yatsushiro City, also running parallel to the Yashiro active segment, mere 260 m away from the fault (Figure 20a). The

[27] **Yomiuri Shimbun -** https://www.yomiuri.co.jp/topics/kumamoto2026eq/ (accessed 1 August 2026)
[28] **Mainichi Shimbun -** https://mainichi.jp/graphs/20260729/mpj/00m/040/011000f/20260729mpj00m040037000p (accessed 1 August 2026)

cracks run across the entirety of the school ground for approximately 50 m and is up to 50 cm deep (TV Kumamoto, 2026)

Minor ground cracks were observed as far as 90 km away from the epicentre at Miyanojo Middle School in Satusma District, Kagoshima (Figure 20b). The site however does not sit in the proximity of the Hinagu Fault.

a.

b.

Figure 20. a) Ground cracks at Ryuho Primary School[29] b) Ground cracks at Miyanojo Middle School[30]

Foundation-related damage

Reporting on foundation damage has been limited due to the presence of rubbles at most of the damaged buildings preventing close-up photos/assessment of the foundation conditions. There have been some damage reported including damage to concrete pads seen at Ryuho Primary School in Yatsushiro City (Figure 21a), and significant differential settlement observed at a recently constructed residential structure in Uki City (Figure 21b).

b.

a.

Figure 21. a) Concrete foundation damage at Ryuho Primary School [31] b) Differential settlement in Uki City[32]

[29] **Kumamoto Nichinichi Shimbun** - https://kumanichi.com/articles/2020427 (accessed 1 August 2026)
[30] **MBC Minaminihon Broadcast** - https://newsdig.tbs.co.jp/articles/mbc/2839904 (accessed 1 August 2026)
[31] **Kumamoto Nichinichi Shimbun** - https://kumanichi.com/articles/2020427 (accessed 1 August 2026)
[32] **Nagoya TV** - https://www.youtube.com/watch?v=oLJ9DCJz2EE (accessed 2 August 2026)

Landslides, rockfalls, slope instability

Slope failures were reported throughout the affected region, particularly within steep terrain, transport corridors, and engineered cut slopes. Several prefectural roads were closed due to rockfall and slope instability, including routes in the Mifune and Kosa areas.

According to Kumamoto Prefectural Government[33], the most widespread impacts were reported within the forestry network, where 28 slope failures and rockfalls were recorded across 11 forest roads in Yatsushiro City. Localised failures were also reported within active quarry sites, although these were generally small in scale and remained contained within quarry boundaries.

Notable slope-related impacts were reported at several significant assets, including a landslide at the Hitoyoshi Castle Ruins, damage to the historic stone walls of Kumamoto Castle and Yatsushiro Castle Ruins (Figure 22), and a slope failure affecting water-supply infrastructure at the Grassland and Livestock Research Institute.

Figure 22. Kumamoto Castle with collapsed stone walls (Source: Yomiuri Shimbun[34])

Beyond the main disaster area, a landslide was reported on the slopes of Mount Mayuyama (Figure 23), Shimabara City, Nagasaki Prefecture, demonstrating that earthquake-induced slope instability extended beyond Kumamoto Prefecture and affected steep volcanic terrain around the Ariake Sea.

Overall, the observed damage indicates that earthquake-induced instability was concentrated within steep natural slopes, road cuttings, quarry faces, and exposed rock slopes.

[33] **Kumamoto Prefectural Government, 2026.** 6th Kumamoto Earthquake Disaster Response Headquarters Meeting (Reiwa 8 Kumamoto Earthquake), Situation Report No. 6, 30 July 2026. Kumamoto Prefectural Government, Japan. Available at: https://www.pref.kumamoto.jp/uploaded/attachment/315639.pdf?_ga=2.121297793.845975709.1785637313-420993815.1785637313 (accessed 2 August 2026).

[34] **Yomiuri Shimbun, 2026**. Seismic intensity 7 in Kumamoto Prefecture photo gallery and news coverage. Photographed by Michihiro Kawamura. Available at: https://www.yomiuri.co.jp/slides/s/kumamoto202607earthquake/#42 (accessed 2 August 2026).

Figure 23. Landslides on the slopes of Mount Mayuyama, Shimabara City (Source: Yomiuri Shimbun[35]).

Coastal and riverbank effects

Major Ports

According to Kumamoto Prefectural Government[33], significant geotechnical damage was reported along the coastal margins of Yatsushiro Bay and within several major port facilities. The most severe impacts were concentrated in low-lying reclaimed land, port reclamations, and waterfront infrastructure, where liquefaction, settlement, and lateral ground deformation were observed.

Damage to coastal infrastructure was reported across the ports of Yatsushiro, Kumamon Port, Misumi, Tanoura and Sashiki, as well as numerous fishing ports throughout the affected region. The reported damage pattern is generally consistent with the widespread effects of strong shaking on young coastal deposits, reclaimed ground, and waterfront structures.

The most extensive damage was reported at Yatsushiro Port (Figure 24 and Figure 25), where liquefaction occurred within the container terminal yard and other reclaimed areas. Associated damage included ground settlement, distortion of crane rails, damage to gantry cranes, liquefaction of adjacent roadway infrastructure, apron cracking, and damage to wharf structures.

[35] Yomiuri Shimbun, 2026. Seismic intensity 7 in Kumamoto Prefecture photo gallery and news coverage. Photographed by Michihiro Kawamura. Available at: https://www.yomiuri.co.jp/slides/s/kumamoto202607earthquake/#54 (accessed 2 August 2026).

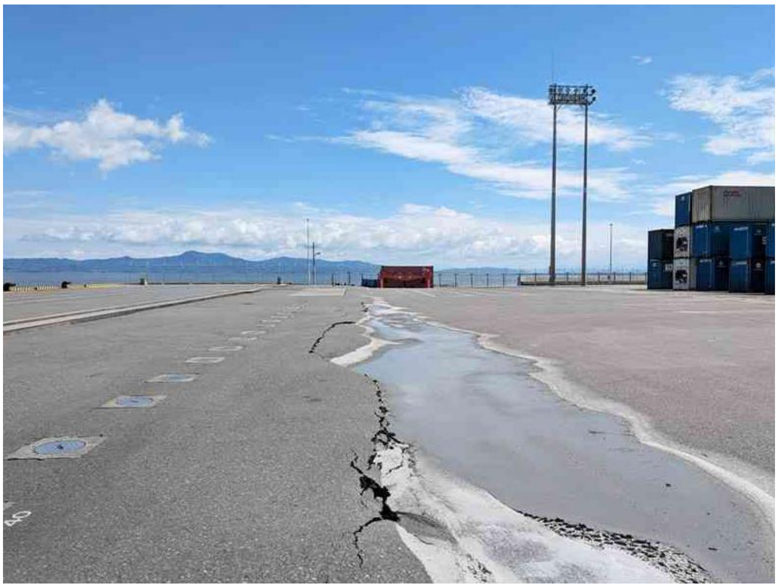


Figure 24. Liquefaction effects at Yatsushiro Port, including ground subsidence, sand boils, and surface cracking following the 2026 Kumamoto Earthquake (Source: NHK News[36])

Figure 25. Comparison of satellite imagery of Yatsushiro Port before and after the 2016 Kumamoto Earthquake sequence, illustrating earthquake-induced ground deformation and liquefaction on reclaimed port areas. (Source: Geospatial Information Authority of Japan (GSI) online map service[37])

Similar manifestations of liquefaction and ground deformation were reported at Kumamon Port, where liquefaction, pavement cracking, and settlement of port facilities were observed.

More localised port-related damage included pavement cracking at Misumi Port, apron and road cracking at Tanoura Port, and breakwater settlement and tilting at Sashiki Port. Damage was also reported across a number of fishing ports, including Akase, Kouriura, Aikushi, and Hiai, where failures included breakwater damage, apron settlement, and deterioration of waterfront structures.

[36] **NHK News, 2026**. Nine ports managed by Kumamoto Prefecture and Yatsushiro City: Damage such as liquefaction and cracks. Available at: https://news.web.nhk/newsweb/na/na-k10015191251000 (accessed 2 August 2026).

[37] **Geospatial Information Authority of Japan (GSI), GSI Maps**. Available at: https://maps.gsi.go.jp (accessed 2 August 2026).

Coastal Defense and River Systems

Coastal protection structures were also affected. According to Kumamoto Prefectural Government[33], inspections undertaken on 83 coastal sites identified damage at nine locations, primarily comprising cracking of revetments and coastal protection structures, together with displacement and misalignment of sections of coastal defence infrastructure. These observations suggest localised ground deformation and settlement, possibly due to fault rupture, liquefaction and/or lateral spreading.

Riverbank damage was widespread, with embankment settlement and revetment cracking reported at 25 locations across 12 rivers. In several cases, longitudinal crest cracking and displacement of revetment elements were observed, indicating permanent ground deformation and lateral movement towards river channels, potentially due to fault rupture, liquefaction and/or lateral spreading (Figure 26).

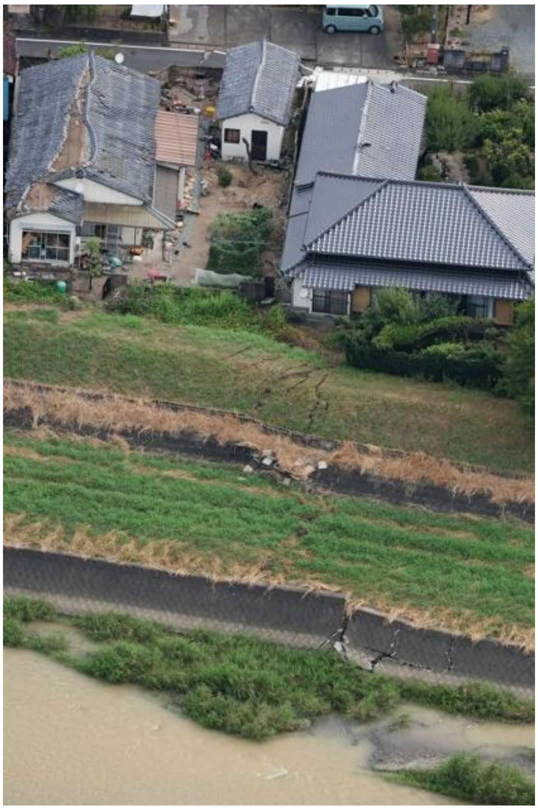


Figure 26. Surface expression of the suspected active fault associated with the 2026 Kumamoto Earthquake sequence, showing visible ground rupture and displacement causing levee cracking in Hikawa, Yatsushiro District (Source: Asahi Shimbun[38])

Overall, the distribution of coastal and riverbank damage suggests a strong relationship between observed ground performance and the presence of young alluvial, estuarine, and reclaimed deposits. The concentration of liquefaction, settlement, and waterfront deformation within ports and low-lying coastal areas is consistent with the expected behaviour of loose, saturated granular soils subjected to strong earthquake shaking.

[38] **Asahi Shimbun, 2026**. *Active fault from the Kumamoto earthquake clearly visible on the ground; Shinkansen stopped on the fault, on-site report*. Available at: https://www.asahi.com/articles/ASV7Y2QTGV7YUTFL00JM.html (accessed 2 August 2026).

Building Performance

Building damage ranged from local non-structural and service failures to major structural collapse. Older timber and heritage buildings were particularly vulnerable, while damage to ceilings, façades, utilities and equipment caused significant downtime in hospitals, commercial and industrial facilities. Reconstructed or strengthened facilities generally maintained structural integrity and operations, demonstrating the benefits of retrofit and functional-continuity design.

Commercial buildings

AEON Mall[39, 40] is 2-storey reinforced concrete structure located in Kashima Town, Kumamoto Prefecture, Japan. Following damage in the 2016 earthquake, a 2017 retrofit [41]sought to improve seismic performance; including ceilings, lighting and other building-service equipment. In 2026 earthquake, ceiling sections and parts of the exterior wall fell, sprinklers activated, and the mall was evacuated. Aeon reports that evacuation was completed by 17:00 and that an explosion occurred approximately 50 minutes later.

Damage to the gas system led to a major explosion in the rebuilt section in 2017. This caused the collapse of the second-floor structure, damaged floor slabs, roof bearings, and secondary structural members (See Figure 27). Non-structural damage included: ceilings, glazing, exterior walls and storefronts, interior partitions, mechanical and electrical systems (see Figure 28).

(a) (b)

Figure 27. Fire explosion damage from Aeon Mall (a - Link[42] and b - Link[42])

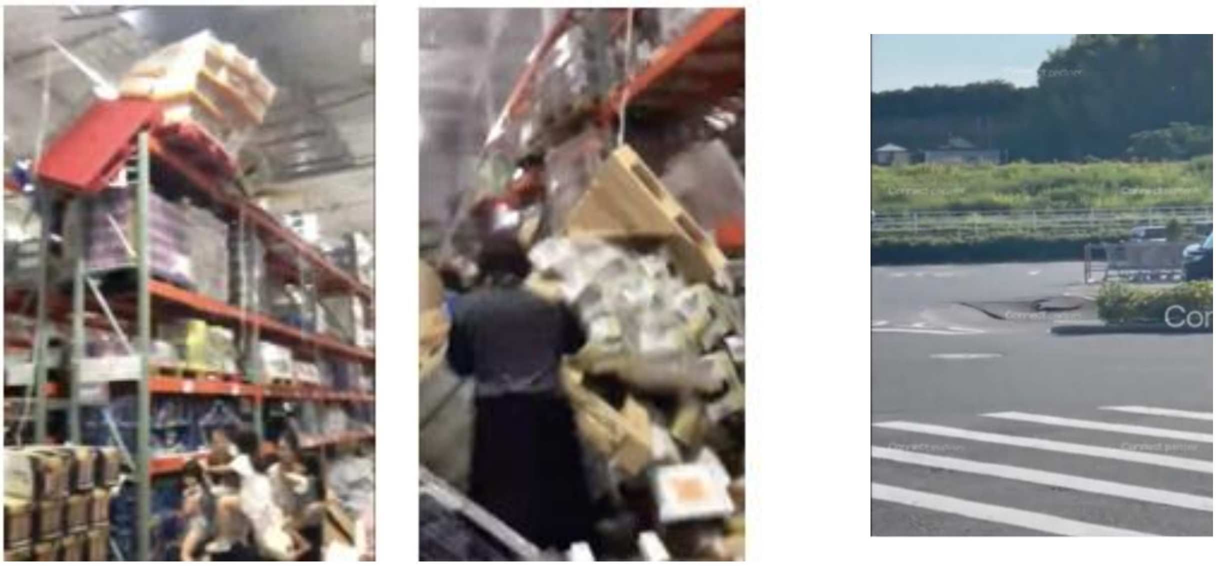
[39] AEON Mall Co., Ltd. (2018). AEON Mall Kumamoto Expansion Grand Opening, 20 July 2018: Safety and Security Initiatives. Available online (accessed 2 August 2026).
[40] AEON Co., Ltd. and AEON Mall Co., Ltd. (2026). Update concerning the explosion at AEON Mall Kumamoto, 30 July 2026. Available online (accessed 2 August 2026).
[41] https://www.aeonmall.com/files/management_news/1084/pdf.pdf
[42] https://bsky.app/profile/themanilatimes.bsky.social/post/3mrsx2gm2jq2m

(a) (b)

Figure 28. Non-structural damage in AEON Mall (a - [Link](https://news.tv-asahi.co.jp/news_society/articles/900196033.html?utm_source=chatgpt.com)[43] and b - [Link](https://www.aljazeera.com/news/2026/7/30/like-volcanic-ash-falling-inside-aeon-mall-after-japans-earthquake)[44])

The **Costco Wholesale Kumamoto Mifune Warehouse** was built in 2021. The shelving system, roof-mounted NSEs and building structure appear to have performed well. The heavy contents on pallets atop the shelving system were unsecured and fell from tall shelving racks. Video footage[45] appears to show people underneath, as shown in Figure 29.a. Geotechnical damage was observed in the car park (see Figure 29.b).

Ground and Parking Lot Damage: The intense seismic forces caused the soil in and around the store's parking lot to cave in, resulting in a localized ground collapse and sinkholes (Spectee, 2026). Additionally, the paved asphalt roads immediately leading to the Costco store buckled and cracked heavily (Newsflare, 2026).



a) Pallets fall from Costco shelves (Link[45]) b) Carpark damage (Link[46])

Figure 29. a) Pallets fall from Costco shelves, b) Carpark damage

[43] https://news.tv-asahi.co.jp/news_society/articles/900196033.html?utm_source=chatgpt.com
[44] https://www.aljazeera.com/news/2026/7/30/like-volcanic-ash-falling-inside-aeon-mall-after-japans-earthquake
[45] https://bsky.app/profile/tanukinomori.bsky.social/post/3mrpesvg3hc2e
[46] https://www.reutersconnect.com/item/japan-costco-parking-lot-ground-collapses-in-kumamoto-after-earthquake/dGFnOnJldXRlcnMuY29tLDIwMjY6bmV3c21sX09XU1BDQzI2MDE2MTIwMQ%5b

Elsewhere in Kumamoto City, minor damage to facades and awnings were observed (see Figure 30).

Figure 30. Facade linings losing bonding to exterior walls in a commercial area ([Link][47])

Industrial buildings

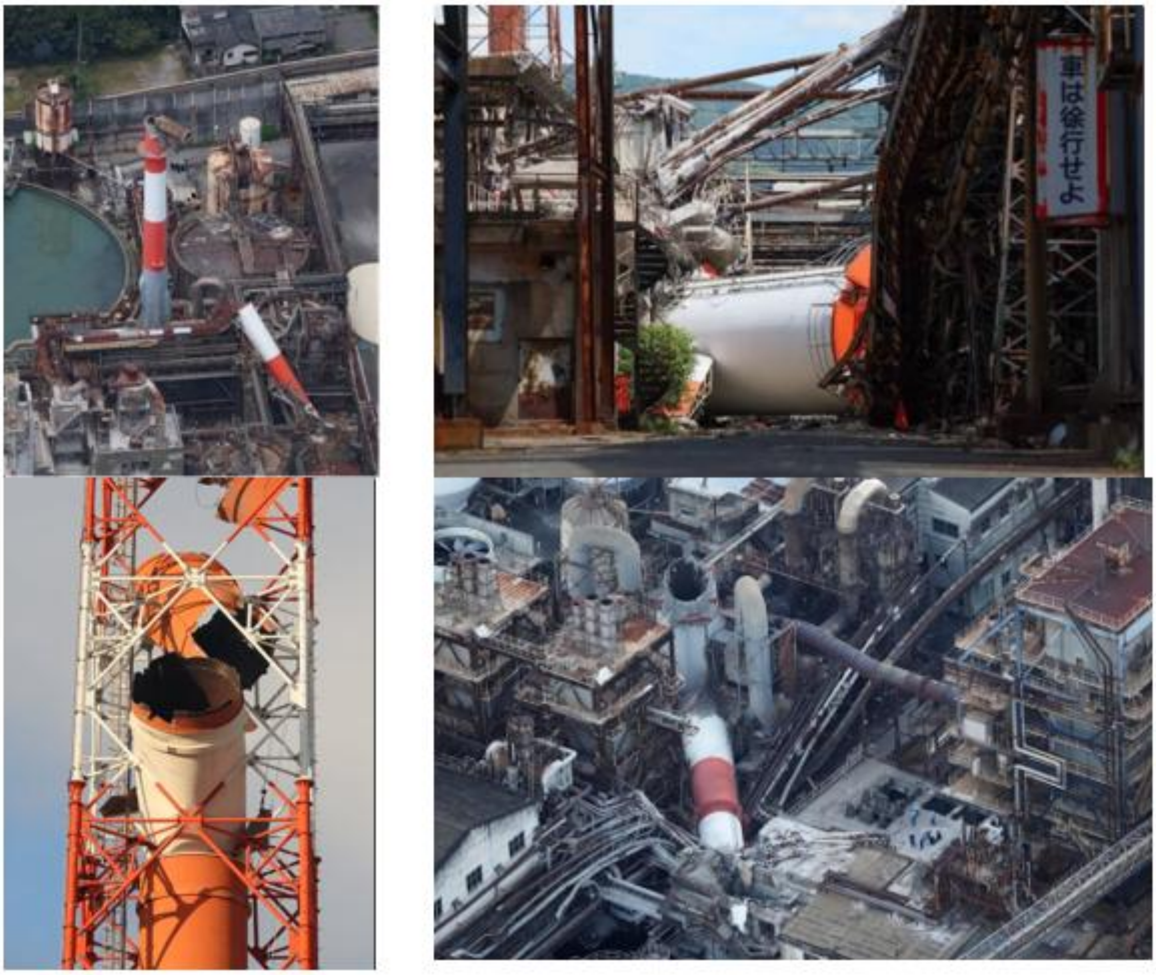
At **Nippon Paper Industries Yatsushiro Mill**, industrial chimneys snapped near their bases and collapsed onto the mill's office blocks (see Figure 31), utility lines, and production buildings (QAB, 2026; Yomiuri Shimbun, 2026c). The falling concrete and steel debris crushed a two-story facility, trapping 11 workers inside[48], of which 9 died and 2 had moderate injuries. The falling chimneys damaged piping and surrounding buildings, resulting in steam leaks[48]. Production has halted indefinitely[49]. The newest 110-metre concrete and steel chimney was built in November 2009. Older chimneys were 70 meters tall.

[47] https://www.cbsnews.com/news/strong-earthquake-with-7-1-magnitude-strikes-southern-japan-tsunami-alert-issued/?ftag=CNM-00-10aab6a&linkId=987172024

[48] Yomiuri Shimbun. (2026c, July 31). Japan paper mill worker describes shock at destruction from Tuesday's earthquake. The Yomiuri Shimbun. https://www.yomiuri.co.jp/national/20260731-OYT1T50220/

[49] Jota Machinery. (2026, July 30). Japan quake disrupts Nippon Paper mill and manufacturing hub. Jota Machinery News. https://www.jotamachinery.com/japan-quake-disrupts-nippon-paper-mill-and-manufacturing-hub/

(a) Street view before the earthquake



(b) After earthquake (Link[50], Link[51], Link[50], Link[52])

Figure 31. Chimney failure in Nippon Paper Industries (a) before the earthquake (b) After the earthquake

Kumamoto's **High-Tech and Semiconductor Manufacturing Plants**, known as Japan's "Silicon Valley," was forced into temporary shutdowns, but demonstrated improved holistic seismic performance compared to 2016[53]. Some articles note that lessons on functionality have been heeded by these companies. Across industries, disruption appears to have come from loss of power and water (unclear if mains or local supply), collapse of ceilings, cracking in walls, leaking of water (unclear from fire or water distribution pipework). At the Renesas Kawashiri factory, this damage forced the halt of pure water supply required in chip manufacturing.

- The Honda motorcycle plant appears to have the longest downtime: projected to be over a week to return to operation.

[50] https://mainichi.jp/english/articles/20260728/p2g/00m/0na/041000c

[51] https://www.malaymail.com/news/world/2026/07/29/rescue-attempts-continue-in-wake-of-japan-quake/229454

[52] https://x.com/ShanghaiEye/status/2082369271724716487/photo/1

[53] SCMP. (2026, July 31). Quake in Japan's 'Silicon Valley' disrupts car, chip supply chains. South China Morning Post. https://www.scmp.com/news/asia/east-asia/article/3272658/quake-japans-silicon-valley-disrupts-car-chip-supply-chains

- Microchip manufacturers (e.g.: TSMC / JASM; Renesas Electronics Nishiki[54], Sony Semiconductor Solutions) halted operations for at least two days, aiming to start again with one week or phasing staged resumption. Machines typically required re-calibration. Cleanrooms were not compromised, suggesting good performance of both drift-sensitive elements and acceleration-sensitive ventilation to maintain positive pressure and sterile environments. Reporting states that plant and equipment were typically undamaged.
- Visual data was not obtained during the VERT, likely owing to commercial sensitivity.

Historical buildings

Damage has been reported to several historic buildings in the cities of Kumamoto and Yatsushiro. These include the Kumamoto Castle, Yatsushiro-gu shrine and two Buddhist temples. An online report suggests damage to more than a dozen other cultural sites in the prefecture.[55]

Kumamoto Castle

Following this earthquake, there was visible damage to the outer stone walls of the castle, observed to have collapsed at several locations (see Figure 32). Full extent of the damage to the buildings within the castle is unclear; however, some reports suggest minor damage to timber structure and cracking interior walls in four buildings within the castle complex. The castle has been closed to the public for underway investigation [link[56]].

Figure 32. Partially collapsed stone walls at Kumamoto castle.

In the 2016 Kumamoto earthquake sequence, approximately 30% of **Kumamoto Castle**'s stone walls collapsed or displaced; all 13 nationally designated Important Cultural Property buildings were damaged [link[57]]. Restoration has proceeded in stages (see Figure 33). The main keep was strengthened by rebuilding its heavily damaged top floor in steel, installing friction-viscous dampers and high-damping-rubber dampers [link[58], link[59]]. Lightweight roof tiles were mechanically secured against falling [link[58]]. Stone-walls have been repaired or strengthened with

[54] Renesas Electronics Corporation, 2026, https://www.renesas.com/en/about/newsroom/renesas-announces-consolidated-forecasts-2026-07-31?srsltid=AfmBOorCkhuJxH_90QrkyeFBvrk2llovOxjE9ykdC4OnZZV-CleydvrU

[55] The Art Newspaper (2026)Japan's 400-year-old Kumamoto Castle damaged by 7.1 magnitude earthquake - The Art Newspaper - International art news and events

[56] Notice of Kumamoto Castle Park Closure | [Official] Kumamoto Castle

[57] Kumamoto City (2018). Kumamoto Castle Restoration Basic Plan. Available online (accessed 2 August 2026).

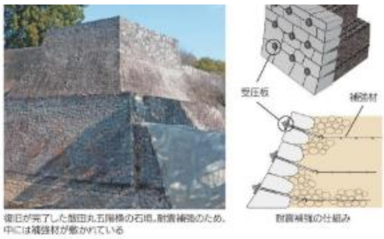
[58] Obayashi Corporation (2025). Kumamoto Castle Main Tower: Seismic Retrofitting to Restore Kumamoto Castle as a Resilient Building. https://www2024-2.obayashi.co.jp/en/thinking/detail/focus18.html

[59] Sumitomo Rubber Industries (2019). High-damping-rubber vibration-control dampers adopted for the small keep of Kumamoto Castle. https://www.srigroup.co.jp/newsrelease/2019/sri/2019_079.html

traditional approaches [link[57]]. Much of the castle remained under restoration in 2026, as original components must be documented, dismantled and reused.

(a) Seismic design: Dampers [link[58]]

(b) Seismic design: Rebuilt roof [link[58]]



(c) Seismic design: Strone-wall strengthening [link[57]]

Figure 33. Restoration of Kumamoto castle

Yatsushiro-gu Shrine

The Yatsushiro-gu is a single-storey timber structure, built in 1883, and the main worship hall in the shrine. It fully collapsed from the shaking (see Figure 34). Extensive ground cracking on the site could also be observed, along with damage to other minor structures. Most of the bell towers and entrance gates have collapsed[60].

(a) Before earthquake

(b) After earthquake (Link[61], Link[62])

[60] ABS-CBN News (2026). https://www.youtube.com/watch?v=bSAlxLF8bHw

[61] https://www.reutersconnect.com/item/aftermath-of-earthquake-in-yatsushiro/dGFnOnJldXRlcnMuY29tLDIwMjY6bmV3c21sX1JDMklOTUFFUk1PRg

[62] https://www.youtube.com/watch?v=bSAlxLF8bHw

Figure 34. Collapse of the main worship hall in Yatsushiro-gu.

Buddhist Temples

Two Buddhist temples are observed to have suffered significant structural damage. At the Jufukuji Buddhist temple in Kumamoto, the entrance gate fully collapsed (see Figure 35). The timber portal gate that supports a seemingly heavy roof with tiles is observed to have been damaged, with the roof structure falling to ground[63].

(a) Before earthquake (b) After earthquake (Link[64])

Figure 35. Collapse of entrance gate at Jufukuji Buddhist Temple, kumamoto

Another Buddhist temple in Hikawa, Yatsushiro is observed to have suffered a full collapse, as shown in Figure 36. The entire structure of the timber building failed after shaking.

(a) Before earthquake (b) After earthquake (Link[65])

Figure 36. Total collapse of the Buddhist temple in Hikawa, Yatsushiro.

Public buildings

Public facilities

Public Emergency Facilities and Fire Stations across the affected area, including fire stations in Kumamoto City, Uki, and Hikawa, performed well. No major structural damage occurred at municipal fire stations or critical public safety facilities (WHDH, 2026). Operational continuity was maintained.

At one of the **port facilities**,

[63] AP News (2026).https://apnews.com/article/japan-earthquake-kumamoto-kagoshima-mall-factory-6b0fe69d44fa5c82ac4765a8ad82ebf6
[64] https://www.hindustantimes.com/world-news/japan-quake-aftermath-death-count-hits-34-among-rising-heat-earthquake-kumamoto-heatstroke-101785399009319.html
[65] https://www.asahi.com/special/photo-map/?theme=disaster01&iref=ap_topics

- Regarding the container crane, rail deformation and oil leakage from the crane have occurred.
- Damage has occurred to some shipping companies' factories in Kumamoto Prefecture, including cracks in the walls and damage to the hulls of ferry operators' vessels.
- Coastguard building note damage to water supply and walls.

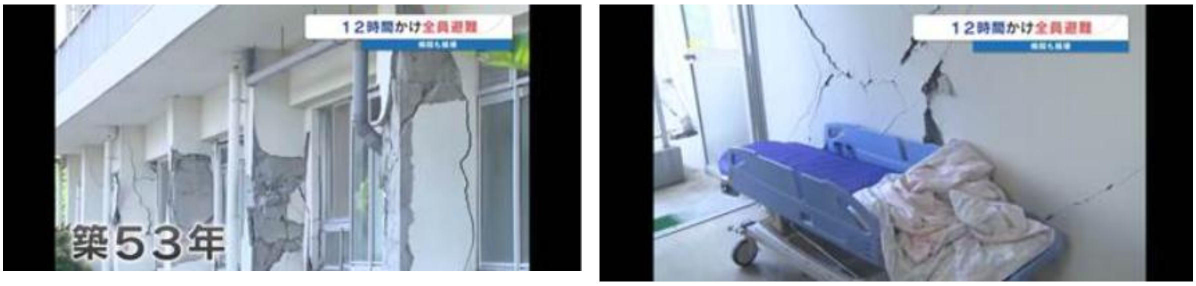
Hospitals[66]

According to a summary by the Ministry of Health, Labour and Welfare on 30 July, 45 to 54 **healthcare facilities** in Kumamoto Prefecture reported damage. That summary notes:

- Water outages at approximately 40 facilities
- Power outages at approximately 9 to 15 facilities
- Disruptions in medical gas supply at approximately 8 to 12 facilities

Medical gas supplies were also reported to have been disrupted. This is likely local distribution pipework within hospital campuses. Hospitals typically have local backup power (generators, batteries) and water supply (on-site tanks). It is unclear from this reporting but appears that these systems failed.

At **Kumamoto South Hospital**[67] in Uki, extensive structural damage occurred to structural columns, walls, and nonstructural concrete infill walls experienced heavy damage. It was reported “some patients require ventilators, but at present they can only barely rely on two emergency generators to power the ventilators and other life-support equipment.” Surgeries were cancelled at midnight on 29 July. 127 patients were evacuated. There were multiple reports of hospitals being evacuated. Localised structural and non-structural damage, combined with loss of essential services, can result in major functional disruption even without total building collapse (see Figure 37).



(a) (b)

[66] NHK WORLD-JAPAN (2026). Women’s clinic in quake-hit Kumamoto remains open despite damage, 31 July 2026. Available online (accessed 2 August 2026).
[67] RKK Kumamoto Broadcasting (2026). Maximum seismic intensity 7: wall cracking and evacuation of all 127 patients from Kumamoto South Hospital, 29 July 2026. Available online (accessed 2 August 2026).

(c) (d)

(e) (f)

Figure 37. Kumamoto South Hospital / Minami structural and non-structural damage occurred. The building did not collapse. Patients were safely evacuated (Link[67])

At the **Matsubase Ladies Clinic**, heavy cladding, exterior canopies, and nonstructural walls experienced significant damage or collapse, as shown in Figure 38. 11 inpatients were transferred to nearby hospitals. The damage to these drift sensitive elements has halted operational capabilities; the facility is partially operational at a reduced capacity out of a temporary annex.

(a) Exterior canopies damage (b) Wall damage

Figure 38. Damages Observed at Matsubase Ladies Clinic (Link[68])

Residential buildings

Damages of traditional timber buildings

[68] Women's clinic in quake-hit Kumamoto remains open despite damage | NHK WORLD-JAPAN News

There were several residential timber buildings in the Kumamoto region that experienced significant damage, including partial or complete collapse, excessive lateral deformation, wall and roof failure (see Figure 39).

(a) partial or complete collapse of building (Link[69])

(b) roof collapse (Link[69])

(c) complete collapse of building (Link[70])

(d) complete collapse of building (Link[71])

(e) complete collapse of building (Link[72])

[69] https://www.theguardian.com/world/2026/jul/29/japan-earthquake-stories-people-survival-loss-hikawa-uki?utm_source=chatgpt.com
[70] https://www.theguardian.com/world/video/2026/jul/29/people-are-waiting-to-be-rescued-race-under-way-to-find-japan-quake-survivors-video
[71] https://infonews.ca/inhome/news/8777/quake-survivors-in-southwestern-japan-sleep-in-cars-in-sweltering-heat-as-death-toll-rises-to-34/?region_refresh=1785491543519
[72] https://www.asahi.com/special/photo-map/?theme=disaster01&iref=ap_topics

Before earthquake After earthquake

(f) partial or complete collapse of building (Link[73])

Figure 39. Damages observed from the several residential timber buildings in the Kumamoto region

Soft-storey damage

Soft-story damage was observed at the ground level of the two-story building (see Figure 40). Moreover, the lightweight metal cladding elements fell down.

Figure 40. soft storey damage of two-storey building

Fire

Post-earthquake fire damage was observed for two residential apartment buildings, resulting in structural failure of roof and collapse of the upper level, as shown in Figure 41.

[73] https://www.bing.com/videos/riverview/relatedvideo?q=%e5%85%ab%e4%bb%a3%e5%b8%82%e5%bd%b9%e6%89%80&mid=DBF6A9B135ABA52FA0D9DBF6A9B135ABA52FA0D9&churl=&FORM=VIRE

(a) (b)

Figure 41. Fire damage to residential buildings (a - Link[74] and b - Link[75])

Seismic Improvement Policy and Performance in Kumamoto

Japan has an established policy framework dedicated to improving the seismic performance of existing buildings. Following the 2016 Kumamoto earthquake, seismic assessment and retrofit initiatives were further promoted, with expanded support for vulnerable buildings and greater attention to post-earthquake functionality.

Policy in Japan and Kumamoto

Japan's seismic-retrofitting framework is established principally through the Act on Promotion of Seismic Retrofit of Buildings, enacted in 1995 following the 1995 Great Hanshin–Awaji Earthquake and substantially strengthened through amendments implemented in 2006 and 2013. The framework has focused particularly on existing buildings constructed before the New Seismic Design Standard came into force in June 1981. Under the Act, the Minister of Land, Infrastructure, Transport and Tourism prepared the national Basic Policy, which established national objectives and technical principles for seismic assessment and retrofit. In tandem with the national policy framework, prefectures prepared regional seismic-retrofit promotion plans, while municipalities developed local plans and implement assessment and retrofit programmes, including advice, administer assessment and financial assistance [link[76], link[77]].

The framework combines regulatory and promotional measures. Mandatory seismic assessment and publication of results apply to specified large buildings, including hospitals, shops, hotels, schools, welfare facilities, hazardous-material buildings, designated disaster-management facilities and buildings that could obstruct important evacuation or emergency-transport routes. For most private houses and smaller buildings, however, retrofit remains primarily an owner responsibility supported through grants, tax incentives and technical assistance [link[43], link[78]].

The 2013 amendment strengthened mandatory assessment, public disclosure and administrative powers, while also facilitating retrofit through relaxed approval requirements,

[74] https://www.cbsnews.com/news/strong-earthquake-with-7-1-magnitude-strikes-southern-japan-tsunami-alert-issued/?ftag=CNM-00-10aab6a&linkId=987172024
[75] https://www.yomiuri.co.jp/slides/s/kumamoto202607earthquake/#11
[76] Government of Japan (1995, as amended). Act on Promotion of Seismic Retrofitting of Buildings (Act No. 123 of 1995). e-Gov Law Search. Available online (accessed 2 August 2026).
[77] Kumamoto City (2021; minor revisions 2024). Kumamoto City Building Seismic Retrofit Promotion Plan. Available online (accessed 2 August 2026).
[78] Ministry of Land, Infrastructure, Transport and Tourism (MLIT) (2013). Amendment to the Act on Promotion of Seismic Retrofit of Buildings. Available online (accessed 2 August 2026).

special treatment of floor-area and building-coverage limits, certification of seismic safety and reduced voting thresholds for major retrofit of condominium buildings [link[78]].

The 2016 Kumamoto earthquake revealed persistent vulnerability in older buildings and in timber houses built between 1981 and 2000, before key connection and wall-balance requirements were clarified. Kumamoto City therefore reviewed its seismic-retrofit plan in 2018, while prefectural and municipal programmes increased attention to assessments, retrofit support, disaster-response buildings and residential-land safety. The governance framework is hierarchical but interdependent: national policy provides legislation and funding, Kumamoto Prefecture sets regional priorities and designations, and Kumamoto City delivers local plans, subsidies, assessments and engagement with building owners at the community level locally [link[77]].

The main implication is that Japan has a strong institutional framework, but actual risk reduction depends on local implementation and owner participation. National MLIT data show that inadequate seismic resistance had been resolved in approximately 94% of large buildings requiring urgent safety confirmation by the end of FY2024. The corresponding figure for buildings along designated evacuation routes was approximately 46%. Housing was reported separately, with an estimated seismic-resistance rate of approximately 90% in 2023. These figures indicate uneven progress across different building categories, although the indicators are not directly equivalent [link[79]].

In Kumamoto City, subsidised timber-house diagnoses rose from 421 in FY2013–2015 to 1,910 in FY2016–2018. In 2018, eligibility was extended to houses built before June 2000 and support expanded to include integrated retrofit, replacement and seismic shelters, although the proportion of eligible houses strengthened is unknown [link[77]].

Examples of good performance

Uto City Office's (see Figure 42) pre-1981 predecessor suffered dramatic mid-storey collapse in 2016. The replacement, completed in 2023, is a four-storey base-isolated building designed to remain an operational disaster-response facility [link[80], link[81]]. No major structural damage has been publicly reported in 2026, operations continued [link[82]].

(a) Overall appearance of replaced Uto City Hall [link[81]]

(b) Seismic design: Base-isolated foundation and business-continuity provisions [link[82]]

Figure 42. (a) Overall appearance of replaced Uto City Hall (b) Seismic design

[79] [20] Ministry of Land, Infrastructure, Transport and Tourism (MLIT) (n.d.). Current Status and Targets for Seismic Upgrading of Housing and Buildings. Available online (accessed 2 August 2026).
[80] EEFIT (2017). The Kumamoto Japan Earthquakes of 14 and 16 April 2016: A Field Report. Institution of Structural Engineers. Available online (accessed 2 August 2026).
[81] Uto City (2019). Uto City Hall Reconstruction Basic Design—Summary. Available online (accessed 2 August 2026).
[82] Kumamoto Prefectural Government (2026). Seventh Disaster Management Headquarters Meeting for the 2026 Kumamoto Earthquake, 31 July 2026. Available online (accessed 2 August 2026).

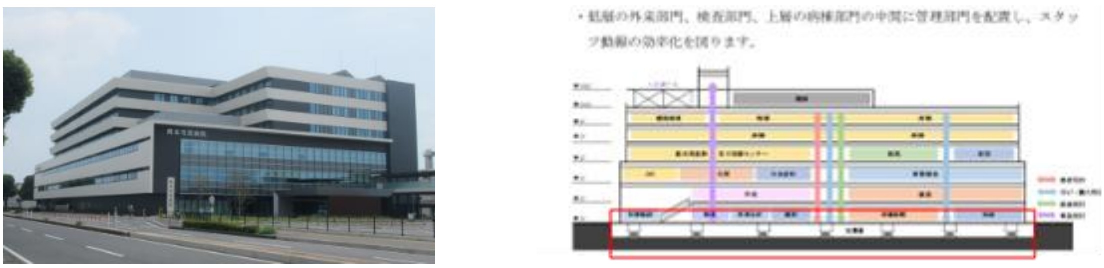
Mashiki town hall (see Figure 43) saw no major structural damage that has been publicly reported, and operations continued [link[49]]. It had been retrofitted before 2016 and its strengthened block performed reasonably well, but connecting structures and surrounding ground suffered damage [link[80]]. The replacement Mashiki Town Hall, opened in 2023, is a four-storey base-isolated RC building with emergency power, water, storage and disaster-response functions [link[83]].

(a) Overall appearance of replaced Mashiki Town Hall [link[84]]

(b) Seismic design: Base-isolated foundation [link[83]]

Figure 43. (a) Overall appearance of replaced Mashiki Town Hall (b) Seismic design

The [85] **Kumamoto City Hospital** (see Figure 44) maintained good structural and functional integrity: it announced normal clinical services for the following morning with no publicly reported evacuation or significant functional interruption [link[86]]. This follows a transition from life-safety design to functional-continuity design. During the 2016 Kumamoto earthquake, the former RC hospital avoided collapse but suffered wall and ceiling damage, concrete cracking and loss of water and other building services. Consequently, all 310 inpatients were transferred or discharged [link[87], link[88]]. The hospital was thereafter relocated and rebuilt, opening in 2019 as a low-rise steel building with concrete-filled steel tube columns and base isolation [link[88]].



(a) Overall appearance of Kumamoto City Hospital after reconstruction [link[89]]

(b) Seismic design: Base-isolated foundation [link[88]].

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[83] Mashiki Town (2021). New Government Building and Reconstruction Community-Support Facility Project: Project Overview. Available online (accessed 2 August 2026).
[84] Kakuta, K. (2023). Visit to Kumamoto: Mashiki Town Hall (photograph). Available online (accessed 2 August 2026).
[85] Post-earthquake hospital functionality evaluation: The case of Kumamoto Earthquake 2016." DOI: 10.1177/8755293020926180
[86] Kumamoto City Hospital (2026). Notice on clinical services following the 2026 Kumamoto earthquake. Available online (accessed 2 August 2026).
[87] Achour, N. and Miyajima, M. (2020). Post-earthquake hospital functionality evaluation: The case of Kumamoto Earthquake 2016. Earthquake Spectra, 36(4), 1670–1694. Available online (accessed 2 August 2026).
[88] Kumamoto City and Kumamoto City Hospital (2016). Kumamoto City Hospital Reconstruction Basic Plan. Available online (accessed 2 August 2026).
[89] Wikimedia Commons contributor Sanjo (2019). New Kumamoto City Hospital [photograph]. Available online (accessed 2 August 2026).

Figure 44. (a) Overall appearance of Kumamoto City Hospital after reconstruction (b) Seismic design

Kiyama Junior High School (see Figure 45**)** had been seismically retrofitted with external steel braces before the 2016 Kumamoto earthquakes. These strengthened classroom blocks performed well, but damage concentrated in un-strengthened or more flexible components: connecting-corridor columns developed severe flexural damage and residual drift, gymnasium braces buckled, and cracking occurred around brace connections [link[47]]. The damaged facilities were subsequently repaired, and the gymnasium received documented non-structural seismic upgrading in 2020 [link[90]], although detailed information on further structural strengthening is unavailable. In 2026, only damaged storage racks and lockers were reported, with no reported recurrence of structural, corridor or gymnasium-brace damage [link[82]].

Figure 45. Kiyama Junior High School classroom blocks; external steel braces are visible on the north elevation [link[80]]

Airport

Aso Kumamoto Airport performed well in this earthquake. Minor flight delays were made for inspections. Video[91] within the terminal showed good non-structural restraint conditions. The former terminal suffered extensive non-structural and service damage in 2016, including fallen ceilings, damaged lifts and an overturned transformer. The terminal closed temporarily and passenger operations were significantly disrupted. The replacement terminal, opened in 2023, was designed with structural redundancy and protected lifelines to withstand repeated major earthquakes.

Infrastructure and Lifelines

Fault movement and ground deformation caused bridge displacement, partial collapse, road cracking and cave-ins. Railways sustained track deformation, displaced girders, damaged power infrastructure and collapsed noise barriers, while widespread water outages disrupted communities. Emergency access was progressively restored, and critical response facilities generally remained operational.

Bridges

There are multiple bridge damages. This section takes four representative examples.

Bridge 1: Myoken Daiichi Bridge (妙見第一橋)

[90] Mashiki Town (2020). Seismic upgrading of non-structural components in town elementary- and junior-high-school gymnasiums. Available online (accessed 2 August 2026).
[91] https://x.com/WeatherMonitors/status/2082013360493822248

Ground shift due to the movement of Hinagu Fault, causing differential settlements at bridge supports and resulting in the unseating of bridge girders with an approximate 1.5 metre drop, as shown in Figure 46 and Figure 47.

Figure 46. Ground on right side of fissure near the damaged expressway was raised by about 1 meter in Yatsushiro, Kumamoto Prefecture (Link[92])

Figure 47. About 1.5 m drop in a bridge deck (Link[93])

Bridge 2: Kawada Bridge 川田橋

[92] https://www.asahi.com/ajw/articles/16769153
[93] https://japannews.yomiuri.co.jp/attachment/340716/

Structural damage observed: bridge joint degradation, girder displacement, and inspection path collapse (see Figure 48). Road surface formatting shows significant irregularities, specifically a ~1m vertical offset and a ~0.5m horizontal gap (Link[94]).

Figure 48. Damage to Kawada Brid (Link[95])

Bridge 3: Katanogawa Bridge 片野川橋

Bridge girder displacement has caused a road surface step and corresponding gap, both measuring approximately 0.5 metres, as shown in Figure 49.

Figure 49. Damaged Katanogawa bridge (Link[96])

Bridge 4: Ueyanagi Bridge, Yatsushiro City, Kumamoto Prefecture

The Ueyanagi Bridge (see Figure 50) in Yatsushiro City suffered a partial collapse, with pedestrian walkways falling into the river, while the vehicular lane seemed to have remained functional (Link[97] & Link[98])

[94] https://www.w-nexco.co.jp/emc/emcpdfs/20260731082107-01.pdf
[95] https://www.cntravellerme.com/story/japan-earthquake-is-it-safe-to-travel-after-the-deadly-71-magnitude-kumamoto-quake
[96] https://www.w-nexco.co.jp/emc/emcpdfs/20260731082107-01.pdf
[97] https://www.independent.co.uk/news/science/japan-kumamoto-earthquake-unusual-tremor-b3023630.html

Figure 50. An aerial drone view shows a damaged bridge in Yatsushiro after a magnitude 7.1 earthquake struck Kumamoto Prefecture in southern Japan (Link[98])

Roads

Road closures and damage were concentrated on expressways, national highways, and prefectural roads in Kumamoto and neighbouring areas. At 15:00 JST on 1 Aug 2026, expressway restrictions had been reduced from an initial 3 routes and 17 sections (about 142 km) to 2 routes and 9 sections (about 100 km). About 80 km had been opened for emergency vehicles. Access on National Routes 3 and 57 was secured by the morning after the earthquake (Link[99]).

Ground crack on the road and about 30 cm of vertical movement were observed by drivers, as shown in Figure 51.

Figure 51. Road damage (Link[100])

Road cave-ins and partial collapses of homes were reported in Ogawa Town, Uki City, Kumamoto Prefecture, on the morning of July 29, as shown in Figure 52.

[98] https://www.japantimes.co.jp/business/2026/07/29/companies/businesses-impacted-kumamoto-quake/
[99] https://www.mlit.go.jp/common/002014898.pdf
[100] https://373news.com/news/local/detail/237250/

Figure 52. road collapse in Ogawa Town (Link[101])

Public transportation

Railway

On July 29, 2026, JR Kyushu announced the extent of damage the previous day's Kumamoto earthquake had caused to its railway infrastructure. On the Kyushu Shinkansen, overhead wires were severed at Kumamoto Station, and there were seven locations with rail deformation in the Kumamoto rolling stock depot. At Shin-Yatsushiro Station, rails were fractured and bridge girders had shifted. Between Kumamoto Station and Kagoshima-Chuo Station, more than 200 noise barriers had collapsed or been damaged (Link[102])

Rail damage/distortion: Rail damage/distortion (see Figure 53) potentially due to ground lateral movement.

(a) Kumamoto General Rolling Stock Depot of the Kyushu Shinkansen (Link[102])

(b) Yanagisawa Bridge between Matsubashi and Ogawa stations on Kagoshima Main Line (Link[102])

[101] https://japan-forward.com/kumamoto-earthquake-more-than-dozen-feared-dead/

[102] https://xtech.nikkei.com/atcl/nxt/column/18/03703/073000021/

(c) Between Higo-Koda and Hinagu Onsen (Link[103])

(d) Damage to base support (with bridge pier) of a utility pole between Kami-Kumamoto and Kumamoto stations on Kagoshima Main Line (Link[102])

Figure 53. Rail damage/distortion due to earthquake

Utility pole damage: Utility poles (see Figure 54) are found damaged or collapsed across the region with unknown failure mechanism given the limited information received. Damage also occurred at based of the utility pole with the bridge. The failure could be caused by the insufficient seismic gap provided between the bridge viaducts.

(a) Utility pole damage observed between Ogawa and Arisa (Link[103])

(b) Collapse of utility pole and deformation of railway Between Ogawa and Arisa stations on JR Kagoshima Line (Link[104])

Figure 54. Utility pole damage

Failure of noise barriers: The noise barriers appeared to be made by precast concrete panel with unknown connection details to its supports (see Figure 55). Occurred at over 200 locations over one rail line.

Figure 55. Noise barrier collapse between Kumamoto and Shin-Yatsushiro (Link[105])

Locomotive and freight car derailment: locomotives and freight cars derailed and overturned, as shown in Figure 56.

[103] https://www.mlit.go.jp/common/002014898.pdf
[104] https://www.sponichi.co.jp/society/news/2026/07/31/gazo/20260731s10042000008000p.html

Figure 56. Locomotive and freight car derailment (Link[105])

Lifeline

Water[105]: Water outages occurred in 4 prefectures and 15 municipalities, with a peak of about 108,100 households affected. As of 1 Aug 2026, at 6:00 UTC (15:00 JST), about 59,000 households in 6 municipalities in Kumamoto Prefecture were still affected. Major ongoing outages listed in the original page include Uki City (about 15,648 households), Yatsushiro City (about 25,269), Uto City (about 12,200), Kumamoto City (about 2,250), Hikawa Town (about 3,231), and Kosa Town (about 400). The Japan Water Works Association and other organisations were carrying out emergency water supply operations.

Power: Kyushu Electric Power reported no abnormalities at the Sendai and Genkai nuclear power plants in adjacent prefectures. Of the government facilities conducting disaster emergency response activities, 13 facilities suffered minor building damage. While confirmed, there were no reports of damage that would disrupt activities.

105 https://www.mlit.go.jp/common/002014898.pdf