M7.7 28 March 2025 Sagaing Earthquake, Satellite-Based Comprehensive Damage Assessment Report

Sagaing, Mandalay, Shan (North), Magway, Nay Pyi Taw, Shan (South) and Bago (East) Regions
Myanmar

13 June 2025

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I. Overview

On the afternoon of March 28, 2025, a devastating 7.7 magnitude earthquake struck central Myanmar, with its epicentre near the city of Mandalay in central Myanmar. This was followed 12 minutes later by a significant aftershock measuring 6.4 in magnitude. The quake, at a shallow depth of 10 km, caused widespread destruction across several regions including Sagaing, Mandalay, Naypyidaw, Bago, Magway, and parts of Shan State.

The earthquake resulted in approximately 3,800 confirmed deaths, over 5,100 injuries, and at least 116 people reported missing, making it one of the deadliest seismic events in the country's recent history. According to the United Nations Office for the Coordination of Humanitarian Affairs (OCHA), more than 1.1 million people have been identified as in need of humanitarian assistance, with nearly 600,000 already reached through emergency relief operations. Tens of thousands have been displaced from their homes, many now residing in overcrowded temporary shelters. Entire neighbourhoods have been reduced to rubble, and critical infrastructure—including hospitals, schools, bridges, and cultural heritage sites—has suffered extensive damage (UN OCHA, Situation Report No. 4, 25 April 2025).

The World Health Organization reported that nearly 70 health facilities were damaged or destroyed, leading to a scarcity of medical supplies and a heightened risk of disease outbreaks amid extreme heat and limited sanitation. The worst-affected areas include the municipalities of Sagaing, Mandalay, Naypyidaw, Bago, Magway, and parts of Shan State. In Mandalay, approximately 50% of structures were destroyed or heavily damaged. Other towns such as Pyawbwe, Kyaukse, Yamethin, and Meiktila also reported significant casualties and infrastructure damage.

The earthquake's impact extended beyond Myanmar's borders, with tremors felt in neighbouring countries including Thailand, India, and China. In Bangkok, Thailand, an unfinished 30-story building collapsed, resulting in eight fatalities and numerous injuries. As Myanmar faces the aftermath of this catastrophic event, international aid organizations continue to mobilize resources to provide emergency assistance, including food, shelter, and medical care, to the millions affected by the earthquake.

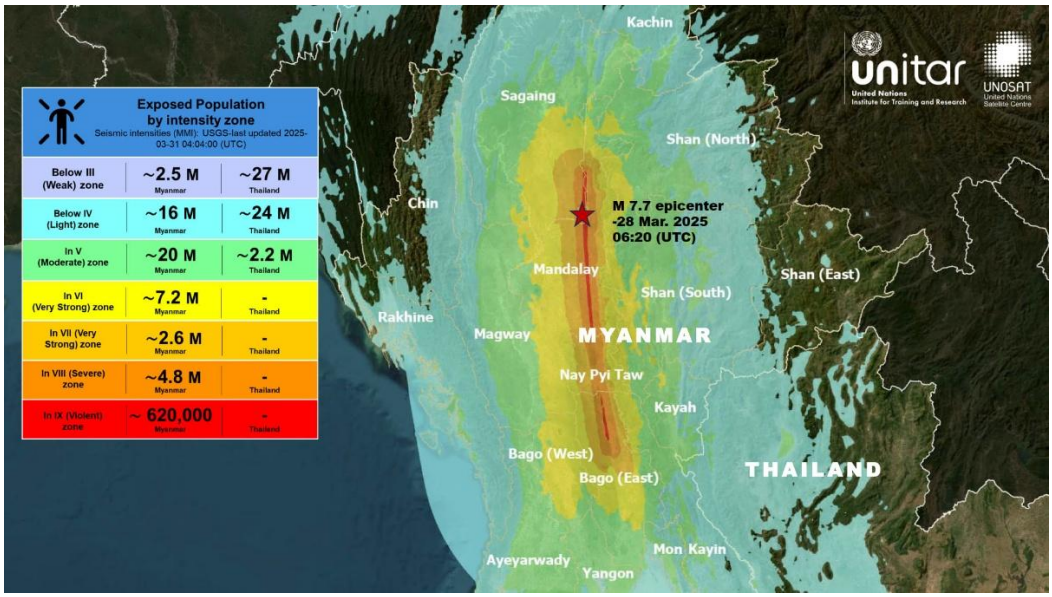

Figure 1 – Map illustrating the seismic intensity zones following the Sagaing Earthquake (28 March 2025, M 7.7). Approximately 15 million people are potentially exposed to strong to severe shaking.

II. Comprehensive Satellite-Detected Building Damage Assessment

On 28th March 2025, the United Nations Satellite Centre (UNOSAT) Emergency Service was activated to support emergency operations following requests from UNOCHA regional office in Aia and Pacific and the International Federation of Red Cross and Red Crescent Societies (IFRC). On the same day, UNOSAT has activated the International Charter Space and Major Disasters mechanism to maximize the satellite images acquisitions.

UNOSAT was nominated as the Project Manager (PM) for Charter Call 956 – Earthquake in Myanmar and also appointed a Deputy PM for this activation. Several other satellite mapping groups were nominated as Value-Adders (VA) to deliver satellite-derived analysis and geospatial products to the end-users. The VA's consisted of 8 entities: National Remote Sensing Centre / Indian Space Research Organisation (NRSC/ISRO), Copernicus EMS, ICube-SERTIT, EMERCOM of Russia, Federal Rural University of Rio de Janeiro (UFRRJ), Istituto Nazionale di Geofisica e Vulcanologia (INGV), Asian Institute of Technology (AIT) and Luxembourg Institute of Science and Technology (LIST).

UNOSAT released a live web map on the 28 March 2025 displaying the baseline data, the seismological data from USGS, and an exposure population analysis across the regions and districts within the light to severe intensity zones. Throughout the activation, UNOSAT continuously updated the live web map with ongoing analysis carried out by the different VA's to ensure the availability and visibility of the analysis performed to the end-users.

Furthermore, UNOSAT published and shared the GDACS-Satellite mapping and Coordination System (SMCS) with all actors involved in this activation. This platform facilitates the coordination and the communication among the various VAs and provides an overview, status update for each area of interest as well as a direct link to the products related to a specific area of interest for the end-users.

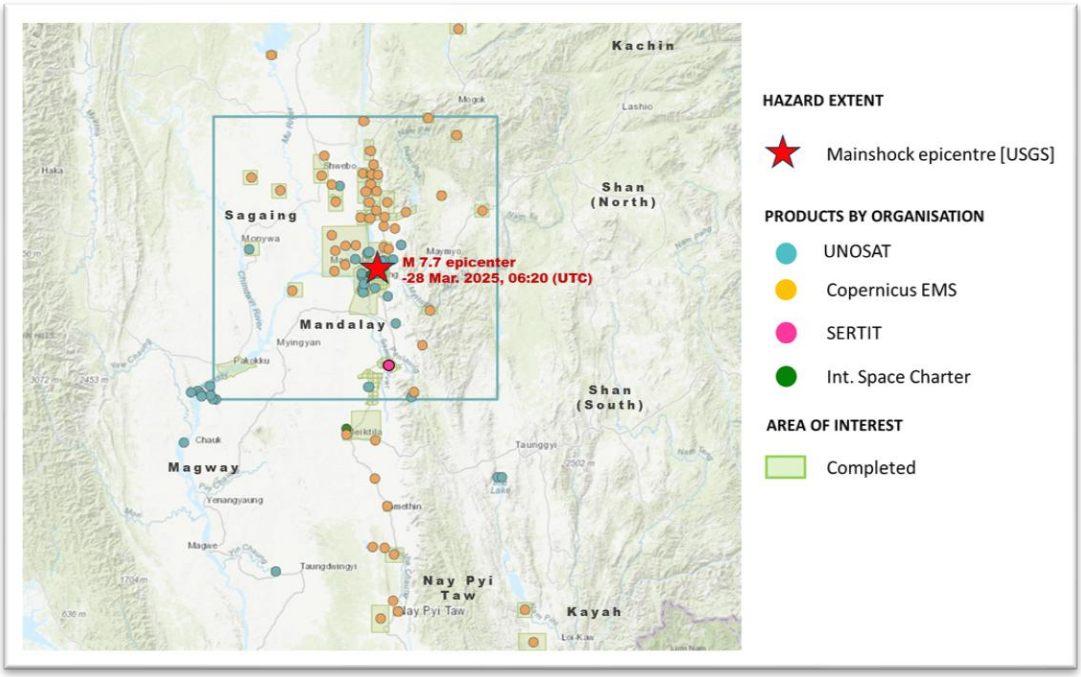

Figure 2 - Snapshot of the GDACS-SMCS for the activation related to the Earthquake in Myanmar (28 March 2025). Gives an overview of the extent and the analysis status of each AOI.

II.1 Satellite-derived analysis

UNOSAT used a wide range of pre- and post-event satellite imagery made available through the activation of the Charter. The analysis primarily focused on providing an overview of the distribution and the extent of the damage caused by the earthquake. In addition to the population exposure analysis, UNOSAT conducted several comprehensive damage assessments over designated areas of interest to estimate the number of affected structures. Copernicus EMS and SERTIT also contributed to the activation by analysing several other zones. The coordination was facilitated through the GDACS-Satellite mapping and Coordination System (SMCS). The damage assessments were based on a series of pre- and post-event satellite images covering the areas of interest.

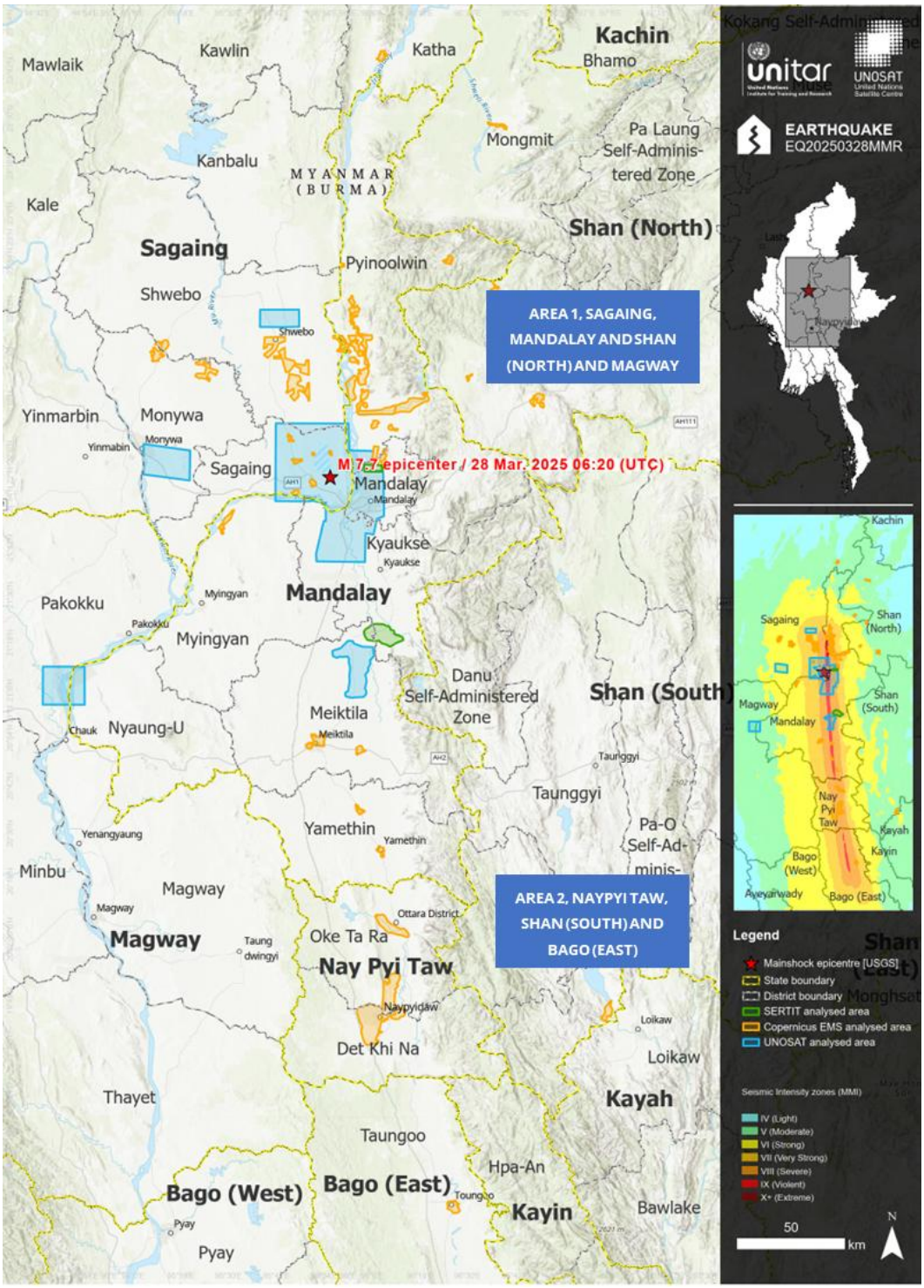

Figure 3 - This map shows the analysis extents in the two main areas examined by UNOSAT, Copernicus EMS, and ICUBE-SERTIT to assess infrastructure damage caused by the M7.7 earthquake on 28 March 2025. The map also identifies the earthquake epicentre, located northwest of Mandalay city, Myanmar.

Area of interest	Post event satellite data	Pre event satellite data
Area 1, Sagaing, Mandalay, Shan (North) and Magway	1. Pléiades Neo: 29 March 2025	1. Pléiades Neo: 21 January, 5 June 2023, 20 April, 11 May, 06 October, 1 & 21 November, 5 December 2024, 13, 18 and 26 Januay 2025
	2. Pléiades: 1, 10, 12, 13, 14 and 15 April 2025	2. Pléiades: 15 Decmber 2021, 16 Febuary 2023, 6 and 16 March 2025
	3. WorldView-1: 3 April 2025	3. WorldView-2: 14, 25 April, 9 May 2023, 18, 28 January, 17, 20, 23 March, 24, 30 December 2024 and 21 Jan 2025
	4. WorldView-2: 3, 11 and 25 April 2025	4. WorldView-3: 21 Jan 2025, 15 Febuary 2025, 6 and 18 March 2025
	5. WorldView-3: 0 March 2025	5. PlanetScope: 4 January 2023
	6. GeoEye-1: 29 March 2025, 4, 14 April 2025	6. ESRI World Imagery: 13 April, 2 October 2023 and 18 January 2024
	7. THEOS-2: 29 March 2025	7. SPOT6: 6 January and 8 Febuary 2025
		8. GeoEye-1: 23 March 2024
Area 2, Naypyi Taw, Shan (South) and Bago (East)	1. Pléiades: 31 March, 1, 3, 14 and 16 April 2025	1. Pléiades: 23 Febuary 2024
		2. Pléiades Neo: 25 January 2024 and 7 Febuary 2025
		3. WorldView-2: 4 Febuary 2025
		4. ESRI World Imagery: 13 December 2023

Table 1 – Overview of satellite imagery used for the damage assessment covering all analysed areas and their respective acquisition dates.

II.2 Analysis summary

This comprehensive satellite-derived building damage analysis identified a total of 28,672 buildings or structures with visible damage in the assessed areas, including Magway, Mandalay, Sagaing, Bago (East), Nay Pyi Taw, Shan (North), and Shan (South) States. Additionally, approximately 314 locations with damaged or potentially damaged roads and bridges were identified.

State / Region	Analysed area (km^2)	Building damage assessment			Transportation damage assessment		
		Potentially Damaged Buildings	Damaged and Destroyed Buildings	Total of Pot. Damaged & Damaged Buildings	Damaged bridge	Damaged road segments	Total of affected road and bridge
Mandalay	1,792	7,966	3,408	11,374	4	247	249
Sagaing	1,818	5,973	2,674	8,647	5	39	44
Shan (South)	21	3,774	1,285	5,059	-	11	11
Nay Pyi Taw	340	1,898	314	2,212	-	7	7
Bago (East)	22	149	225	374	-	-	-
Magway	212	447	26	473	-	-	-
Shan (North)	32	349	184	533	1	2	3
Total	**4,236**	**20,556**	**8,116**	**28,672**	**10**	**306**	**314**

Table 2 - This map depicts the analysis extents in Bago (East), Magway, Mandalay, Nay Pyi Taw, Sagaing, Shan (North) and Shan (South) Regions of Myanmar examined by UNOSAT, Copernicus EMS and ICube-SERTIT to determine infrastructure damage caused by the M7.7 earthquake on the 28th of March 2025. The map also identifies the earthquake epicentre northwest of Mandalay city, Myanmar.

II.3 Area 1: Sagaing, Mandalay, Shan (North) and Magway Regions

Based on 2025 WorldPop spatial demographic dataset, the four regions of Mandalay, Sagaing, Shan (North), and Magway have a combined population of about 18 million with a total area of about 146,000 km². As illustrated in Figure 4, the analysis focused on 15 districts within these regions, covering approximately 3,900 km². As detailed in Table 3, UNOSAT identified 21,027 buildings or structures with visible or potential damage, along with 10 damaged bridges and 288 segments of damaged or affected roads.

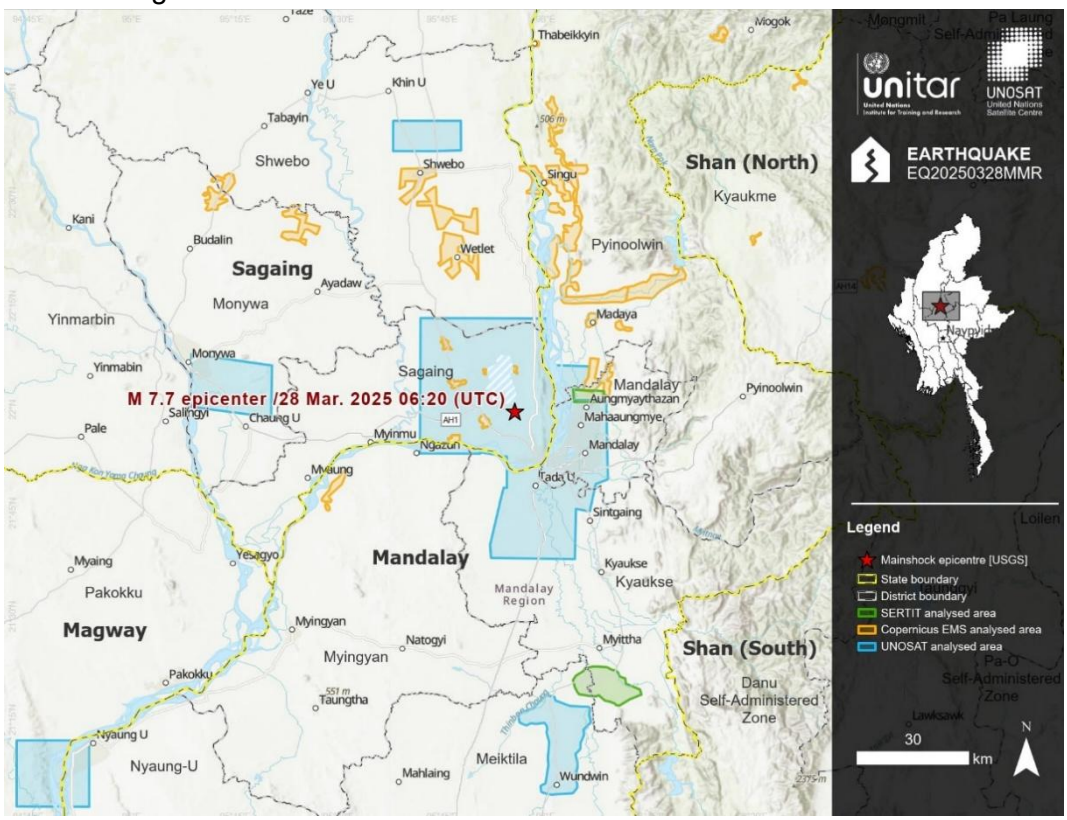

Figure 4 - This map depicts the analysis extents in Sagaing, Mandalay, Shan (North) and Magway Regions of Myanmar examined by UNOSAT, Copernicus EMS and ICube-SERTIT to determine infrastructure damage caused by the M7.7 earthquake on the 28th of March 2025. The map also identifies the Mainshock epicentre, which is also situated within the region.

State/ Region/ District	Analysed area (km²)	Building damage assessment			Transportation damage assessment		
		Potentially Damaged Buildings	Damaged and Destroyed Buildings	Total of Pot. Damaged & Damaged Buildings	Damaged bridge	Damaged road segments	Total of affected road and bridge
Magway	**212**	**447**	**26**	**473**	**-**	**-**	**-**
Pakokku	212	447	26	473	-	-	-
Mandalay	**1,792**	**7,966**	**3,408**	**11,374**	**4**	**247**	**249**
Kyaukse	553	772	344	1,116	3	6	8
Mandalay	373	1,249	1,495	2,744	1	195	196
Meiktila	306	878	396	1,274	-	2	1
Myingyan	52	865	239	1,104	-	-	-
Nyaung-U	109	426	24	450	-	-	-
Pyinoolwin	384	3,233	725	3,958	-	20	20
Yamethin	16	543	185	728	-	24	24
Sagaing	**1,818**	**5,973**	**2,674**	**8,647**	**5**	**39**	**44**
Katha	11	57	119	176	-	-	-
Monywa	334	2,592	87	2,679	-	-	-
Sagaing	1,093	2,436	1,572	4,008	2	9	11
Shwebo	380	888	896	1,784	3	30	33
Yinmarbin	0	-	-	-	-	-	-
Shan (North)	**32**	**349**	**184**	**533**	**1**	**2**	**3**
Kyaukme	25	299	108	407	1	2	3
Mongmit	7	50	76	126	-	-	-
Total	**3,854**	**14,735**	**6,292**	**21,027**	**10**	**288**	**296**

Table 3 - Overview of Building/Structure Damage Assessment in [1]Sagaing, [2]Mandalay, Shan (North), and Magway Regions. The table provides an overview of the total and analysed areas for each affected district within the region/state, as well as the potentially damaged or destroyed buildings, potentially damaged buildings, and damaged roads and bridges identified during the analysis.

[1] https://unosat.org/products/4095
[1] https://unosat.org/products/4097
[2] https://unosat.org/products/4094
[1&2] https://unosat.org/products/4096
[1&2] https://unosat.org/products/4098

II.3.1 Building/Structure damage assessment in Sagaing, Mandalay, Shan (North) and Magway Regions

The preliminary assessment of damage to buildings and structures in the Sagaing, Mandalay, Shan (North), and Magway Regions was conducted by UNOSAT, Copernicus EMS, and ICube-SERTIT using a photo-interpretation approach with very high-resolution satellite images from before and after the seismic event, made available through the Space Charter. Post-event satellite images were acquired on 29 and 30 March and 3, 4, 11, 14, 15 and 25 April 2025, along with pre-disaster images. In the analysed areas, 21,027 buildings with significant visible damage were identified. The district of Sagaing recorded the highest number of earthquake-affected buildings, with 4,008 damaged or potentially damaged structures.

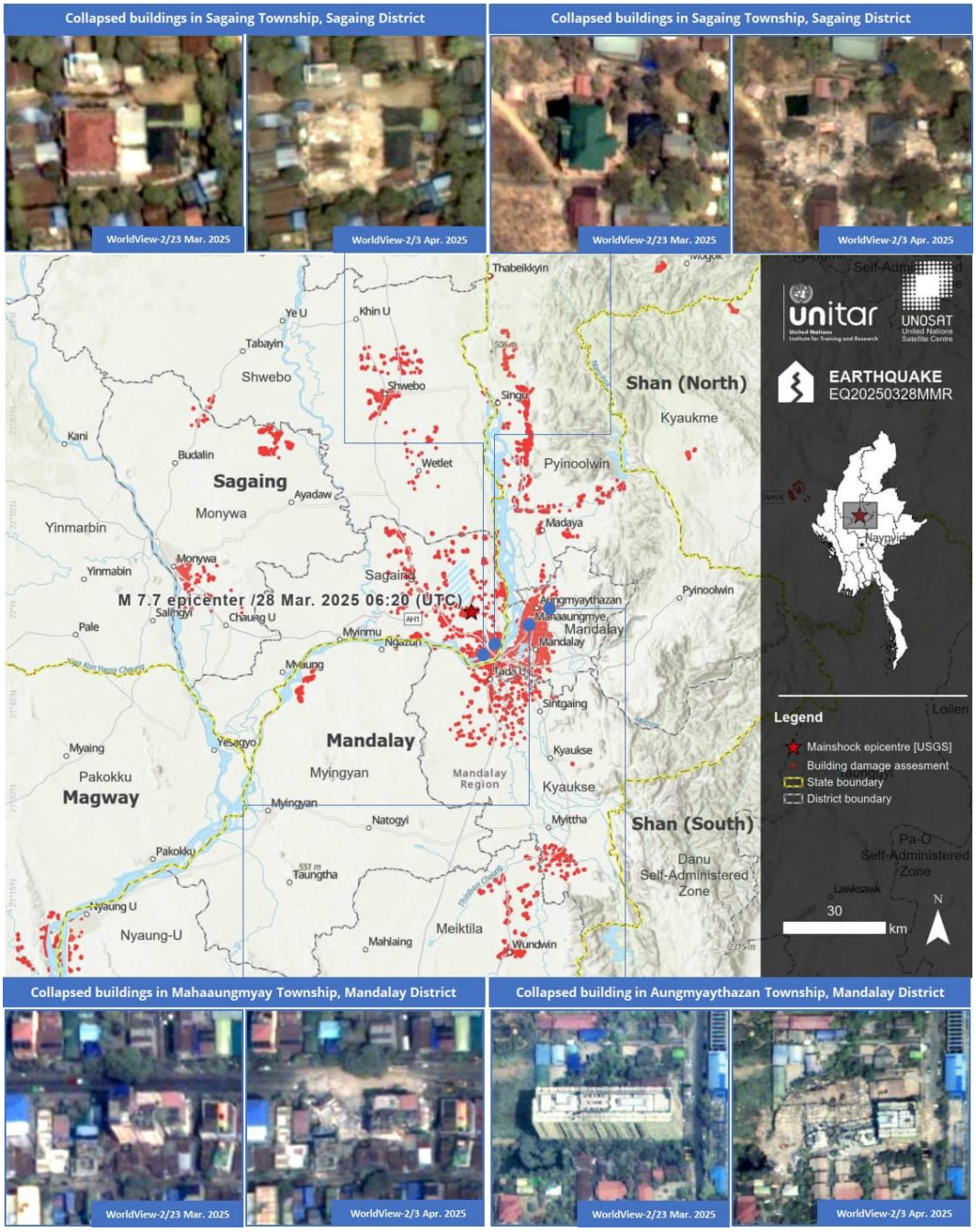

Figure 5 - This map depicts the extent of damaged buildings in the Mandalay, Sagaing, Shan (North), and Magway Regions of Myanmar, with a specific focus on the Sagaing and Mandalay Regions. Inset images from the WorldView-2 satellite, acquired on 3 April 2024, highlight and visualize the damage to buildings in Sagaing Township (Sagaing District), as well as in Mahaaungmyay and Aungmyaythazan Townships (Mandalay District).

Source: USGS / HDDS and the International Charter Space and Major Disasters

II.4 Area 2: Nay Pyi Taw, Shan (South) and Bago (East) Regions

Based on 2025 WorldPop estimates, the three regions of Nay Pyi Taw, Shan (South) and Bago (East) have a combined population of over 7 million and cover a total area exceeding 90,000 km². As illustrated in Figure 6, the analysis focused on 4 districts within these regions, covering approximately 380 km².

As reported in Table 4, UNOSAT identified 7,645 buildings or structures with visible or potential damage, along with 18 segments of damaged or affected roads.

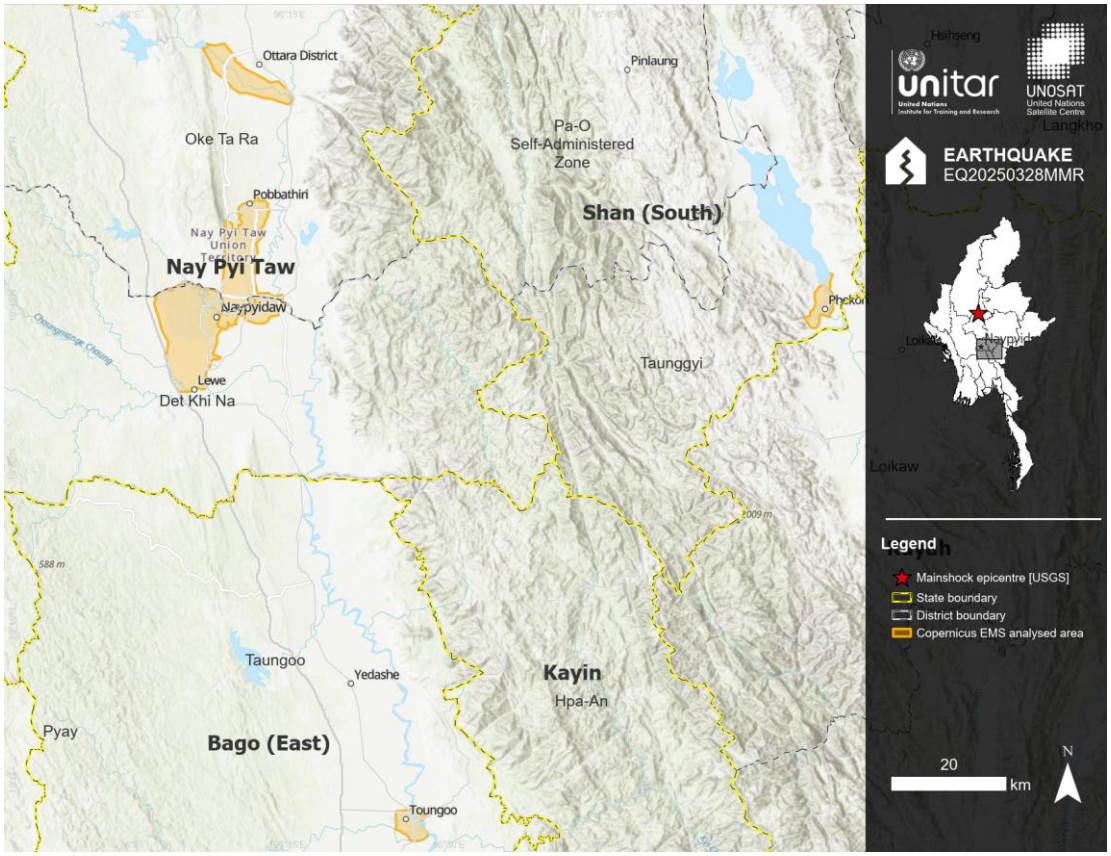

Figure 6 - This map depicts the analysis extents in Nay Pyi Taw, Shan (South) And Bago (East) Region of Myanmar examined by UNOSAT and Copernicus EMS to determine infrastructure damage caused by the M7.7 earthquake on the 28th of March 2025. The map also identifies the Mainshock epicentre, which is also situated within the region.

State/ Region/ District	Analysed area (km²)	Building damage assessment			Transportation damage assessment		
		Potentially Damaged Buildings	Damaged and Destroyed Buildings	Total of Pot. Damaged & Damaged Buildings	Damaged bridge	Damaged road segments	Total of affected road and bridge
Bago (East)	**22**	**149**	**225**	**374**	**-**	**-**	**-**
Taungoo	22	149	225	374	-	-	-
Nay Pyi Taw	**340**	**1,898**	**314**	**2,212**	**-**	**7**	**7**
Det Khi Na	184	835	254	1,089	-	-	-
Oke Ta Ra	156	1,063	60	1,123	-	7	7
Shan (South)	**21**	**3,774**	**1,285**	**5,059**	**-**	**11**	**11**
Taunggyi	21	3,774	1,285	5,059	-	11	11
Total	**382**	**5,821**	**1,824**	**7,645**	**-**	**18**	**18**

Table 4 – Overview of Building/Structure Damage Assessment in Nay Pyi Taw, Shan (South) and Bago (East) Regions. The table provides an overview of the total and analysed areas for each affected district within the region/state, as well as the potentially damaged/destroyed buildings, potentially damaged buildings, and damaged roads and bridges identified during the analysis.

II.4.1 Building/Structure damage assessment in Nay Pyi Taw, Shan (South) and Bago (East) Regions

The preliminary assessment of damage to buildings and structures in the Nay Pyi Taw, Shan (South) and Bago (East) Regions was conducted by UNOSAT, Copernicus EMS using a photo-interpretation approach with very high-resolution satellite images from before and after the seismic event. These images were made available through the International Charter Space and Major Disasters. Post-event satellite images were acquired on 31 March and 1, 3, 14 and 16 April 2025, along with pre-disaster images. In the analysed areas, 7,645 buildings with significant visible damage were identified. The district of Taunggyi recorded the highest number of earthquake-affected buildings, with 5,059 damaged or potentially damaged structures.

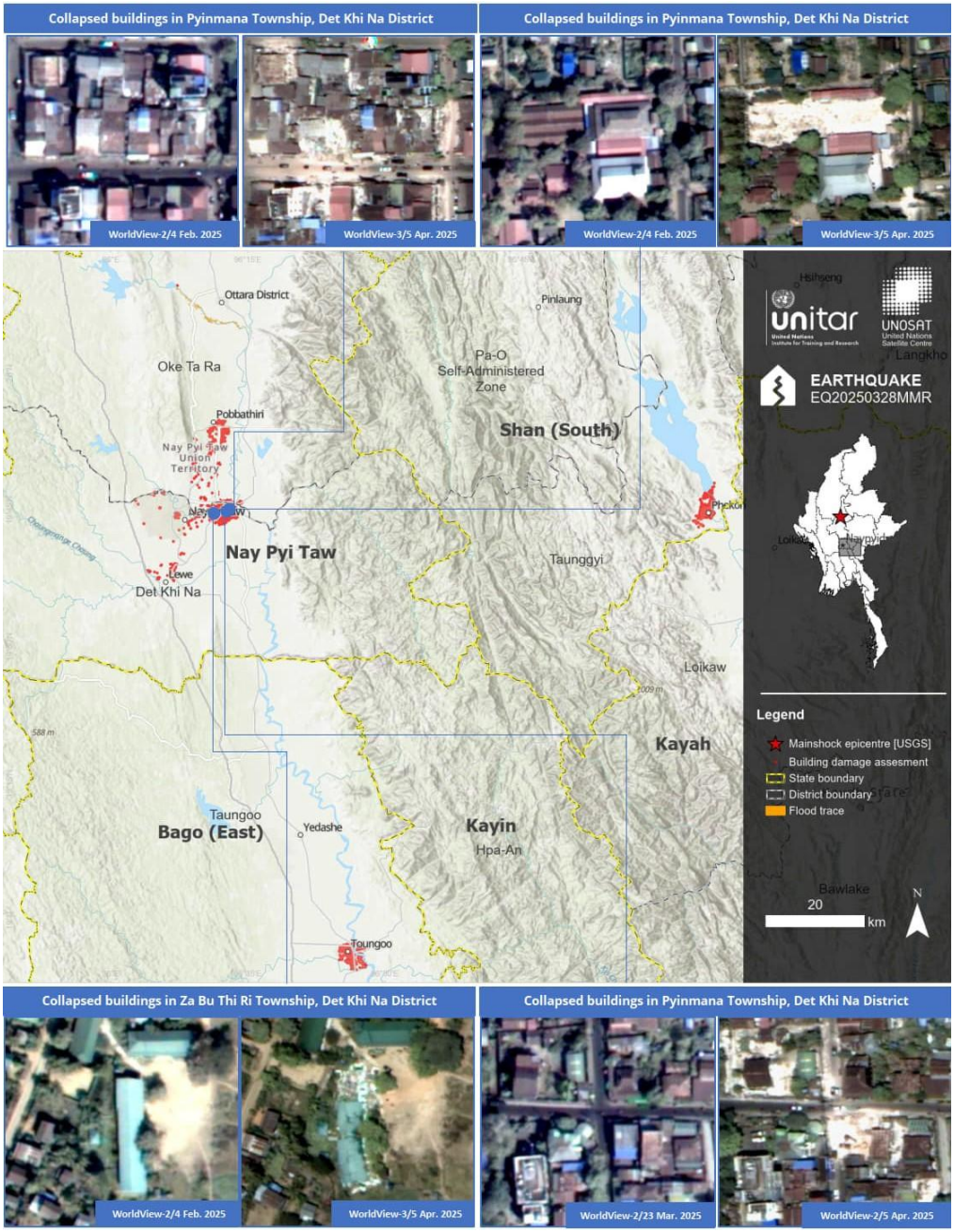

Figure 7 - This map depicts the extent of damaged buildings in the Nay Pyi Taw, Shan (South) and Bago (East) Regions of Myanmar, with a specific focus on the Nay Pyi Taw Regions. Inset images from the WorldView-3 satellite, acquired on 5 April 2024, highlight and visualize the damage to buildings in Za Bu Thi Ri Township and Pyinmana Township in Det Khi Na District.

Source: USGS / HDDS and the International Charter Space and Major Disasters

III. Additional Analysis

III.1 Damage Assessment of Cultural Heritage Sites

UNOSAT's specialised heritage unit was activated immediately to specifically assess the impact and damage to cultural heritage sites in Myanmar following the earthquake 28 March 2025. The team began by identifying all UNESCO World Heritage Sites and Tentative List sites, and contacted UNESCO, which has field offices around the world, including in Myanmar, to inquire if there were any particular sites they were concerned about. This formed the initial list of sites for analysis. While damage analysis began on these identified locations, in order of imagery availability, UNOSAT continued to identify and map further cultural heritage locations with a total comprehensive survey within the area of interest shown in figure 8. Where higher densities of cultural heritage were identified, additional areas of interest (AoIs) were defined and added to the list of locations for analysis. Beyond this area and the list of heritage sites and AoIs, UNOSAT's rapid mapping team identified further damage within their comprehensive building damage analysis that were identified as cultural heritage by the heritage unit.

In total, 407 instances of damage to cultural heritage were identified with a further 332 instances of possible damage observed. Most damaged locations were near the epicentre of the earthquake with possible damage detected across a slightly wider area (figure 9). A notable exception is a damaged village built with traditional architecture located on the north shore of Inle Lake.

All components of the UNESCO Tentative List Site, Ancient Cites of Upper Myanmar, are located within 20 km of the epicentre of the earthquake. Namely, these are Mingun (less than 15km from the epicentre), Amurapura, [3]Innwa, [4]Mandalay, and [5]Sagaing. These five historic cities are still populated today with an estimated over 120,000 people across the five historic cities exposed to the effects of the earthquake. The walls around the historic city of Mandalay have been damaged, as well as various buildings inside. While at Innwa, iconic architecture including Maha Aung Mya Bonzan Monastery, Nanmyint Tower, Shwezigon Pagoda, Sandamuni Temple, and Lay That Gyi Temple have been damaged. At Mingun the damaged buildings include Mingun Pahtodawgyi and Sat Taw Yar Pagoda and across the whole of modern Minkun, damage was observed at numerous other cultural heritage locations.

Although further from the epicentre, UNOSAT's heritage team observed many damaged buildings within a village located in [6]Intha along the north shore of Inle Lake, while a neighbouring village nearby appears to only have possible damage to a few buildings. Imagery was not available for most of the traditional villages around Inle Lake, and further analysis is recommended.

Of the two UNESCO World Heritage Sites in Myanmar, no visible damage was observed in any of the components of Pyu Ancient Cities ([7]Beikthano, [8]Halin, [9]Sri Ksetra); however multiple instances of possible damage were observed within one of the components of [10]Bagan (component 1).

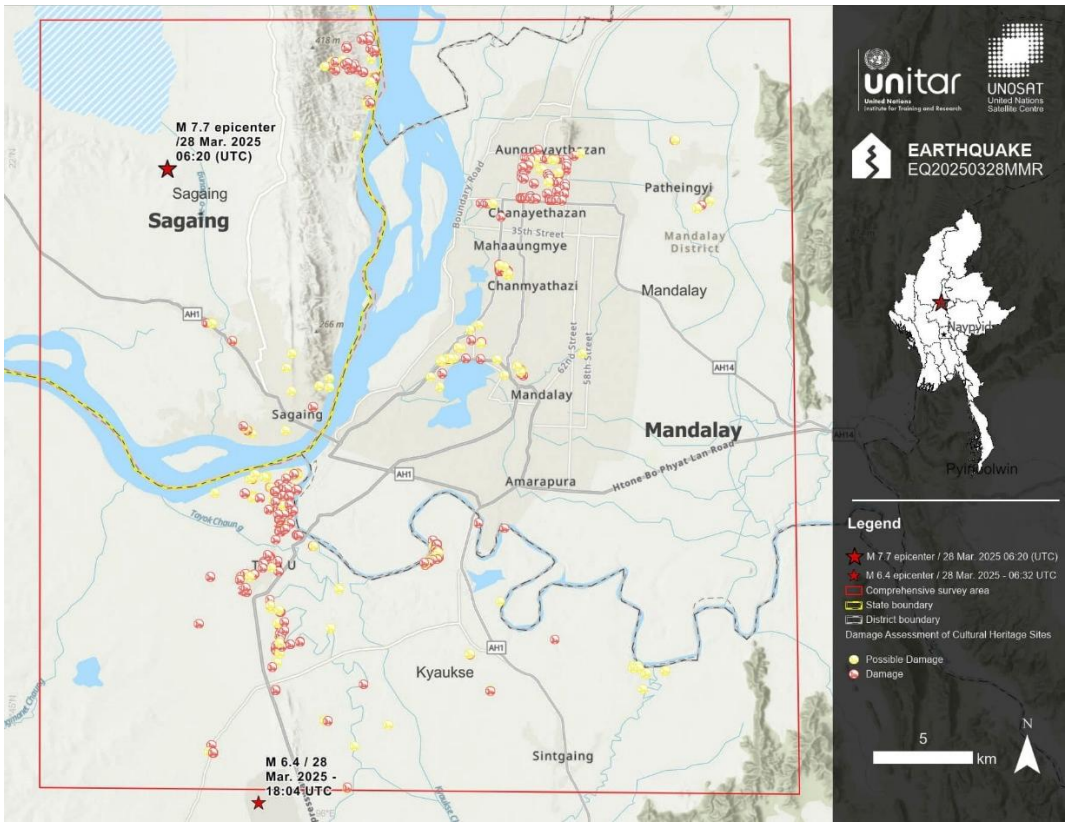

Figure 8- UNOSAT's specialised heritage unit conducted a comprehensive survey with an aim to identify and map all cultural heritage locations within an area of interest located near the epicentre of the earthquake and the 6.4M aftershock. Where higher densities of cultural heritage were identified, additional areas of interest (AoIs) were defined and added to the list of locations for analysis.

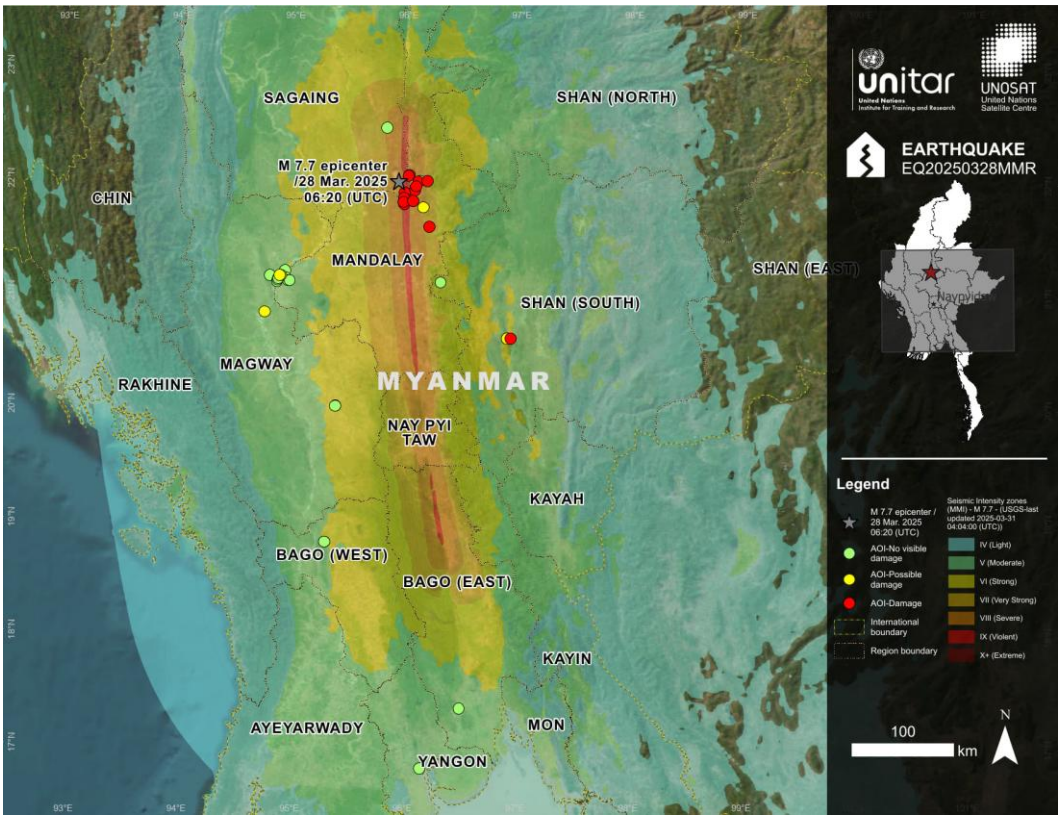

Figure 9 - The majority of damaged locations were near the epicentre of the earthquake with possible damage detected across a slightly wider area. A notable exception is a damaged village built with traditional architecture located on the north shore of Inle Lake.

State / District	Damage Assessment of Cultural Heritage Sites		
	Possible Damage	Damage	Total of Pot. Damaged & Damaged Buildings
Magway	**8**	**-**	**8**
Magway	8	-	8
Mandalay	**204**	**326**	**530**
Kyaukse	129	204	333
Mandalay	51	118	169
Meiktila	14	1	15
Nyaung-U	10	2	12
Pyinoolwin	-	1	1
Sagaing	**62**	**53**	**115**
Sagaing	55	53	108
Shwebo	7	-	7
Shan (South)	**58**	**28**	**86**
Taunggyi	58	28	86
Total	**332**	**407**	**739**

Table 5 – Overview of Building/Structure Damage Assessment at Cultural Heritage Sites in Mandalay, Sagaing, Magway, and Southern Shan.The table summarizes the total number of potentially damaged or destroyed buildings, as well as those identified as potentially damaged during the analysis.

IV. UNOSAT LIVE Web map

A dedicated "*UNOSAT Damage Assessment Live Map*" was published by the United Nations Satellite Centre (UNOSAT) to provide responders and the humanitarian actors with a comprehensive overview of the satellite derived damage assessments conducted by the UN Satellite Centre and other mapping organisations (Copernicus EMS and Sertit). With access to this web map, users have the possibility to view and download damage analyses (such as building damage points in GIS formats) covering all areas of interest defined for satellite damage analyses in Myanmar.

Furthermore, through this live web map it is possible to access geolocated field pictures collected using the UN-ASIGN application. These geolocated ground pictures provided important details situation and about the intensity of damage to buildings and infrastructures.
This web map tool was accessible and provided all humanitarian actors with up-to-date, publicly available building damage datasets from various mapping organizations supporting response operations in Myanmar through satellite imagery analysis.

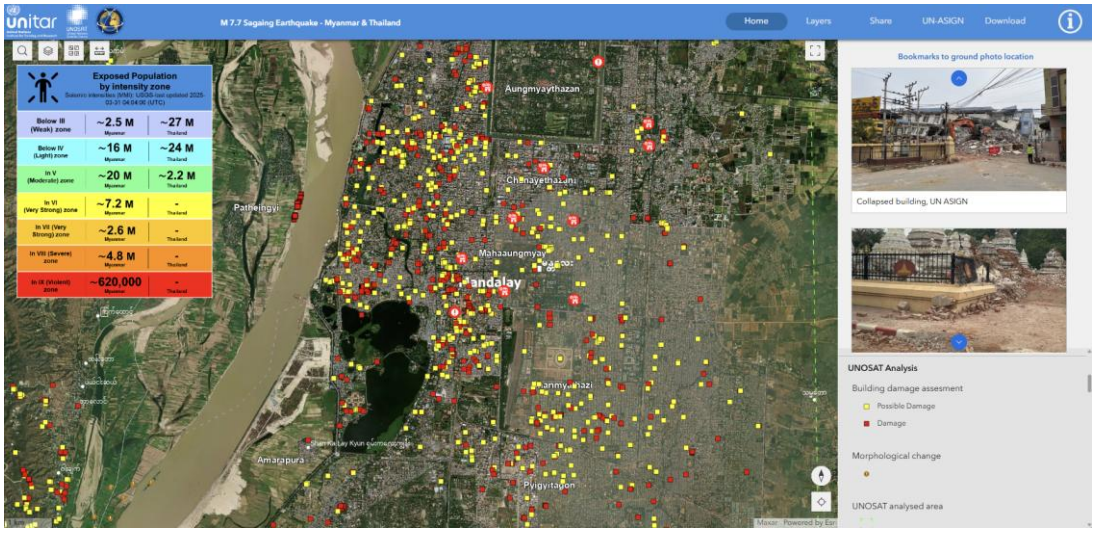

Figure 10 – UNOSAT web map showing damaged (red) and potentially damaged (yellow) areas from the 28 March 2025 M7.7 earthquake, with population exposure by intensity zone.

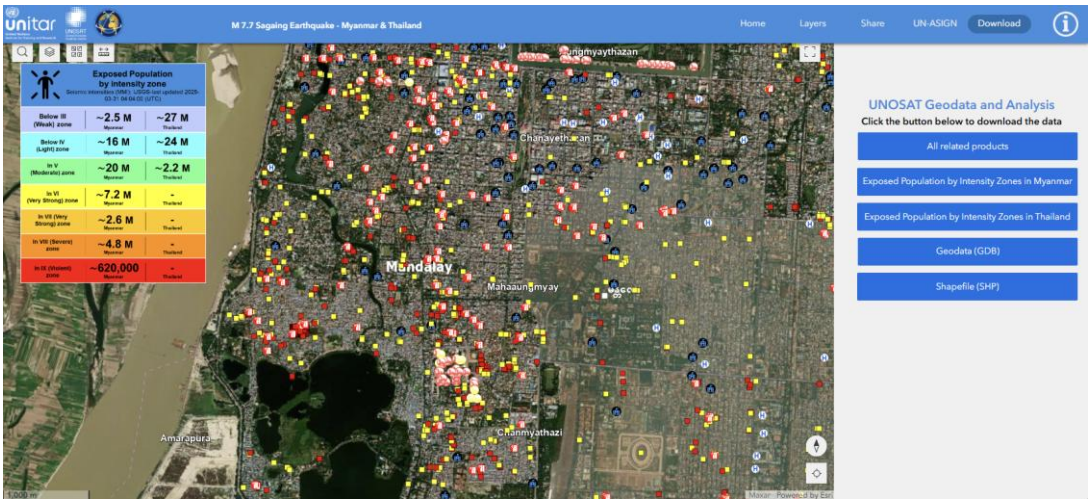

Figure 11 – The UNOSAT Live web map provides a convenient interface for end users to download all geospatial data and statistics via the Downloads tab.

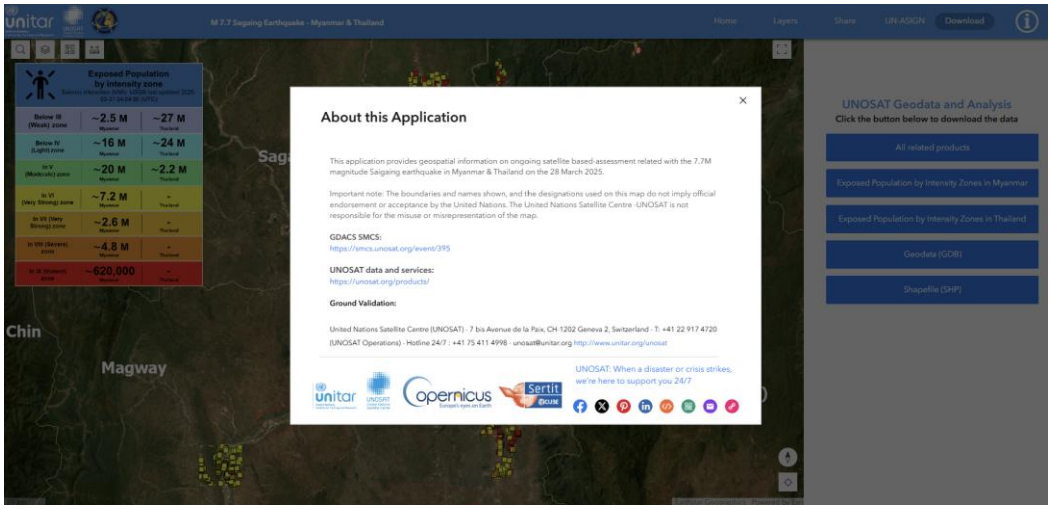

Figure 12 – The UNOSAT Live web map consolidates all related data for this activation, including SMCS, seismic event analysis, and more—providing users with a one-stop service.

V. Ground Photos – UNASIGN

UN-ASIGN It is a free crowdsourcing app provided by the United Nations Satellite Centre (UNOSAT) to support its operations. The app allows anyone to upload geotagged photos with annotations, which are then integrated into UNOSAT mapping products in near real time. It is specifically designed to work over low-bandwidth connections, and contributions are automatically uploaded to UNOSAT's live map tools to support overall situational awareness.

Access to images and on-the-ground feedback is critical for UNOSAT's activities, particularly in validating satellite imagery-based assessments. Relevant feedback is shared with humanitarian entities in the field to enable a comprehensive assessment of the situation.

Users with a mobile device and an internet connection can also view contributions on the map in real time or load an area for later viewing in offline mode.

The UN-ASIGN app can be downloaded on Play store or Apple store.

Figure 13 - UN-ASIGN application interface for download on both respectively Apple and Android devices,

VI Ground photos – Other sources

The United Nations Satellite Centre (UNOSAT) used ground photos from the media and residents to visualize the damage on the ground and understand the damage induced by the Sagaing Earthquake mainshock on the 28th of March 2025 and subsequent aftershocks.

Figure 14 – These are ground photos collected through the UN-assigned system, which allows local people to submit photos from the ground. This is very important and useful, as it supports validation by enabling comparisons with satellite-based damage assessments. As shown, the earthquake caused severe damage, including completely collapsed buildings in many areas—particularly in the Mandalay and Sagaing Regions, which are close to the epicentre

The analysis has not been verified in the field yet; please send your comments and feedback to unosat@unitar.org.

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