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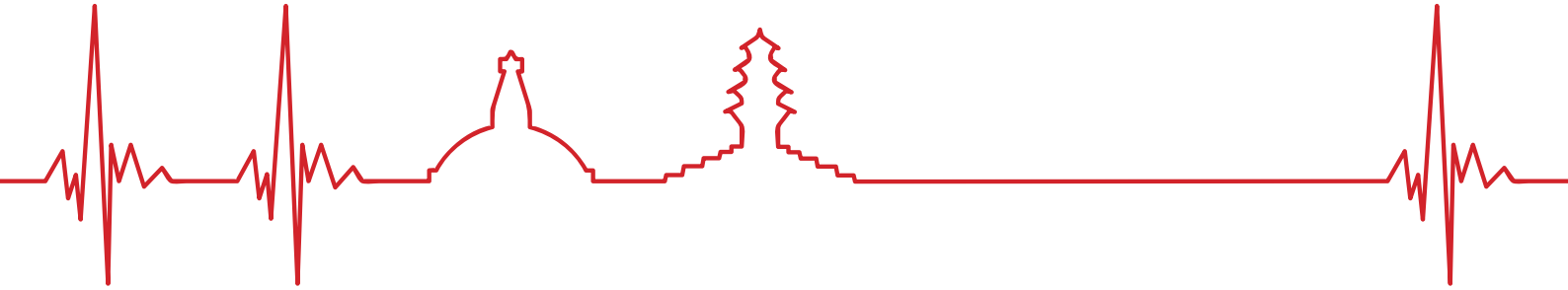
Overview Report of the Nepal Cultural Emergency Crowdmap Initiative

19 May 2015



ACKNOWLEDGEMENTS

As the news of a massive earthquake in Nepal broke out, ICCROM, ICOMOS-ICORP and their combined network of heritage professionals decided to put up the Kathmandu Cultural Emergency Crowdmap to gather on-the-ground reports in order to provide a consistent situation overview.

This initiative was successful in gathering valuable information thanks to the contributions of several institutions namely, the Smithsonian Institution, USA, the Disaster Relief Task Force of the International Council of Museums (ICOM-DRTF) and UNESCO office in Kathmandu, Nepal.

Social media reports of cultural heritage professionals working in Nepal helped in gathering reports of damage to cultural heritage beyond the Kathmandu Valley. In particular the core team of the crowdmap wishes to acknowledge the invaluable contributions of:

Dina Bangdel, Randolph Langenbach, Prof. Arun Menon, Tapash Paul, Neelam Pradhananga, Swosti Rajbhandari, Sudarshan Raj Tiwari, Rakshya Rayamajhi, Kai Weise.

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Report compiled and edited by:

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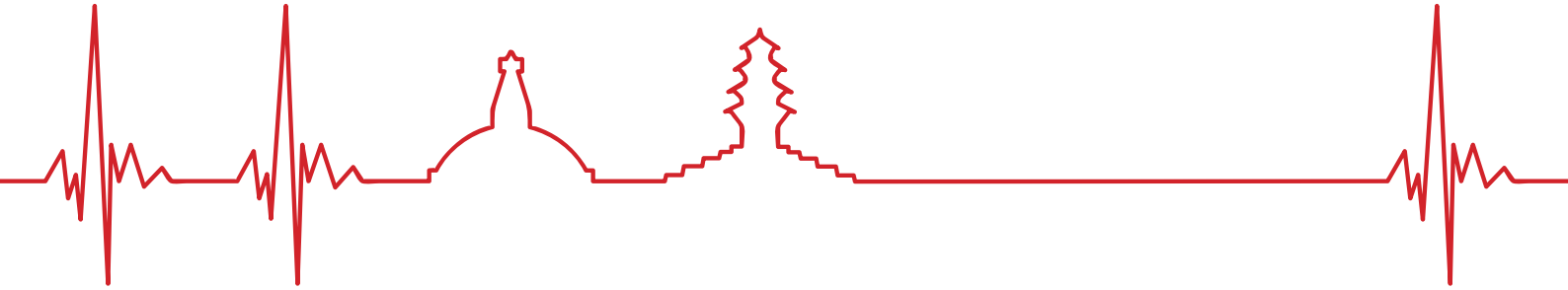
Disclaimer: The contents of this report are based on crowd sourced information and individual reports on damage to cultural sites and collections in Nepal, and which remain to be verified through detailed on-site assessments.



STRUCTURE OF THE REPORT

Figure 1 (cover): The military assist in cleaning and salvage in Swayambhunath, an ancient religious complex, atop a hill in the Kathmandu Valley. Tapash Paul/Drik. April 30, 2015.

Figures 2-3: Aftermath of the earthquake in Bhaktapur Durbar Square, part of the Kathmandu Valley UNESCO World Heritage Site. Tapash Paul/Drik. April 30, 2015

A. CRISIS OVERVIEW

On April 25 at 11:56 AM local time, a 7.8 magnitude earthquake struck Nepal, with its epicenter in Lamjung District, located 81 km northwest of Kathmandu with a depth of 15 km. (USGS)

Although confirmed figures are still to be produced, an estimated eight million people have been affected. 39 districts in the Western and Central regions have been affected, including Kathmandu Valley districts (OCHA CASS25/04/2015). As of 8 May, Death toll: 7,885 (UNOCHA); Injured: 17,803 (UNOCHA) Total Displaced: 2.8 million (UNRC).

As of May 8, the Government of Nepal reports that 288,793 public buildings were damaged and 254,112 were partially damaged. The highest rates of destruction and damage to housing are reported in Sindhupalchowk, Gorkha, Nuwakot, Ramechhap and Dhading. 39 out of 75 districts are affected. The most affected areas are: Makawanpur, Sindhuli, Bhaktapur, Dhading, Dolakha, Gorkha, Kathmandu, Lalitpur, Lamjung, Rasuwa, Ramechhap, Nuwakot, and Sindulpalchowk. (LC, OCHA) (GON)

With the monsoon season beginning in June, providing emergency shelter to affected communities in remote and hard to reach areas is a priority. For the immediate response, high quality tarpaulins, tools and household items (including blankets) are needed. In Gorkha District Headquarters, electricity and water supplies are available and the market is functional. However, access to rural areas in the district remains difficult. Aftershocks continue, with two strong quakes recorded on May 6 causing additional landslides in rural areas, including Laprak, Gunda and Lapu. In Laprak, humanitarian partners reported a lack of shelter, food, water and medicines.

Some villages in northern Gorkha are reachable only by foot trails; thus, there is a need to strengthen partnership with local trekking and porter associations to reach remote areas.



Figures 4-6: Cleaning efforts underway using heavy machinery in Swayambhunath, an ancient religious complex, atop a hill in the Kathmandu Valley, west of Kathmandu city. Tapash Paul/Drik. April 30, 2015

On April 29, the Humanitarian Country Team launched a Flash Appeal to provide life-saving assistance and protection for millions of people affected by the earthquake. The appeal was subsequently revised to include projects in the Online Project System. The revised appeal is seeking $423 million to further scale up the ongoing relief efforts. For further information, read the Office for the Coordination of Humanitarian Affairs' Situation Overview Report.

B. KEY ACTORS

National Actors

1. Civilian: The Government of Nepal (GON) is leading the response through the National Emergency Operations Centre (NEOC) (http://neoc.gov.np/en/) located next to the Ministry of Home Affairs (MOHA) in the Singha Durbar premises. In support of the GON, the On-Site Operations and Coordination Center (OSOCC) has been set up to coordinate the international support to the response. The other coordination hubs are the MNMCC at army HQ; the Reception/Departure Center (RDC) and Humanitarian Staging Area (HSA) at the airport. (UNRC, Log Cluster, VOSOCC)

2. The Nepal Army is leading the Multi-National Military Coordination Centre (MNMCC) at the Army HQ. In support of the Nepal Army and the GON, the UN Disaster Assessment and Coordination Team (UNDAC) has set up a Civil-Military Coordination Cell in the MNMCC to facilitate information from the OSOCC to the MNMCC. The MNMCC is coordinating all foreign military assets through daily meetings (0900). (USPACOM, UN, OCHA, UNRC). The Nepalese military mobilized some 10,000 troops to be deployed in all Village District Committees (VDCs) across 16 districts to support logistics and overall relief efforts (UNOCHA)

3. The Nepal Red Cross Society (NRCS) is attending Central Natural Disaster Relief Committee (CNDRC), National Emergency Operations Center and UN cluster meetings on a regular basis. Coordination with District Disaster Relief Committee (DDRC) and collaboration with agencies for relief distribution continues in the affected areas.

4. Department of Archaeology (DOA) has set up an emergency coordinating cell with the support of UNESCO Kathmandu office for coordinating salvage and securing of damaged cultural heritage sites. (DOA, 9/5/2015)

International Actors

All international humanitarian efforts are being coordinated through the UN Humanitarian Country Team (HCT). Two humanitarian hubs have been established in Gorkha District Headquarters (west of Kathmandu) and Chautara in Sindhupalchowk District (northeast of Kathmandu) to coordinate field level operations. (MNMCC)

For further information, read the report of the Centre for Excellence: Disaster Management and Humanitarian Assistance.

Figures 7-8: Aftermath of the earthquake in Swayambhunath (left) and Bhaktapur Durbar Square (right). Tapash Paul/Drik. April 30, 2015

C. NEPAL'S CULTURAL HERITAGE

Recognised as a country of many ethnic groups, cultures and faiths, the Himalayan state of Nepal has rich tangible and intangible cultural heritage. Four of its cultural and natural heritage sites have been inscribed on the World Heritage list.

Known for its syncretic Hindu and Buddhist traditions, Nepal has unique historic cities, buildings and structures with intricate ornamentation displaying outstanding craftsmanship in brick, stone, timber and bronze that are some of the most highly developed in the world. Newari *Chaityas* (prayer halls with Stupa at one end), *Bahals* (courtyards) and *Patis* (ornamental communal platforms) add to the uniqueness of cities in Nepal. The ancient arts of storytelling, dance, and music are precious gifts passed down to us from our ancestors. Nepal has a rich tradition of music and dance. Example: the legendary *Kartik Nach* is a dance recital that has been performed each year since the 17th century.

In addition to an outstanding built heritage, Nepal's treasure of artworks, antiquities and documentary heritage is housed in an estimated number 50 public and private museums, art galleries and libraries. Nepal also has a national archive.

Guthi is a traditional community organization system that still binds Nepal's society. *Guthis* (community based trusts) were the custodians of religious and cultural sites and undertook activities to preserve culture and tradition. Considering the importance and role of *Guthis*, the government of Nepal has set up the Guthi Sansthan (corporation) to manage, conduct and coordinate the *Guthis* throughout the country.

D. CULTURAL EMERGENCY CROWDMAP AND SUMMARY OF HERITAGE DAMAGE REPORTS

The information contained in this report began with the reports submitted to the Kathmandu Cultural Emergency Crowdmap. This crowdmap was set up on April 25 as a joint initiative of the International Centre for the Study of the Preservation and Restoration of Cultural Property (ICCROM), the International Scientific Committee on Risk Preparedness of the International Council on Monuments and Sites (ICOMOS-ICORP) and several cultural heritage professionals. It is supported by the Smithsonian Institution and UNESCO.

Every humanitarian emergency has a cultural dimension. When culture is affected, the local communities are the first to witness and respond. These local voices, which hold crucial information, often do not reach institutions and organizations that are in charge of responding to the

Figures 9-10: Aftermath of the earthquake in Sankhu, on the outskirts of the Kathmandu Valley (left) and Pashupatinath temple complex in Kathmandu (right). Tapash Paul/Drik. April 30, 2015

emergency with the goal of recovering culture. Therefore, this crowdmap aims to collect on-the-ground reports of the damage caused to cultural heritage in Nepal as a result of the earthquake, particularly those reports that may not be collected by other actors. These reports come from residents, social media (via Facebook and Twitter hashtags), news agencies, and cultural heritage professionals.

The aims of the crowdmap are fourfold:

1. To provide a more inclusive and broader picture of how the heritage of Nepal has been affected (such as historic houses, city squares, World Heritage Sites, traditions, collections, etc.);
2. To provide an easy, shareable and comprehensive platform for all response agencies;
3. To identify immediate needs and priorities for first aid to cultural heritage;
4. To identify key national and local actors and their respective actions in the region.

As of May 15, there have been 84 reports posted to the crowdmap website. These reports have been analyzed and compiled into a quick reference summary of damaged heritage in Nepal (see Annex 2). Added to the list of damaged heritage found via the crowdmap reports were sites gathered from additional sources, bringing the total listing to 150 entries. One particularly useful list came from an article published in NepaliHimal (http://nepalihimal.com/article/4377) and compiled/translated by Jishnu Subedi. Other details came from Bangladeshi photographer Tapash Paul/Drik, who was sent by the Prince Claus Fund (Netherlands) to provide photo-documentation of damage to heritage in Nepal.

Each report in the compiled heritage damage report summary in Annex 2 contains information on:

- Source of the information
- Location
- Type of heritage (generally the name of the temple or site)
- Extent of the damage (minor, medium, major)
- Whether or not protection or recovery measures are known to have been taken
- Corresponding report number from the crowdmap, if applicable
- Any additional notes

The reports reveal substantial damage to built heritage sites across the Kathmandu Valley and, in some cases, into the Western Region of the country, including temples, stupas, palaces, historic houses and central squares. Many of the reports are from well-known monument zones, such as the temple complexes at Swayambhu and Pashupati or the Bhaktapur and Patan durbar squares. However, the list also contains some more remote sites, such as a monastery in Ghiling village, Upper Mustang or vernacular heritage in

Upper and Lower Tsum, Gandaki.

Of the 141 entries, 68 mention sites that have collapsed completely. In most of the cases, these were temples or stupas constructed with brick, which disintegrated when confronted with the motion of the earthquake. An *additional* 56 entries mention major structural damage, which could include anything from large cracks in walls and foundations to partial collapse of a building. These sites are at particular risk, considering that their situation could worsen with another aftershock, weather damage during the oncoming monsoon season or careless attempts at cleaning or shoring. The rest of the entries mention medium or minor damage to heritage, or they refer to salvage, cleaning or protection efforts.

In places with a large concentration of temples and other historic structures, such as the durbar squares in Bhaktapur and Patan or the temple complex of Swayambhu, some structures collapsed completely, while their neighbors remain standing. However, those still standing are often structurally unsound, and efforts to shore them up are desperately needed. Many of the temples and other religious structures feature elaborately carved wooden elements, as well as stone sculptures, much of which ended up in a heap of rubble. In some cases, these elements have now been gathered and, in at least a few instances, documented and protected (see section E), though they are often exposed to the elements.

There are 4 reports of damage to vernacular heritage, including Madanpur, Nuwakot; Barkpak and other villages in and around Gorkha; villages in Upper and Lower Tsum, Gandaki; and, some aerial photographs of unspecified villages outside of Kathmandu.

Vernacular heritage (including traditionally-built homes) and religious sites (temples / stupas) located in more

Figure 11: Scaffolding has been erected around a damaged buidling on Patan Durbar Square, a UNESCO World Heritage Site, in Kathmandu Valley. Tapash Paul/Drik. May 7, 2015

Figure 12: Aftermath of the earthquake in Bhaktapur Durbar Square, part of the Kathmandu Valley UNESCO World Heritage Site. Tapash Paul/Drik. April 30, 2015

remote villages are particularly at risk. There will be less existing documentation of these sites than there is for the more well known Kathmandu Valley World Heritage sites, meaning that if the rubble from these sites is cleared away, there will be less evidence available to repair or reconstruct them. The difficulty of coordinating aid response to more remote areas also puts heritage in these zones at a greater risk of further damage due to weather or landslides.

In addition to the reports of damaged temple complexes, 7 reports indicate damage to museums and a library:

- Chhauni / National Museum in Kathmandu – medium damage
- Gorkha Museum – major damage
- Two museums at Changu (not specified) – complete collapse
- Living Traditions Museum at Changu – major damage
- Patan Palace Museum – major damage – salvage ongoing
- Library in Sankhu (oldest in Sankhu and one of the oldest in Nepal) – major damage
- Kaiser Library, Kathmandu — major structural damage and 1/3 of books damaged

According to the reports, efforts are being made to salvage collections and architectural elements at the Patan Palace Museum and Gorkha Museum (see section E for more).

Several reports also indicate how livelihoods associated with cultural industries including tourism have been adversely impacted by the disaster, thereby adding to the losses. The destruction and damage of major tourist attractions, such as Dharahara Tower and the palace and temple complexes of the Kathmandu Valley, delivers a major blow to the Nepalese tourism industry. According to a 2012 report by the Nepalese Ministry of Culture, Tourism & Civil Aviation, tourism accounted for, on average, 2.2% of GDP from 2000 to 2012 for an annual average of around 242 million US dollars in revenue. In 2012, the country saw more than 800,000 foreign visitors, the majority of whom were visiting for pleasure rather than business or mountaineering. The tourism sector in Nepal will take years to recover. However, this process will be greatly aided by quick and efficient investment in recovery within the cultural sector, particularly the cultural heritage around which much of Nepal's tourism is based.

Docey Lewis describes in HandEye the devastation that has also been wreaked on intangible heritage and heritage-based livelihoods, focusing primarily on the weavers and spinners in Bhaktapur, Khokana, Patan, Kopasi and Bungamati, some of whom have lost their lives, and many of whom have lost their homes and their workplaces.

Figures 13-14: The military assist in cleaning and salvage at the Swayambhunath temple complex (left) and the Patan Museum (right). Tapash Paul/Drik. April 30, 2015

Another report highlighted pottery making in Bhaktapur, a vibrant family-based industry with a long tradition. The destruction of people's homes and livelihoods puts entire craft industries like this at risk. Craft industries must not be overlooked during the recovery phase, given the significant role they can play, both in economic recovery and in restoring heritage sites using traditional materials and techniques.

This damage report summary and the listing contained in Annex 2 are meant to provide a brief overview of the situation. However, every report represents an individual case, backed up by various levels of additional detail about that site, from photographs to rapid assessment results to salvage or cleaning efforts (see Section E). The rapidly changing situation on the ground means that many of these reports are incomplete. Together, though, they provide a snapshot of the damage to heritage in Nepal, one that will be augmented and adapted as events unfold.

E. PROTECTION EFFORTS FOR HERITAGE

The extensive destruction and damage of Nepal's historical and cultural heritage sites demand a rapid intervention. While first responders have started putting up shelters and tents for the safety of the population, the army and volunteers have increased their efforts to protect cultural heritage remains at various levels:

- Documentation
- Retrieval of architectural remains and artefacts
- Salvage and securing the sites
- Assessment

In total, 31 reports mention protection efforts in several cities (Kathmandu, Bakhtapur, Gorkha, Pokhara, Changu, Kokana, Bungamat, Sidhipur et Lubhu) for different types of monuments (museums, temples, monasteries, historic houses). Only one report mentions archives or libraries (the library in Sankhu, one of the oldest in Nepal) and even though museums are mentioned, there is no mention of the status of their collections. Rare data is available on the work forces of the army or the volunteers involved.

The Nepalese army: Salvaging and securing architectural remains and artefacts

The salvage of architectural remains consists of gathering wooden and stone elements in piles around the damaged monuments. As they are more easily removable than other construction materials, they could be reused in reconstructing the building. The Nepalese army appointed 150 soldiers to sort out architectural remains and artefacts of the Durbar square temples in Kathmandu. They also transferred sculptures and other cultural artefacts to Patan Museum. To prevent looting, police were helping to guard the sites.

Local communities and individuals: The very first aiders for heritage

In Kathmandu, local communities and volunteers have been reliable in guarding sites to prevent looting. In this case, the semi-governmental organization of the *Guthis* (see section C) have attempted to coordinate with volunteers and local heritage clubs as they have local heritage lists to rely on. Several pictures show the difficulty in securing damaged monuments and sites, where often a simple sign or a cord delimit the protected zone. In Bakhtapur and its surrounding villages, the local community has proceeded to salvage elements of damaged temples and their protection in safe places even while the region was still unreached by humanitarian aid.

In the same approach based on post-disaster response, engineers and architects gathered in teams with doctors to make a rapid safety assessment of buildings in Lubhu, Siddhipur, Sankhu and Bungmati. They inspected a total of 669 houses that they systematically targeted in three categories based on stability scales: unsafe for living, has to be mended for living and safe for living. Their assessment didn't focus on historic buildings but did specifically mention 4 historic houses, listing 2 of them as unsafe for living.

Photos show monks and bookshop keepers dusting books and relics. In addition to these photos, witnesses also give evidence of a link between intangible heritage and artefacts or monuments. Two reports focused on the importance of craftsmanship for the recovery phase, but no information is available on the loss of intangible heritage due to human loss.

Professionals and international solidarity for documentation and on-the-ground response

In the early stages following the disaster, ICCROM and ICORP shared some training materials that have been used extensively by some organizations involved in salvage, e.g. in the salvage operation at Swayambunath by the Society of Nepalese Architects (SONA) through Prof. Sudarshan Raj Tiwari.

Local professional organizations, including the Kathmandu Valley Preservation Trust and AFCP in Patan Royal Palace, proceeded to conduct the first assessment and salvage operations. In the first hours after the earthquake, a Turkish team of 14 volunteers led by an ICOMOS-ICORP member arrived in Kathmandu ready to assist in salvage for monuments and artefacts. A team of archaeologists mandated by UNESCO also assessed the damages at the Swayambhunath temple in Kathmandu and performed a first triage. Prince Claus Fund (Netherlands)

Figures 15-16: Salvage of artifacts under way at the Swayambhunath temple complex (left) and the Patan Museum (right). Tapash Paul/Drik. April 30, 2015

Figure 17: Aftermath of the earthquake in Swayambhunath, an ancient religious complex, atop a hill in the Kathmandu Valley, west of Kathmandu city. Tapash Paul/Drik. April 30, 2015

sent Bangladeshi photographer Tapash Paul/Drik, who arrived on April 30, to document damage to heritage at Boudhanath, Swayambhunath, Bhaktapur, Sankhu and Pashupatinah. Also, Prof. Arun Menon, Director of National Institute of Safety of Heritage Structures at Indian Institute of Technology, Chennai, shared guidance material on temporary stabilisation of structures.

F. PRINCIPAL NATIONAL ACTORS IN THE FIELD OF CULTURE

- Key contact: Ministry of Culture, Tourism and Civil Aviation, Government of Nepal: Department of Archaeology (DOA) has set up an emergency coordinating cell with the support of UNESCO Kathmandu office for coordinating salvage and securing of damaged cultural heritage sites. (DOA, 9/5/2015).
- UNESCO Kathmandu office
- Kathmandu Valley Preservation Trust (KVPT),
- Society of Nepalese Architects (SONA)
- Kathmandu Living Labs
- Fragments of Extinction
- Guthis Sansthan
- Prominent Citizens: Prof. Sudarsharn Raj Tiwari, Institute of Engineering, Kathmandu

G. IMMEDIATE PRIORITIES FOR ACTION

The following list of actions is proposed in order to provide an outline of steps that should be taken to contribute to a comprehensive and coordinated response to the heritage damaged during the earthquake.

1. **Setting up of a consistent and standardized system for initial damage assessment of all types of heritage (built, movable and intangible):** This would lead to the identification of risks as well as priority actions. Special effort needs to be made to include sites outside of the Kathmandu Valley, which can be more difficult to access and have less baseline data available, and to include traditions and knowledge that can be essential for recovery.
2. **Development of a centralized national plan for first**

Figures 18-19: Aftermath of the earthquake at the Boudhanath stupa (left) and Pashupatinath temple complex in Kathmandu (right). Tapash Paul/Drik. April 30, 2015

aid: This would include plans for salvage, stabilization, temporary storage, as well as documentation of all steps. This plan should include costs, people, supplies and roles for various governmental and non-governmental bodies and organizations, according to their competencies and expertise.

3. **Arrangements with the military, On-Site Operations and Coordination Center (OSOCC) and other agencies for help with logistics and communication for undertaking the first aid to cultural heritage:** These arrangements should include protection of movable heritage and architectural elements against looting, as well as ensuring that cleaning programs do not remove elements of heritage value together with the rest of the rubble.
4. **Arrangements/partnerships with local trekking and porter associations for carrying supplies for securing cultural heritage in remote areas:** This will support a more widespread damage assessment to remote parts of the country.
5. **Training of volunteers and community based organizations such as Guthis (among others) for salvage and stabilization of built and movable heritage:** Their knowledge will also be indispensable when it comes to knowing how intangible heritage can work as a force for both cultural and economic recovery.
6. **Work closely with mainstream emergency actors to participate in Post Disaster Needs Assessment to channel funding for culture recovery**

H. RECOMMENDED METHODOLOGY & APPROACH FOR FIRST AID & RECOVERY

The following recommendations are based on an understanding and analysis of data collected through the Kathmandu Cultural Emergency Crowdmap Initiative, as well as independent reports. As such, they are contingent on the results of detailed on-site assessments:

I. Based on on-site surveys, analyze the damage pattern and accordingly develop techniques for salvage and stabilization of building elements;

II. Increase collaboration between those working on temporary stabilisation of damaged buildings and those salvaging the collections that are contained in them. Trained structural engineers must first ensure the safety of these structures through shoring or bracing before salvage operations can begin;

III. Assess needs for long-term recovery of the affected communities in both urban and rural areas. For example: the need for regeneration/diversification of livelihoods associated with cultural industries;

IV. Identify and develop mechanisms for collaboration with various humanitarian and development actors for early recovery of the culture sector.

END OF REPORT

ANNEX 1: HERITAGE DAMAGE ASSESSMENT: A STRUCTURAL ANALYSIS

Note: Following the earthquake, Randolph Langenbach conducted this analysis, based on secondary sources and his previous visits to Nepal. It was then uploaded to the Kathmandu Cultural Emergency Crowdmap.

Analysis by: Randolph Langenbach
Photos by: Neelam Prdhananga & Kai Weise

This damage (see figures 20-22 below) in my opinion is the result of having a timber framework inside hard against the walls of a bearing masonry structure, but not extending into the structure as it would if it were timber laced masonry. Whenever I have seen this, the problem is that the masonry in effect is not allowed to fully bear onto itself below, as the load path is shared by the frame. The frame is flexible (note that it is not braced) so in the earthquake, the masonry weight responds to the vibration of the earthquake, but the frame then allows the top layers of the structure to sway – which cause the side walls in the direction of the sway to separate, as they have only the short (and rotted) ends of the timbers extending into them. In fact, the structural damage may tell us roughly what the primary wave direction is at this location.

What is interesting is to speculate whether the structure would have done better had it been laced only horizontally with timber, rather than have an internal timber frame. I would expect that it would have – so long as there was a timber ring beam in the walls, tied at the corners, at the level of the cornice and water table above the door at the base of the tall upper cone-shaped structure, and again about 2/3 or 3/4 the way up to the top of the cone shaped roof structure.

On the other hand, since there seems to be a pattern of tall structures on narrow bases having collapsed in this earthquake, I suspect that they were collapsed often by rocking back and forth, causing compression as well as shear failure of the momentary overloaded masonry on the corners and walls at the base, as shown in the onset of damage in a photo circulated by Kai Weise (ICORP) below (see figure 23, next page). This then narrows the base further, and the structures begin to tip over, which then at a certain angle, they pancake the rest of the way in place. This goes part of the way to explain why the pagoda temples which have graced the durbar squares for centuries have been particularly hard hit – and can be seen to have EITHER fallen down completely, or remain standing quite intact (with cracks we cannot yet see in photos, except for this one by Kai) – rather than as is often

Figures 20-22: Damaged structure in Bhaktapur Durbar Square. Neelam Prdhananga & Kai Weise. April 30, 2015

Figure 23: Structural cracks in masonry of a damaged building. Kai Weise. April 30, 2015

with masonry buildings, being damaged partly by the loss of parts of the upper walls or roofs.

On the question of what the vibrational frequency was, some of you may have noticed the video at the address below. If someone in Nepal or who recognizes the hotel behind can map where this swimming pool is, it may be interesting to see the map. Before you wonder why you think I am wasting your time with a swimming pool video, take a look. After the camera responds to the high frequency waves in the seismic vibrations, you can see the water respond to what is clearly a very powerful longer frequency waves. It is this that alerted me to the likelihood

Figure 24: Historical photo showing damage from the 1934 earthquake in Nepal.

of a significant long period component to this earthquake at Kathmandu. (This is consistent with my comment in the last email about the likelihood of concentrations of damage in parts of Kathmandu.) Longer period vibrations tend

to be less damaging to low-rise masonry buildings than shorter ones, but on the other hand, it can be consistent with the rocking hypothesis described above, as well as help to explain in part why the 9-story Dharahara Tower that survived the 1934 earthquake collapsed in this one.
https://www.youtube.com/watch?v=9r-8O8YuUfM

On the question of the difference between the 1934 earthquake and this one, I went looking for a map of their locations, and up popped up first was the map attached here. How uncanny it is that on this map is the clearest prediction of the earthquake that just happened – with its damage district marked almost exactly. Also, the closer proximity of the 1934 quake is an indication that the frequency of its vibrations would have been different in Kathmandu, than in the 2015 quake, which can partially explain differences in buildings that proved to be most vulnerable.

We can see from the above photos that the cultural heritage has been divided into two sides of the center. We can see the left side has been completely destroyed and collapsed while the right side dismantled, but still connected somehow in the original structure. Also, we can see most of the wood of the architecture still connected in good shape slightly. I hope we can discuss this situation if you don't mind.

ANNEX 2: COMPILED HERITAGE DAMAGE REPORT TABLE

Source*	Number	Location	Type/name of heritage	Extent of damage	Protection / recovery measures taken?	Crowdmap report no.	Notes
CM	1	Lagan, Kathmandu	Bhimsen Thapa's Palace	Major damage/partial collapse		6	
CM	2	Patan	Hari Shanker & Uma Maheswar Temple	Major damage/collapse		10	
CM	3	Thapathali	Kalmochan Temple	Major damage/collapse		10	
CM	4	Patan	Patan Durbar Square		Y	12	
CM	5	Bhaktapur	Shiva temple	Major damage (danger of imminent collapse)		14	Includes photos
CM	6	Bhaktapur	Historic building	Major damage (ground floor pati collapse)		16	Includes photos
CM	7	Siddhidas Marg	Historic bazaar neighborhood	Minor damage		21	
CM	8	Near Kathmandu Durbar Square	Kathesimbhu Stupa	Minor/no damage		21	
CM	9	Kathmandu	Trailokya Mohan Narayan Temple	Major damage/collapse	Y	21	Cleaning of rubble
CM	10	Bhaktapur	Intangible/objects – pottery making			24	Can contribute to recovery
CM	11	Kwathandau, Bhaktapur	Agam ghar at Prasannasil Mahavihar	Major damage		26	Includes photos
CM	12	Ghiling village, Upper Mustang	Monastery	Medium damage		30	
CM	13	Swaymbhunath, Kathmandu	Thrangu Tara Abbey	Medium damage		34	Includes photos
CM	14	Patan Durbar Square	Various	Major damage	Y	36	Cleaning efforts ongoing
CM	15	Shobha Bhagwati, Kathmandu	Indrayani temple	Major damage		37	Includes photos
CM	16	Kathmandu	National Museum Chhauni	Medium damage	Y	37	Includes photos
CM	17	Ranipokhari, Kathmandu	Durbar High School	Major Damage		38, 20	Includes photos
CM	18	Bhotahiti, Kathmandu	Lalit Kala Academy (National Academy of Arts)	Major Damage		38, 19	Includes photos
CM	19	Tripureshwor, Kathmandu	Kal mochan temple	Major damage		38	Includes photos

* (CM = CrowdMap, NH = NepaliHimal, UV = other unverified, TP = Tapash Paul photos)

Source*	Number	Location	Type/name of heritage	Extent of damage	Protection / recovery measures taken?	Crowdmap report no.	Notes
CM	20	Sankhu	House with a beautiful wood carved window	Major damage		42	Includes photos
CM	21	Sankhu	Oldest library in Sankhu and maybe Nepal	Major damage		42	Includes photos
CM	22	Sankhu	Jyotilingeswor temple	Major damage		42	Includes photos
CM	23	Kathmandu Durbar Square	Trailokya Mohan Narayan Temple	Major damage		48	
CM	24	Khokana & Bungamati	Medieval villages	Major/medium damage	Y	51	Salvage begun; Includes photos
CM	25	Bungmati	Mix of heritage and non-heritage	4 heritage buildings completely destroyed; 2 others not safe for living; 2 others in good condition	Y	57	Rapid damage assessment / tagging; Includes photos
CM	26	Sankhu	Mix of heritage and non-heritage		Y	58	Rapid damage assessment / tagging; Includes photos
CM	27	Siddhipur	Mix of heritage and non-heritage		Y	59	Rapid damage assessment / tagging; Includes photos
CM	28	Lubhu	Mix of heritage and non-heritage		Y	60	Rapid safety assessment; Includes photos
CM	29	Changunarayan	Changunarayan Temple	Medium - needs shoring up		61	Includes photos
CM	30	Swayambhunath	Thrangu Tara Abbey	Medium/major damage	Y	62	Includes photos
CM	31	Siddhipur	Temples	Minor/no damage		63	Includes photos
CM	32	Barpak, Gorkha	Vernacular houses	Major damage		65	
CM	33	Upper and Lower Tsum, Gandaki, Western Region	Vernacular houses and stupas	Major damage		67	Includes photos
CM	34	Kathmandu	Nautale Durbar	Major damage; using heavy machinery right away	Y	68, 75	Includes photos

* (CM = CrowdMap, NH = NepaliHimal, UV = other unverified, TP = Tapash Paul photos)

Source*	Number	Location	Type/name of heritage	Extent of damage	Protection / recovery measures taken?	Crowdmap report no.	Notes
CM	35	Madanpur, Nuwakot	Vernacular heritage	Major damage to stone and brick buildings in village		71	Includes photos
CM	36	Outside Kathmandu	Vernacular heritage	Major damage to village		73	Includes photos
CM	37	Patan Durbar Square	Various	Major damage	Y	74	Includes photos
CM	38	Outside Kathmandu		Damage to terraced hillsides and villages		76	Includes photos
CM	39	Kankeshwari, Kathmandu	?	Medium		80	Includes photos
CM	40	Patan Durbar Square	Various	Major damage	Y	84	Effective usage of military and police to clean and prevent looting; Includes photos
CM	41	Swotha Tole, Patan	Radha Krishna Temple	Major damage		85	
CM	42	Swotha Tole, Patan	3 temples	2 seem to have minor/no damage; 1 totally collapsed		86	
CM	43	Gorkha	Gorkha museum	Major/medium damage	Y	93	Includes photos
CM	44	Kathmandu Durbar Square	Gaddhi Baithak	Major damage		87, 96	Includes photos
CM	45	Kathmandu Valley (Bhaktapur, Khokana, Patan, Kopasi and Bungamati)	Intangible heritage / heritage-based livelihoods of spinners and weavers	Major damage		94	
CM	46	Sankhu	Vajrayogini temple sculptures	Major damage to sculptures		95	Includes photos
CM	47	Patan Dhoka, Lalitpur	Madan Puraskar Pustakalaya - library and archive of Nepali books and periodicals	Major damage - evacuation required		97	
CM	48	Kathmandu	Kaiser Library	Major damage to building; 1/3 of books damaged	Y	98	
NH	100	Dharahara	Dharahara Tower	Totally damaged	Y	11, 18, 52	
NH	101	Kathmandu Palace (Durbar) Square, Basantapur	Hanuman Dhoka Palace	Completely cracked			

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Source*	Number	Location	Type/name of heritage	Extent of damage	Protection / recovery measures taken?	Crowdmap report no.	Notes
NH	102	Kathmandu Palace (Durbar) Square, Basantapur	Kasthamandap	Complete damage/ Collapse		18, 75, 88	
NH	103	Kathmandu Palace (Durbar) Square, Basantapur	Shikhar style small temple in the north of Kasthamandap	Complete damage/ Collapse		75	
NH	104	Kathmandu Palace (Durbar) Square, Basantapur	Nine storey palace	Roof collapse			
NH	105	Kathmandu Palace (Durbar) Square, Basantapur	Vishnu temple	Complete damage/ Collapse			
NH	106	Kathmandu Palace (Durbar) Square, Basantapur	Maju Deval temple	Complete damage/ Collapse			
NH	107	Kathmandu Palace (Durbar) Square, Basantapur	Bhagavati temple	Complete damage/ Collapse			
NH	108	Kathmandu Palace (Durbar) Square, Basantapur	Mahadev temple	Complete damage/ Collapse			
NH	109	Kathmandu Palace (Durbar) Square, Basantapur	Krishna temple	Complete damage/ Collapse			
NH	110	Kathmandu Palace (Durbar) Square, Basantapur	Das (ten) Mahaghar temple	Complete damage/ Collapse			
NH	111	Kathmandu Palace (Durbar) Square, Basantapur	Statue of King Pratap Malla	Complete damage/ Collapse			
NH	112	Kathmandu Palace (Durbar) Square, Basantapur	Shikhar style Mahadev temple	Complete damage/ Collapse			
NH	113	Kathmandu Palace (Durbar) Square, Basantapur	Kageswari temple	Complete damage/ Collapse			
NH	114	Kathmandu Palace (Durbar) Square, Basantapur	Five small temples around Jagannath temple	Complete damage/ Collapse			

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Source*	Number	Location	Type/name of heritage	Extent of damage	Protection / recovery measures taken?	Crowdmap report no.	Notes
NH	115	Kathmandu Palace (Durbar) Square, Basantapur	Taleju temple	Partial damage			
NH	116	Kathmandu Palace (Durbar) Square, Basantapur	Mahavishnu temple	Cracks			
NH	117	Kathmandu Palace (Durbar) Square, Basantapur	Ranipokhari temple	Partial Damage			
NH	118	Changu Narayana	Seto Gumba (White monastery)	Complete damage/ Collapse	Y	27, 83	
NH	119	Changu Narayana	Kileshwor temple	Complete damage/ Collapse	Y	27, 83	
NH	120	Changu Narayana	Amatya Sattal and other Sattal (public rest houses)	Complete damage/ Collapse	Y	27, 83	
NH	121	Changu Narayana	Chhinnamasta temple	Partial damage	Y	27, 83	
NH	122	Swayambhu	Swayambhu Chaitya	Cracks	Y	39, 47	
NH	123	Swayambhu	Boudhanath Trayodash Bhuvan Chaitya	Cracks	Y	78	
NH	124	Swayambhu	Anantapur Mahavihar	Complete damage/ Collapse	Y		
NH	125	Swayambhu	Shantipur Mahavihar	Complete damage/ Collapse	Y		
NH	126	Swayambhu	Devdharma Mahavihar	Complete damage/ Collapse	Y		
NH	127	Swayambhu	Pratappur	Foundation damage	Y		
NH	128	Thapathali-Tripureswor	Tripureswor Mahadev temple	Complete collapse		39	
NH	129	Thapathali-Tripureswor	Hem-Hiryanya temple	Complete collapse		39	
NH	130	Thapathali-Tripureswor	Sattals	Complete collapse		39	
NH	131	Pashupati	Guhyeswari temple	Complete damage/ Collapse			
NH	132	Pashupati	Kirateswor Sattal	Complete damage/ Collapse			
NH	133	Pashupati	White (Seto) Shivalaya at Aryaghat	Complete damage/ Collapse			
NH	134	Pashupati	Panchadeval	Complete damage/ Collapse			
NH	135	Pashupati	Shankaracharya temple	Complete damage/ Collapse			
NH	136	Pashupati	Viswarup/ Vishworoop temple	Complete damage/ Collapse/ Large cracks in dome		79	

* (CM = CrowdMap, NH = NepaliHimal, UV = other unverified, TP = Tapash Paul photos)

Source*	Number	Location	Type/name of heritage	Extent of damage	Protection / recovery measures taken?	Crowdmap report no.	Notes
NH	137	Pashupati	Mrityunjaya Mahadev temple	Complete damage/ Collapse			
NH	138	Pashupati	Chandreswor Sattal	Complete damage/ Collapse			
NH	139	Pashupati	Ram-Mandir	Complete damage/ Collapse			
NH	140	Pashupati	Laxminarayan temple	Complete damage/ Collapse			
NH	141	Pashupati	Gorakhnath temple	Complete damage/ Collapse			
NH	142	Pashupati	Bhandarghar (Storage house)	Complete damage/ Collapse			
NH	143	Pashupati	Pati east of Pashupati	Complete damage/ Collapse			
NH	144	Pashupati	Sattals west of Pashupati	Complete damage/ Collapse			
NH	145	Pashupati	JayaBageswori temple	Damage to the Top floor and spire		77	
NH	146	Lalitpur	Char Naryan temple	Complete damage/ Collapse			
NH	147	Lalitpur	Hari Shankar temple	Complete damage/ Collapse			
NH	148	Lalitpur	Taleju temple at MulChowk	Cracks in the roof			
NH	149	Lalitpur	Patis in Sundari Chowk and ShorhaKhutte (2)	Complete damage/ Collapse			
NH	150	Lalitpur	Jagatnarayan temple at Shankhamul	Complete damage/ Collapse			
NH	151	Lalitpur	Rato Matsyendra Nath (Red Matsyendra Nath) temple at Bungmati	Complete damage/ Collapse			
NH	152	Bhaktapur	Vatsala temple	Complete damage/ Collapse		13, 44, 45, 82	
NH	153	Bhaktapur	Fasideval	Complete damage/ Collapse		44, 45, 82	
NH	154	Bhaktapur	Harishankar Sattal	Complete damage/ Collapse		44, 45, 82	
NH	155	Bhaktapur	Kedarnath temple	Complete damage/ Collapse		44, 45, 82	
NH	156	Bhaktapur	Lal Baithak	Complete damage/ Collapse		44, 45, 82	
NH	157	Bhaktapur	Small temples infront of Nyatapola temple	Complete damage/ Collapse		44, 45, 82	
NH	158	Bhaktapur	Nyatapola (Five story pagoda style temple)	Cracks in roof		44, 45, 82	
NH	159	Changu Narayana	Two museums at Changu	Complete collapse			

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Source*	Number	Location	Type/name of heritage	Extent of damage	Protection / recovery measures taken?	Crowdmap report no.	Notes
NH	160	Kathmandu	National Museum / Chhauni Museum	Cracks		37	
NH	161	Patan	Patan Palace Museum	Cracks	Y	35	Heritage salvage
UV	200	Hanumandhoka Protected Monument Zone	Jagannath Temple	Collapsed completely			
UV	201	Swayambhu Protected Monument Zone	Karma Raj Monastery	Partially destructed	Y		
UV	202	Swayambhu Protected Monument Zone	Many private buildings	Collapsed completely	Y		
UV	203	Swayambhu Protected Monument Zone	Pati – East of Shantipur Temple	Fully damaged	Y		
UV	204	Swayambhu Protected Monument Zone	Agan dega, South of Mahachaitya	Crack on walls	Y		
UV	205	Swayambhu Protected Monument Zone	Bhajan sattal	Vulnerable – possible collapse	Y		
UV	206	Swayambhu Protected Monument Zone	Padma Bhairab (small shikhara temple in front of Pratappur	fully cracked but not collapsed yet	Y		
UV	207	Patan Durbar Protected Monument Zone	Shankar Narayan Temple	Collapsed completely			
UV	208	Pashupati Protected Monument Zone	Sattals North to Vishwarupa Templ	Collapsed completely			
UV	209	Pashupati Protected Monument Zone	Jitjung Prakasheshwor Temple	Damaged			
UV	210	Pashupati Protected Monument Zone	Jitjung Prakasheshwor Sattal	Damaged			
UV	211	Pashupati Protected Monument Zone	Shankaracharya Ashram	Damaged			
UV	212	Pashupati Protected Monument Zone	Mahasnan Ghar	Damaged			
UV	213	Pashupati Protected Monument Zone	Shankar Narayan Sattal	Damaged			
UV	214	Pashupati Protected Monument Zone	Tamreshwor Mahadev Temple	Damaged			
UV	215	Pashupati Protected Monument Zone	Ghat Pasal Sattal	Damaged			
UV	216	Pashupati Protected Monument Zone	Ananta Narayan Temple and Image	Damaged			

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Source*	Number	Location	Type/name of heritage	Extent of damage	Protection / recovery measures taken?	Crowdmap report no.	Notes
UV	217	Pashupati Protected Monument Zone	Pancha Ganesh	Damaged			
UV	218	Pashupati Protected Monument Zone	3 Sattals of Bhashmeshwor Chowk	Damaged			
UV	219	Pashupati Protected Monument Zone	Udasi Akhada	Damaged			
UV	220	Bauddha Protected Monument Zone	Bouddha Stupa	Partially damaged			Frontal decorated part partially damaged
UV	221	Beyond PMZ in Patan	Temple and Sattals on the bank of Bagmati	Collapsed completely			
UV	222	Beyond PMZ in Patan	Ashokan Chaitya, Pulchowk	Cracks		91	
UV	223	Beyond PMZ in Patan	Garad Ghar	Collapsed completely			
UV	224	Beyond PMZ in Patan	Ranga Mahal	Internal part completely collapsed			
UV	225	Beyond PMZ in Patan	Saat Tale Durbar	Western part (wall) collapsed, crack everywhere on wall			Building tilted
UV	226	Beyond PMZ in Patan	Bhairavi Temple	Collapsed completely			
UV	227	Beyond PMZ in Patan	Bhairaviko Ama Budhi Devata Sthan	Collapsed completely			
UV	228	Beyond PMZ in Patan	Lampati	Collapsed completely			
UV	229	Beyond PMZ in Patan	Shital Pati	Collapsed completely			
UV	230	Beyond PMZ in Patan	Seto Pati	Collapsed completely			
TP	300	Kathmandu Football Stadium	Sculptures	Major/Medium damage			TP photo no. 198-200
TP	301	Pashupatinath Temple Complex	Bankali Temple	Major damage			TP photo no. 214, 219-220
TP	302	Pashupatinath Temple Complex	Rajrajeshwari Temple	Major damage			TP photo no. 215-218
TP	303	Baluwapati, Sudal	Historic buildings	Major damage			TP photos
TP	304	Dube Gaun, Kavrepalanchowk	Historic buildings	Major damage			TP photos
TP	305	Changu Narayana	Living Traditions Museum	Major damage			TP photos
TP	306	Changu Village	Historic buildings	Major damage	Y		TP photos
TP	307	Balephi Village, Sindhupalchowk district	Stupa	Major damage - collapse			TP photos
TP	308	Dulikeh Village, near Bhaktapur	Historic buildings	Major damage - collapse			TP photos

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END OF TABLE

ANNEX 3: OBSERVATIONS FROM PROF. ARUN MENON

Significant Observations from 25 April M 7.8 and 12 May M7.3 Nepal Earthquakes

The following are five significant preliminary observations from the aftermath of the 25 April M 7.8 and 12 May M7.3 Nepal earthquakes:

(1) *Quality of construction:* Severe damage or total collapse is observed in poor quality masonry constructions, particularly with sun-burnt clay bricks in mud mortar and burnt clay bricks with mud mortar in both urban and semi-urban areas. Poor quality RC frame structures with probably no seismic design have collapsed in the earthquake. This is in an MMI of VI-VIII in Kathmandu. Focus on earthquake engineering education at different levels (structural engineers, architects, construction engineers, civil contractors, and labour), general awareness (owners) and building approvals regime have to be strengthened.

Figure 1: (A) Total collapse of brick masonry constructions; (B) Pancake failure in poor quality, non-designed RC frame structures

(2) *Typologies of Heritage Structures:* Traditional brick masonry with timber frame structures appear to have performed reasonably well in the low amplitude, long-period ground motion in Kathmandu valley (as observed in Patan, Kathmandu and Bhaktapur Durbar squares). Under the same shaking massive brick masonry structures in lime mortar or mud mortar have completely collapsed. Typological differences must guide retrofit strategies in heritage structures to ensure life safety and loss of heritage. Understanding differences in seismic behaviour can also lead to promoting good local practices in building construction. Possible effect of the swinging nature of the long-period ground motion in the poor performance of rigid, slender masonry structures needs to be studied.

Figure 2: (A) Good performance of traditional brick masonry with timber frame structures; (B) Total collapse of heavy brick masonry heritage structures

(3) *Mitigation measures in buildings:* Historical structures, that collapsed in the 1934 Nepal-Bihar earthquake, and were retrofitted and reconstructed (*e.g. Cyasilin Mandap in Durbar Square of Bhaktapur: Ref.: Neils Gutschow and Gotz Hagmuller*) have performed well. Massive multi-storied masonry structures (*e.g. Rana dynasty buildings*), housing many administrative functions, critical during emergencies, with no seismic-resistant features, have been rendered unusable by the earthquake due to severe damage and partial collapse.

Figure 3: (A) Good performance of traditional brick masonry with timber frame structures retrofitted in the past: Cyasilin Mandap in Bhaktapur; (B) Poor performance of massive multi-storied masonry administrative buildings with no seismic-resistant features

(4) *Long-period structures:* Multi-storied Reinforced Concrete frame structures, with approximately 15-20 stories have been significantly affected by the earthquake. There is possible tuning of the fundamental period of vibration of these tall structures and the long-period ground motion in the two earthquakes.

Figure 4: (A-B) Significant infill damage (with falling hazard) in multi-storied (~ 20 stories) RC frames;

(5) *Free-standing long structures:* A prominent, wide-spread feature of this earthquake is the damage or collapse of numerous free-standing, unsupported compound or precinct walls in brick and stone masonry. The response to a long-period ground motion on rigid, linear (*horizontal*) structures needs investigation.

Figure 5: (A-B) Prominent sliding or overturning and collapse of numerous long unsupported compound/precinct walls;