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Damage Assessments by International Engineers following the Albania Earthquake of November 2019

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Abstract

Following earthquakes in populated areas there is need to assess damage to buildings and other structures. A challenge for the local authorities is to set up a system for coordination of potentially hundreds of assessors over several weeks or even months. The objectives of a Damage Assessment Coordination system are to protect people from potentially dangerous buildings and to facilitate the rapid return to medium-term/permanent accommodation and work. For large events, assessments generally require hundreds of assessors, and many weeks for the initial life-safety assessments. In past events International Engineers have been dispatched to assist national Engineers in their efforts. This paper outlines key challenges in incorporating International Engineers into a national effort by reviewing literature of two recent earthquake responses and providing a detailed account of the damage assessment provided by International Engineers during the response to the November 2019 Albanian Earthquake. The authors deployed to Albania and jointly set up and operated a new concept: Damage Assessment Coordination Centre (DACC). The DACC had two objectives: (1) Support the local authorities to setup their own effective system of Damage Assessment Coordination, and (2) Coordinate international teams to assist the local authority-led damage assessments. Between 1st - 18th December, 185 International Engineers from 18 countries were deployed alongside Albanian assessors, supporting the Albanian-led assessments, and directly conducting over 3200 assessments. This paper recommends that preplanning of a damage assessment coordination system based on 4 proposed categories would expedite the establishment and the effectiveness of a national system and the incorporation of International Engineers.

Keywords: Engineering Damage Assessment; Coordination; EU Civil Protection Mechanism; UN Disaster Assessment and Coordination

1. Introduction

Disaster response includes activities to quickly and accurately understand the extent of damage to inform response and recovery. Damage assessments of affected buildings require inspections by experienced assessors, to make decisions on whether the occupants should be evacuated, and define the level of damage. These assessments therefore have implications for life-safety, remedial actions and compensation, as well as feeding into national/regional datasets to inform response/recovery strategies and budgets, and requests for international assistance.

For large events, assessments generally require hundreds of assessors and several weeks for the initial life-safety assessments, and then further months or years for follow-up secondary assessments related to financial compensation and remedial actions. An effective system of Damage Assessment Coordination protects people from potentially dangerous buildings, and facilitates the rapid return to medium-term/permanent accommodation and work.

International assistance may be requested in a number of fields, including Urban Search and Rescue (USAR) and damage assessment. USAR teams classified through the International Search and Rescue Advisory Group (INSARAG) incorporate Structural Engineers [1], who are sometimes also engaged in damage assessment after USAR activities have concluded.

Following a major earthquake in Albania on 26th November 2019, the Government of Albania requested international assistance, including Urban Search & Rescue and Engineers for damage assessment. The authors of this paper came from EUCPT, UNDAC and INSARAG, and all deployed to the Albania earthquake, and jointly set up and operated the Damage Assessment Coordination Centre (DACC). The DACC had two objectives: (1) Support the local authorities to setup their own effective system of Damage Assessment Coordination, and (2) Coordinate international teams to assist the local authority-led damage assessments.

There are many internationally-recognised guidance documents on the technical assessment of damaged buildings [2–4]. However, this paper highlights needs/gaps in the systems of Damage Assessment *Coordination*, observed in two past events for which damage assessment support was provided by International Engineers: the 2015 Nepal Earthquake, and 2016 Ecuador Earthquake. From review of these events, it is seen that there are common lessons and requirements for effective Damage Assessment Coordination. An account is then provided of the operations of, what became known as, the Damage Assessment Coordination Centre (DACC) established to address these gaps in response to the November 2019 Albanian Earthquake.

2. Desktop studies

A review of the accounts from the engineering assessments in the Nepal and Ecuador earthquakes provided an overview of the activities undertaken and the challenges faced the national and international stakeholders. An analysis of the overview led to the identification of four core components of a disaster assessment coordination system. The categories are described in Table 1. These categories are used to analyse and compare activities in the three events studied herein, and to frame recommendation for future events.

Category	Description
1. Coordination with National Entities and Procedures	The rules by which all assessments will be conducted, and how assessment coordination efforts fit within the governance structure of the affected country. This includes: identifying the government authority responsible for overall assessment coordination; the mode of cooperation with international resources; the agencies responsible and procedure for applying placards and safety measures; scope of the mission of the DACC; roles and responsibility International Engineers; stage of assessment (e.g. rapid visual screening, rapid safety assessment, detailed safety assessment etc); and whether demolition, repair and damage valuation/compensation are within the scope of assessments.
2. Procedure for Technical On-Site Assessment of Damage	The procedures and criteria against which decisions are made regarding the severity of damage to a structure, and whether it poses a significant risk to safety. These onsite procedures are dependent on the stage of assessment being conducted.
3. Coordination of Assessors	The processes and systems put in place to manage the pool of assessors. This includes gathering information on the available numbers and capabilities of assessors, assigning assessors to the locations to be assessed, and managing their daily activities.
4. Data Management and Analysis	The collation of damage assessment results in a rapid and comprehensive manner, and analysis of that data in a timeframe suitable to inform ongoing operational decisions.

Table 1: The four components of damage assessment coordination proposed by this paper. These 4 components apply to collaboration between the international (DACC) and national coordination efforts.

The study focusses on engineering assessments. Different types of assessments are performed at different stages of the assessment process. Table 2 below presents the definitions used herein. The assessments in Table 2 may be preceded by stages of wide area assessments and USAR building triage according to INSARAG Guidelines [1], and/or 'Rapid Visual Screening' to gain an overview of damage and identify priority areas.

Stage of Assessment	Personnel	Duration	Description
Rapid Safety Assessment	Structural Engineers, Architects, Building Inspectors, Disaster Workers	10-30 mins / building	A rapid assessment of building safety. To quickly determine habitability, and to identify any restrictions on use.
Detailed Safety Assessment	Structural Engineers	1-4 hours / building	Thorough visual assessment of a building. Used to evaluate questionable buildings, to identify necessary restrictions on use, or to identify the need for an Engineering Assessment.
Engineering Repair Assessment	Structural Engineers	1-7 days / building	Detailed Engineering investigation, to identify the extent of damage and/or how to stabilize and repair the building.

Table 2: Stages of Assessment, adapted from ATC-20 [3].

2.1. Mw7.8 Nepal Earthquake, April 2015

On 25th April 2015, Nepal was struck by a magnitude (Mw) 7.8 earthquake with an epicentre approximately 80km West of Kathmandu, and several aftershocks including a Mw7.3 on 12th May [5,6]. The seismic sequence caused 8790 deaths, and damages of $7 billion (24% of GDP [7]). The Post-Disaster Needs Assessment [8] reported 498,852 dwellings classed as 'fully damaged' and 256,697 as 'partially damaged', resulting in an estimated 8 million people initially left homeless.

Several damage assessments occurred over the months and years following the earthquake [9,10]. There was a need for rapid damage estimation in the initial days when many people were temporarily sheltering outside of their homes unsure if it was safe to return, and many buildings in possible danger of further collapse.

Following Nepal's request for international assistance 76 USAR teams deployed [11]. After USAR operations were completed some USAR Engineers were engaged in damage assessment.

Coordination with National Entities and Procedures: The Ministry of Home Affairs and the Ministry of Urban Development (Department of Building Construction) asked the Nepal Engineers' Association (NEA) to conduct building damage assessments. The NEA sent requests to the OSOCC, for Engineers from international USAR teams to assist with these damage assessments. Assessments were conducted by International Engineers from 1st-4th May. International Engineers were paired with Nepali Engineers, who completed all paperwork. This work was conducted in parallel with other damage assessment efforts by NSET and others.

It was noted that no placarding system was observed for notifying those in/near buildings of assessment results. Therefore, the International Engineers were asked to advise building owners directly of their findings, if possible. Work by the International Engineers was limited to damage assessment, and no work was conducted related to demolition, reconstruction, or shoring, despite observations of inadequate shoring throughout the region.

Procedure for Technical Building Assessment: There was not initially a standard method of damage assessment. Therefore, it was proposed by the Engineer with the EUCP team that all assessments were conducted according to an existing Nepali document [12] based on ATC-20 [3], and that all forms should be completed by Nepalese Engineers. No training was provided to the International or local Engineers on the use of the forms. However, the Nepali document was based primarily on ATC-20, which many of the International Engineers were familiar with, and so able to mentor the Nepali Engineers in its use.

Coordination of Assessors: The initial request from the NEA to UCC was for International Engineers to join six teams of four Nepalese volunteers (including an Engineer, Architect and Geologist). International Engineers were from the EU Civil Protection Mechanism Team (EUCPT) and international USAR teams. More than 10 International Engineers were available on the first day of assessments, but quickly reduced to 2-3 Engineers for the remaining days as USAR teams demobilized back to their home countries.

International Engineers reported to the NEA mid-morning to be grouped with Nepali volunteers and tasked with assessments. This process was slow, and assessments often did not begin until midday. Furthermore, selection and prioritization of the buildings to be assessed was not systematic in the initial days, which prompted the International Engineers to request they be tasked with priority buildings, such as hospitals, schools and public buildings.

Data Management: Completed assessment forms were returned to the NEA daily, and later collated and returned to the Department of Building Construction.

Overall, the International Engineers from the International USAR teams were somewhat utilised after the USAR phase. However, the Damage Assessment Coordination system was ineffective, with slow and non-systematic taskings for assessors, no training on use of the assessment forms so no checks that consistent decisions were being made on damage-level or habitability, and no system of placarding to inform inhabitants of assessment findings.

2.2. Mw7.8 Ecuador Earthquake, April 2016

The following account is based on [13] and discussion with the EUCP Engineers that deployed to the event.

Ecuador was struck by a Mw7.8 earthquake on April 16 2016, with an epicentre approximately 27km from the towns of Muisne and Pedernales, and 170 km from the capital Quito. There were two strong aftershocks of Mw6.2 on April 20, with epicentres in the same area. 661 people were killed, 6274 injured and 28,678 displaced. Damage was spread throughout the regions of Manta, Pedernales and Portoviejo, but greatest in the City of Portoviejo, Ecuador's sixth largest city, and the capital of Manabi Province.

Ecuador made a request for International assistance on April 17, and among the deployments were an EUCP team (including three Structural Engineers), an UNDAC team, and structural assessment teams from Italy, France, and the United Kingdom (UK).

Coordination with National Entities and Procedures: Ecuador-led Damage Assessment Coordination within Portoviejo was managed by the Cadastral Unit of the Public Services Department of Portoviejo Canton, who performed several activities:

- Assessment Team composition;
- Data computerisation in GIS;
- Daily reporting from assessment teams to local authorities;
- Task assignment based on priorities defined by the local authority;
- Data reporting to provincial COE.

International Engineers conducted the following: (i) reassessment of buildings that had undergone a rapid assessment prior to their arrival, (ii) demolition verification to confirm whether red-tagged buildings could be repaired, (iii) assessment of buildings to enable safe road access, and (iv) detailed post-earthquake safety assessments of critical buildings. International Engineers did not advise on repair or reconstruction.

Method of Technical Building Assessment: Portoviejo had its own methodology for rapid damage assessment derived from ATC 20 documents. However, no formal methodologies were in place in other municipalities. Informal training was conducted by International Engineers during the building assessments.

EUCP Engineers drafted forms for demolition verification, and for safe road access. For detailed damage assessments, a form was drafted by EUCPT Engineers, based on ATC 20 [16,17] documentation, adjusted to the local context.

Organisation of Assessors: Authorities performed an aerial inspection with drones around the centre of Portoviejo on 17th April, and cordoned off the city centre (Zone Zero) on 18th April. A rapid visual screening conducted at street level started on 19th April, with groups formed by a representative from the cadastral services, and volunteers from local universities and a private company.

The EUCP Engineers focussed on the city centre of Portoviejo from 22nd April to 7th May. Teams were composed of 2–3 International experts and 1–2 national experts (specialising in Engineering or architecture). During inspections, security in Zone Zero was not an issue since the whole area was cordoned-off and guarded by the police. Six teams operated on the 52 blocks in Zone Zero. The average number of inspected buildings per day per team was 25 for rapid assessments, and 13 for detailed assessments.

Interventions were prescribed alongside major roads to enable safe access, including: debris clearance, temporary shoring, removal of overhanging objects, and demolition. Detailed assessments were conducted for 159 buildings from May 1 to May 7.

Data Management: Paper forms were completed in the field, and buildings were associated to a unique ID in the Municipal GIS platform. Tasks were assigned through paper cadastral maps where buildings to be inspected were highlighted and their ID was shown.

Overall, the following field assessments were performed by International Engineers:

- Rapid post-earthquake building assessment on 510 buildings in Portoviejo and 144 in Pedernales. Following inspection by the International Engineers, the percentage of green-tagged buildings rose from 22% to 34%, which prevented over-estimation of damage, so was beneficial to recovery.
- Demolition confirmation on 192 buildings in Portoviejo;
- Evaluation of safe access routes which required assessment of 153 buildings in Portoviejo;
- Detailed post-earthquake building assessment on 159 buildings in Portoviejo.

2.3. Observed Gaps in Damage Assessment Coordination

From the review of responses to earthquakes in Nepal and Ecuador, it is seen that there are common lessons-learnt and requirements for effective Damage Assessment Coordination. These are presented in Table 3, and apply to both International coordination efforts, and national efforts (supported by International partners).

Component of DAC	Common Lessons related to the Coordination of International Engineers
1. Coordination with National Entities and Procedures	• In the immediate aftermath, it is necessary to identify what scale of damage assessment is needed, and whether international assistance will be required. • If international assistance is needed to support damage assessment International Engineers can be available from: o In-country international USAR teams after USAR duties are fulfilled (it is necessary to act quickly to capture USAR resources before they demobilize) o A request from the affected country for International Engineers, based on bilateral agreements. • The effected country will need a specifically designed Damage Assessment Coordination system to fully utilize national resources and to ensure that International engineers are efficiently brought in as part of that system. The control of the system must be a National Authority, based on the laws and governance structure of the affected-country. • It is important to identify which stages of damage assessment are to be conducted and the expected role of International Engineers: e.g., rapid visual screening, rapid assessment, detailed assessment, demolition verification, road safety assessment. • The system of tagging buildings and placing/enforcing access restrictions, and whether this should be conducted by assessors or other authorities, must also be defined.
2. Procedure for Technical On-Site Assessment of Damage	• Consistent methods of assessment should be conducted by all authorities in all parts of a country. It is therefore crucial that a consistent method of on-site damage assessment be agreed across all entities involved in the assessment, before conducting assessments. • Damage assessment methods should be based on local procedures where available, and can then be supplemented with international guidance where necessary. • Collaboration between the local and International Engineers is an opportunity for two-way knowledge-share and capacity-building.
3. Coordination of Assessors	• There is a daily process of assigning teams of national and International Engineers, defining their areas of work, and any priority locations. • The material needed for task assignments (e.g. assessment forms) should be prepared in advance. • International assessment teams need to be flexible enough to perform different types of activities according to the local needs and the assessment scope agreed with the National Authorities. This includes (i) rapid post-earthquake safety evaluations of buildings, (ii) demolition verification, (iii) safe road access and (iv) detailed post-earthquake safety assessment of critical buildings.
4. Data Management and Analysis	• Data should be stored centrally, and an electronic system of data collection should be formed ASAP, to facilitate gaining a rapid situational overview. • It is the Host-Nation's responsibility to collate overall damage data of the event, but they should be assisted by the international personnel if needed, as it also relates to the effective usage of international resources. • Appropriate building identification and link to GIS should be considered in advance.

Table 3: Key Lessons in Damage Assessment Coordination (DAC) related to International Engineers, Observed Across Multiple Events.

3. Mw 6.4 Albania Earthquake, Nov 2019

3.1. International EngineersThe Event and Response

Albania was struck by a magnitude (Mw) 6.4 earthquake at 03:54 local time on 26th November 2019 (epicentre approximately 22km Northeast of the centre of Durrës), causing 51 fatalities, and injuring more than 913 people, including 255 people injured during aftershocks. 48 people were rescued from collapsed buildings by first responders [14]and all deceased were recovered.

National Response. The Government of Albania (GoA) declared a State of Emergency following the earthquake, deploying 7,600 national responders (Firefighters, civil emergency, medical emergency, Armed Forces and State Reserve), including 534 volunteers and 278 Army Urban Search and Rescue (USAR) personnel. The Albanian National Civil Protection Agency had only recently been moved into the Ministry of Defence, and several functions were still in planning. Given the scale of this event, on the 28th November the Inter-Ministerial Committee of Civil Emergency was established to oversee the response and recovery. A Crisis Response and Relief Centre operated under the Inter-Ministerial Committee (Figure 1).

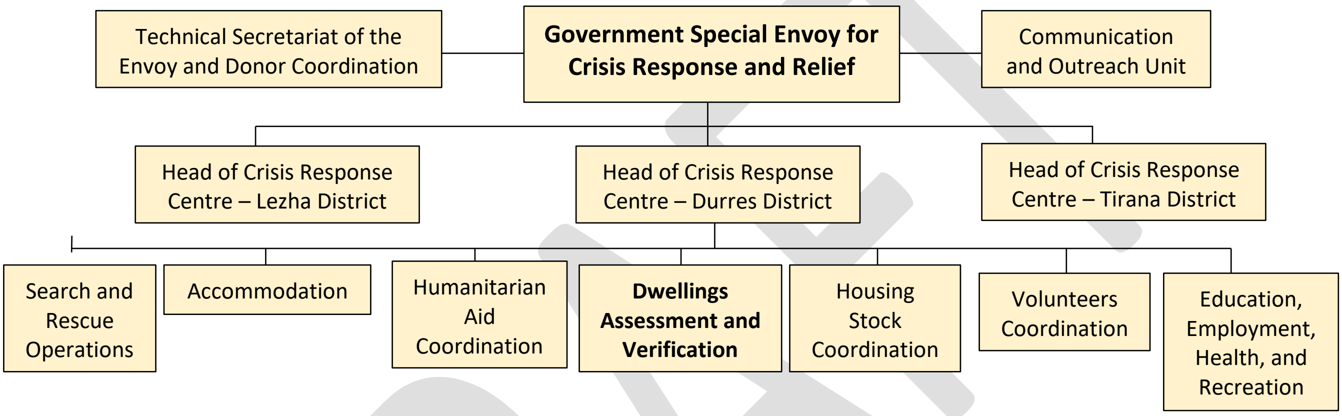


Figure 1: Government of Albania Crisis Response and Relief Centre Organization (Figure 1).

International Response. The first arriving team to Albania was the Italian USAR team who set up a USAR Coordination Cell (UCC) in the Durres Province building, and other international USAR teams provided staff to support, as per the INSARAG Guidelines [1]. 14 international USAR teams from 11 countries were active in Albania [15]: three teams via the UCPM, and the remaining 11 on a bilateral basis. The GoA requested assistance from the EUCPM (European Civil Protection Mechanism) on 26th November. Two EUCP Teams (EUCPT Alpha and Bravo) were deployed on 27th November and 4th/5th December respectively. The UN mobilized an UNDAC team, which was embedded within the EUCPTs. On 27th November, the Government of Albania requested assistance from International Engineers, and continued to accept offers of assistance until 21st of December to help with the assessment of damaged buildings. In total, the Albanian first responders were supported by 541 emergency personnel from twelve EU countries and 304 personnel from eight non-EU countries [14].

Estimation of Damages. 10,225 people were accommodated in temporary shelter, and a total of 17,000 were estimated to have been displaced from their homes. Damage assessments were conducted to protect people from potentially dangerous buildings, and facilitate the rapid return to medium-term/permanent accommodation and work. Between 27th November and 30th December 39,310 buildings were reported as assessed under the Albania-led system of Damage Assessment Coordination, supported by the DACC [16]. Assessment efforts involved several hundred Albanian assessors, supported by 185 International Engineers from 18 countries conducting damage assessments [17].

Damage assessments had far-reaching implications, beyond the emergency phase. After the immediate humanitarian phase, the Government of Albania requested support from the EU, the UN and the World Bank to undertake a Post-Disaster Needs Assessment (PDNA), which was completed in February 2020. The PDNA, enabled in-part by the damage assessments described above, estimated direct damages of €843m and losses of €141m. Informed by this estimate, an international donor conference "Together for Albania" on 17th February 2020 resulted in €1.2bn of pledges from 41 countries as well as multi-lateral donors and international financial institutions [18].

Lessons utilized from a Preceding Earthquake. The November 26 earthquake was preceded on September 21 by a Mw5.6 earthquake, that occurred 5 km north of Durrës city injuring 108 people and causing damage to more than 2,000 buildings. A comparison of the ground-shaking is shown in Figure 2.This earthquake may have increased the vulnerability of some buildings. The GoA requested assistance from the UCPM in this event also, and an EUCPT was deployed to facilitate the arrival of incoming assistance and support the GoA in its response to the event. Part of that role included the evaluation of Albania's damage assessment methods, the findings from which informed the operations of the DACC during the November event.

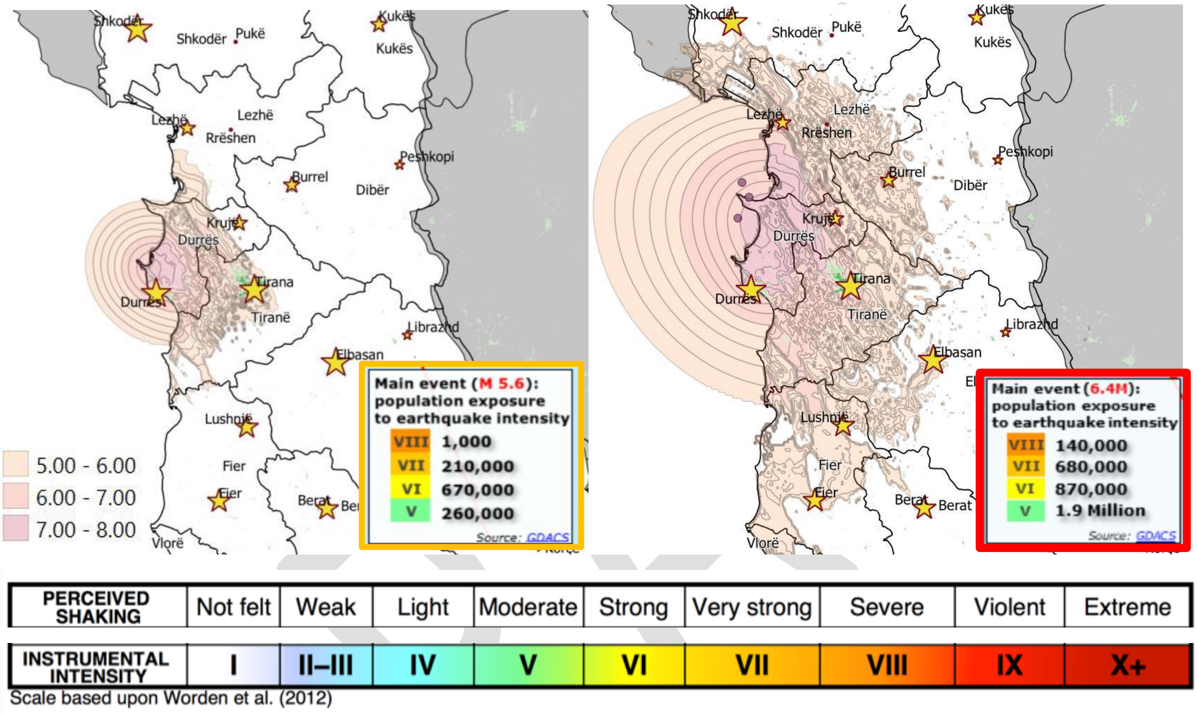


Figure 2: Comparison of earthquake ground-shaking intensity in September (left, M5.8) and November (right, M6.2). This paper focusses on the November (right) event. [19]

During EUCPT's deployment to the preceding September 2019 earthquake it was observed that: (1) different Municipalities and organisations followed different methods of assessment, and (2) no guidance was provided to assessors on how to classify building damage, or how to decide whether a building is habitable or uninhabitable. EUCPT worked with the various Institutions and Municipalities at that time to agree on a Unified Albanian Damage Assessment Method, based on existing Albanian methods (assessment forms of Farkë Administrative Unit, and the Construction Institute of Albania), and supplemented with international standards (AeDES [2], ATC-20 [3], Greek Field Manual [22]). This was the result of multiple site visits with assessors from several Municipalities, and workshops with multiple stakeholders. The methodology was then tested during the September deployment via onsite exercising with a cohort of 24 Albanian assessors.

3.2. Establishment of the Damage Assessment Coordination Centre (DACC)

EUCPT Alpha arrived on November 27 and UNDAC members arrived the following morning, by which time there were 14 international USAR teams in-country and USAR four active worksites [20]. When the EUCPT/UNDAC team arrived, it received a briefing from the Italian team, who had started daily meetings with the Albanian Authorities. A proposal was made by EUCPT to make use of spare USAR Structural Engineering capacity to assist the Albanian authorities with their damage assessments, which was accepted on November 28 by the head of the 'Dwellings Assessment and Verification' cell of the Albanian Crisis Response and Relief Centre.

A Damage Assessment Coordination Centre (DACC) was established by members of EUCPT and UNDAC in Durres on November 29, and INSARAG UCC (USAR Coordination Cell) trained coordination experts from USAID supported the DACC from November 30. The DACC was an *international* structure that operated alongside, but separate from, Albania's own Damage Assessment Coordination structure. The DACC had the following two objectives:

(1) Support the local authorities to setup their own effective system of Damage Assessment Coordination,
(2) Coordinate international teams to assist the local authority-led damage assessments.

International Engineers were initially drawn from in-country international USAR teams, but the GoA then made further requests for International Engineers, meaning that dedicated international damage assessment teams continued to arrive throughout the lifetime of the DACC.

The USAID coordination experts demobilized on December 14, and all remaining Damage Assessment Coordination was handed over to the Albanian Authorities on December 17. Overall, the DACC supported the Albanian authorities in creating a Damage Assessment Coordination Methodology that oversaw the assessment of tens of thousands of buildings in many municipalities belonging to different Prefectures; and (2) directly coordinated 185 International Engineers from 18 countries to support 3,189 assessments.

Figure 3: Left: Damage Assessment Coordination Centre (DACC) daily meeting between DACC personnel, and Albanian assessment coordinators. Right: Briefing for incoming teams on the assessment methodology and the organisation of taskings.

3.3. DACC Component Activities in Albania

3.3.1. Coordination with National Entities and Procedures

The DACC manager met daily with the Albanians responsible for damage assessments to plan the operations. It was necessary to confirm the local coordinators leading the Albanian-led assessments, and agree the working relationship, and the procedural framework within which the DACC would operate. The following procedures were agreed.

International assessors always worked alongside local assessors. All decisions and paperwork were completed by the local assessors, with the international assessors acting as advisors only. This meant that responsibility for assessment decisions remained with the local personnel that would remain in-country after the international teams departed. The relationship also allowed for two-way knowledge transfer, from local Engineers who were most familiar with the building typologies, and from International Engineers who often bring experience of other earthquakes.

International assessors focussed on life-safety assessments. There were far fewer international assessors than Albanian assessors, so it was agreed that the use of international assessors was to prioritise buildings that could potentially pose a risk to life. In practice this meant that when it was felt that all of the heavily damaged buildings in a sector had been assessed, then local assessors were left to complete all remaining assessments for that sector and international teams were then reassigned to another sector. This was to stop the international assessors being used for a damage census of all affected buildings, when there may be life-safety related assessments yet to be complete.

A building placard system was agreed (based on ATC-20 [3]) and translated into Albanian. The findings from the EUCPT Deployment to the preceding September earthquake were that placarding of buildings was not taking place and safety measures (such as cordoning off areas beneath fall-hazards) were often not enacted. Therefore, the agreed procedure for the November earthquake was for assessors to return their assessments to the Municipality, and for the authorities (e.g., Police) to place the placards, enact any safety measures, and ask inhabitants of red-placarded buildings to vacate the property. Assessors were asked to communicate their findings to the building inhabitants, if they were present and only if it felt appropriate/safe to do so.

International Engineers were asked to state their levels of qualification. Given the range of assessor experience levels the DACC requested that only Engineers with professional qualification be allowed to conduct these assessments (e.g.,those Chartered with an Engineering Institution, or those defined as "Structural Engineer" according to INSARAG Guidelines). This information was not systematically gathered, which is identified as a learning point.

The International Engineers focused on Rapid Safety Assessments. No formal preceding Rapid Visual Screening phase was conducted by the DACC, as the Albanian authorities reported to have an understanding of the priority areas by time the DACC was established (see Table 3).

Advice on demolition, and remedial measures (repairs) was not formally provided by international assessors as part of these Rapid Assessments, who instead focused on building safety. Decisions on demolition and repairs have financial implications for building occupants, require knowledge of local construction practices and are part of legislative / political processes, and require knowledge of local construction practices.

The agreed procedures were communicated to the public. It had been informally communicated to the EUCPT that many Albanian households had the expectation that all assessments had to be conducted by International Engineers. This was an unrealistic expectation, given the scale of the assessment needs and the limited timeframe that international resources would be incountry. To address this, it was decided to communicate the purpose of the international assessors through a video aired on national television [21].

3.3.2. Procedure for Technical On-Site Assessment of Buildings

During the deployment to the November earthquake, the same pattern was observed as following the September earthquake, that different assessment methods were being used, without formal training or documentation. The first priority was therefore to identify the agreed assessment methodology, that would be used consistently across all teams.

An assessment form, methodology and decision criteria. Forms, methodology and criterian were agreed with the head of the Dwellings Assessment and Verification cell of Albania's Crisis Response and Relief Centre, with technical agreement from the Construction Institute of Albania. This was based on the form agreed with Albanian Authorities during the EUCPT deployment to the September earthquake.

The form and guidance on its use were condensed into a 3-page field reference note. The procedures and simplified criteria outlined in the field reference note were provided as *simplified* guidance to allow a common framework for suitably qualified, experienced and trained Engineering assessors to make consistent technical judgements. The notes are provided in the annex.

The key points on the agreed assessment method are:

- The key decision was on whether a building could be inhabited, followed by whether any restrictions should be placed on its use (Figure 4).
- The assessment form was based on existing Albanian assessment forms, developed by the Municipality of Farka and the Albanian Institute of Construction. This is to allow the Albanian assessors to continue using the systems that they are familiar with.
- Gaps in the original assessment forms were addressed using examples from international standards. Gaps addressed include: clear assessment outcomes regarding the level of damage and whether the building is habitable or uninhabitable; and a clear place to include recommendations for restricted use.
- The assessment form and simplified guidance note were as simple as possible, whilst still capturing the key life-safety aspects.
- The simplified field reference takes guidance from the AeDES manual [2], American standard (ATC-20 [3]), and the Greek Field Manual [22]. This way nothing new was created, but these components were put together to give assessors quick and consistent guidance. Assessors were then referred to the full AeDES manual for more information.
- The assessment forms included information on the location/ownership of the property, construction material, level of damage (light, medium, heavy – with criteria provided for each), habitable or uninhabitable (again, with criteria, noting that).
- A building assessed as uninhabitable was not necessarily to be demolished. A building may have little damage but still be uninhabitable, e.g., due to the threat from a neighbouring building.

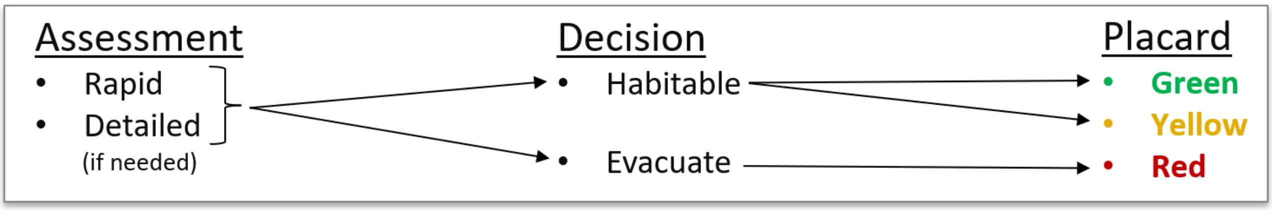


Figure 4: Simplified assessment process. First a decision is made as to whether a building must be evacuated, then a decision is made as to the placard to be placed on the building (for assessment form see Annex).

A Detailed Assessment Form was proposed by the Construction Institute of Albania, for use on critical buildings (those of high importance such as schools and hospitals). However, it was observed that during assessment of critical buildings, the Detailed Assessment Form was generally not used by assessors who were not from the Construction Institute. Most assessors instead simply used the Rapid Assessment Form but took more time on the assessment than for non-critical buildings.

3.3.3. Coordination of the International Assessors

The coordination of International Engineers in Albania evolved from the coordination of international USAR teams, which was based on the INSARAG methodology [1] and the UNDAC handbook [23].

By the time the EUCPT was discussing with the Albanian authorities whether to use International Engineers for damage assessments, the USAR operations were winding down. EUCPT organized a meeting at the UCC with the USAR representatives to ask the teams to provide Engineers to conduct Damage Assessments, if they were not engaged in the USAR operations, which they agreed. The EUCPT team leader delegated the efforts of damage assessment coordination efforts to one of the embedded UNDAC team members for the coordination of personnel in the field. Since Damage Assessments were being planned at the municipal level, the team sought to move the DACC operations from the Province Building to the Municipality Building, also located at Durres main square, to be closer to the municipality coordination activities. This strengthened cooperation since it was easier to be closely linked to the largest municipality of the affected area. The DACC was given an office next to the Durres coordination room and maintained close cooperation throughout the operations. This office was given the DACC to make it easy for incoming engineers to know that there was a physical location that they were to report to. Office hours were 0800 till 1900 daily, with a "must answer" phone number for off-hours. The members of the Americas Support Team (AST) supported the DACC activities in the same way that additional arriving international USAR teams support the first arriving team in UCC activities.

The basic mission objectives were that the Albanian authorities would identify which buildings or areas needed to be assessed, assign Albanian Engineers to lead the assessment missions, and the DACC would supply International Engineers to work with the Albanian Engineers. The DACC registered incoming international resources, ensured that they received maps and briefings, and were assigned to an Albanian team. Albanian and international assessors were provided a training briefing on the form and methodology. Assessors were also requested to study the more extensive examples and guidance of the AeDES manual [2]. The key DACC activities are listed in Table 4, including transition activities.

A significant challenge for International Engineers was the need for them to be self-sufficient. International Engineers were expected to arrange their lodging, meals and transport to and from Albania, and sometimes within their assigned area. Often the Albanians could provide the International Engineers a lift in their cars, but that was never assured. A key challenge for the DACC was that the Albanian Engineers and/or International Engineers did not always arrive at the scheduled time each morning. The DACC needed to find out why, solve the issue, or make a new assignment. Another challenge was International Engineers coming with their own agenda, mainly research, and not helping the national assessors.

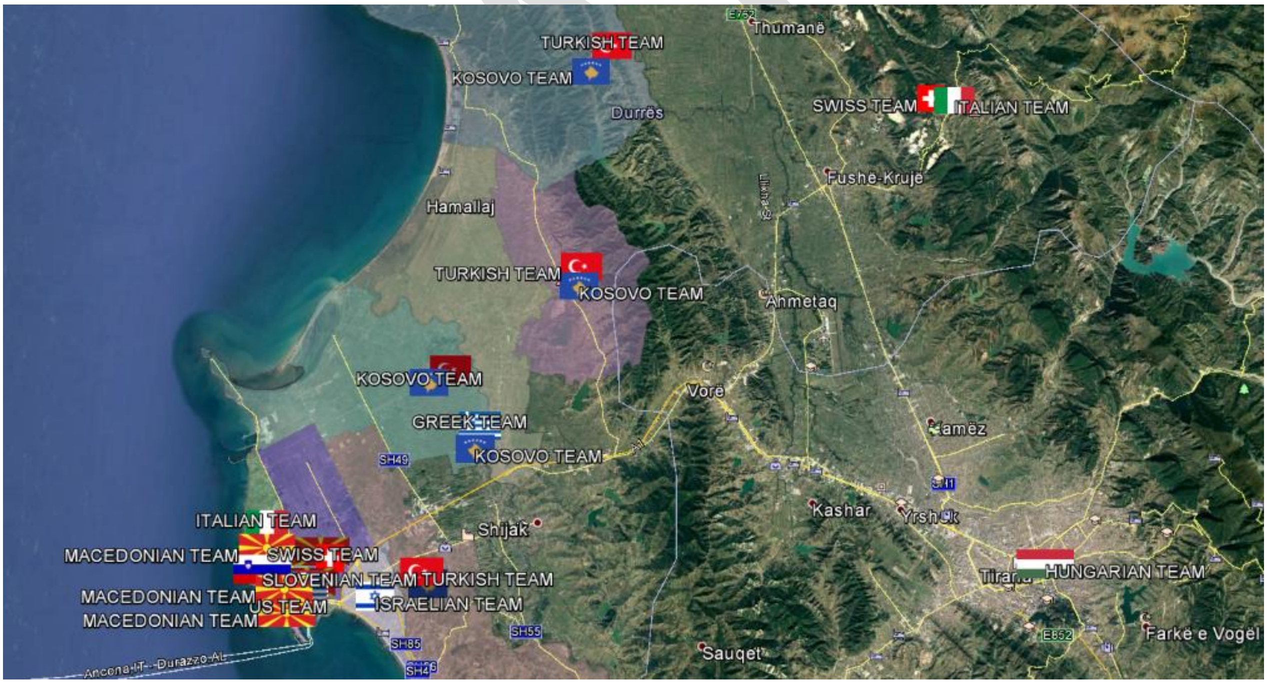


Figure 5: International Engineer locations on 5th Dec**.**

Table 4: Key Operations in the DACC

Category	Steps
DACC routine for receiving teams	• Information about incoming International Engineers was provided by Albanian authorities, the EU Emergency Response Coordination Centre (*ERCC),* and the Virtual OSOCC. • Registration of incoming Engineers (from where, how many, how long, confirm that they are certified/chartered Engineers, contact details). • Provide teams with maps. • Provide a briefing of the process of getting assignments, reporting results, and expectations. • Schedule a briefing given by the UCPT Engineers to explain the process to newly arrived International Engineers.
DACC Daily routine for integrating International Engineers into Albanian authorities assessment teams	• Each morning, resolve problems for teams who could not find their counterpart or other issues (transportation, changes to schedule, unscheduled team departure). • Collect assessment results from previous day. • Review which International Engineers were departing compared to new arrivals to maintain an overview of the capacity to provide Albanian authorities. • Meet with Albanian authorities planners to plan the next day's assignments. For continuity of operations, International Engineers worked with the same Albanian team until all assessments were completed in their assigned area. This made the assignment easier, as many were repeats from the day before. • Send emails to International Engineers with their next day assignments. • Phone municipality officials in other municipalities (outside Durres) to coordinate assignments with them (needs, how things were going, did the international Engineers arrive, and were they useful). International Engineers were assigned to municipalities where they had lodgings to reduce transport needs.
Handover	• Early on, the DACC started addressing issues of handover to facilitate a smooth transition. At the time it was not known how long the assessments would take, however, the international DACC staff would stay for approximately 3 weeks. • The DACC requested to have Albanian staff assigned with it to train these staff members and create a smooth handover. It was problematic to get local staff because of their other duties. Two University students volunteered to provide this service, received the training, and gradually took over activities of the DACC. • There was a lack of ICT equipment for the Albanian staff. To resolve this the EUCPT purchased and donated two computers, a printer and software to the DACC. • The DACC was handed over to the Albanians on the 18 December 2021.

3.3.4. Data Management and Analysis

The collection, storage, analysis and reporting of data was of central importance, both for informed operational decisions during the damage assessment phase, and for informed long-term decision-making and reporting.

Collection of Albanian damage assessment data. In the initial days, assessment data within Durres Municipality was collected via paper forms, though different forms had been in use in other municipalities. Forms were returned to the Durres Municipality office daily, collated and manually converted into spreadsheets. This was a very simple system and allowed for assessments to begin without losing the time needed to set up a unified and nationwide electronic Data Collection Tool (DCT). However, it was also a very manual process that meant that data took several days to be collated and analyzed. This meant that it was not possible to use this data to make operational decisions.

In parallel to the paper system, an electronic DCT was designed in collaboration with the UNDP and an Albanian power distribution company, OSHEE. The DCT was originally designed based on the UNDP Household and Building Damage Assessment Tool [24], and OSHEE's household database, which provided building-by-building GPS and occupant data with a coverage claimed to be nearing 100% of dwellings. EUCPT worked with the UNDP to ensure that the electronic form included the same information as the paper forms, such that the datasets could be combined. Tablets were made available to assessors and the DCT, operated by OSHEE, gradually became live after training in Mid-December, with is taking approximately 2 weeks until SIM cards and GPS were widely functioning.

Data collected in the initial days contained a number of inconsistencies, such as incomplete location/address information needed to locate the assessed properties, no photographs and incomplete description of damage. These issues were somewhat addressed through knowledge-share with the International Engineers during joint assessments, and through the DCT and associated training provided to assessors.

In Durres, by 5th December, 1,376 buildings were inspected in total (by all assessors, Albanian and international), with 470 uninhabitable (34%) (Table 6). In the neighbouring capital, Tirana, by the 7th December 1,154 buildings were inspected in total (by Albanian assessors, without the input of international assessors), with 225 uninhabitable (19%) (Table 6). Durres has far fewer resources than Tirana, and so the faster rate of inspection in Durres may indicate the positive impact of the International Engineers.

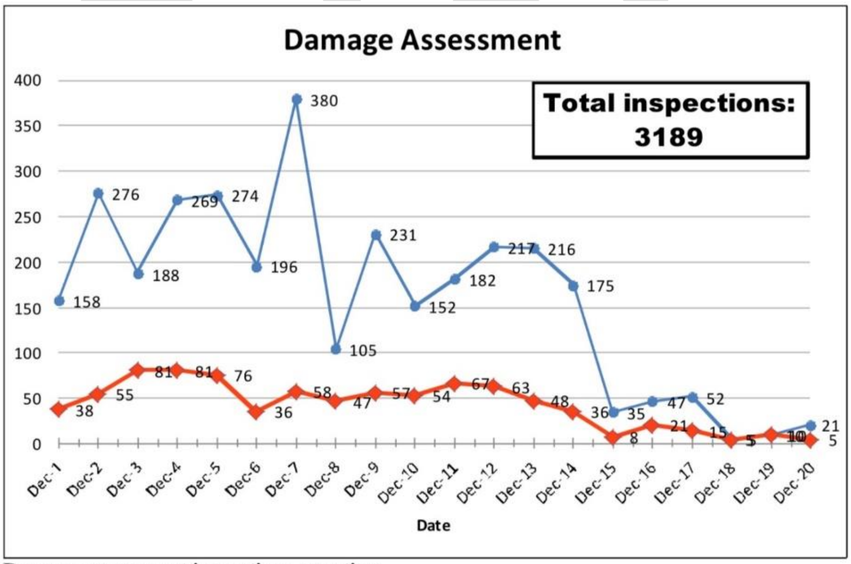
Data on international assessments. Overall, 185 International Engineers were registered through the DACC, as shown in Table 5. Note that Table 5 does not include International Engineers that did not register with the DACC.

Several international teams had their own DCTs, and the Albanian authorities therefore changed their chosen platform several times. It was eventually decided that these systems would not be used and instead the Albania DCT described above was developed.

International teams were asked to report their daily assessment results. Figure 7 shows that in almost all reported locations the percentage of buildings classified as uninhabitable was reducing, suggesting that the objective of prioritising the life-safety buildings was being met. This information allowed the DACC to identify where International Engineers were perhaps no longer needed (i.e. when the percentage of uninhabitable buildings becomes consistently low).

	Country	Registered Engineers
1	Bulgaria	16
2	Croatia	5
3	Cyprus	6
4	Czech Republic	10
5	France	9
6	Greece	16
7	Hungary	11
8	Israel	7
9	Italy	18
10	Kosovo	28
11	North Macedonia	23
12	Poland	4
13	Romania	14
14	Slovenia	2
15	Switzerland	2
16	Turkey	8
17	United Kingdom	4
18	United States of America	2
Total		**185**

Table 5: International Engineering Teams registered with the DACC



Damage assessment inspections over time.
Blue line shows amount of assessments per day.
Red line shows amount of international engineers involved in the assessments.

Figure 6: Timeline of International Engineers registered with the DACC, until the last international Engineer demobilized on 20th December.

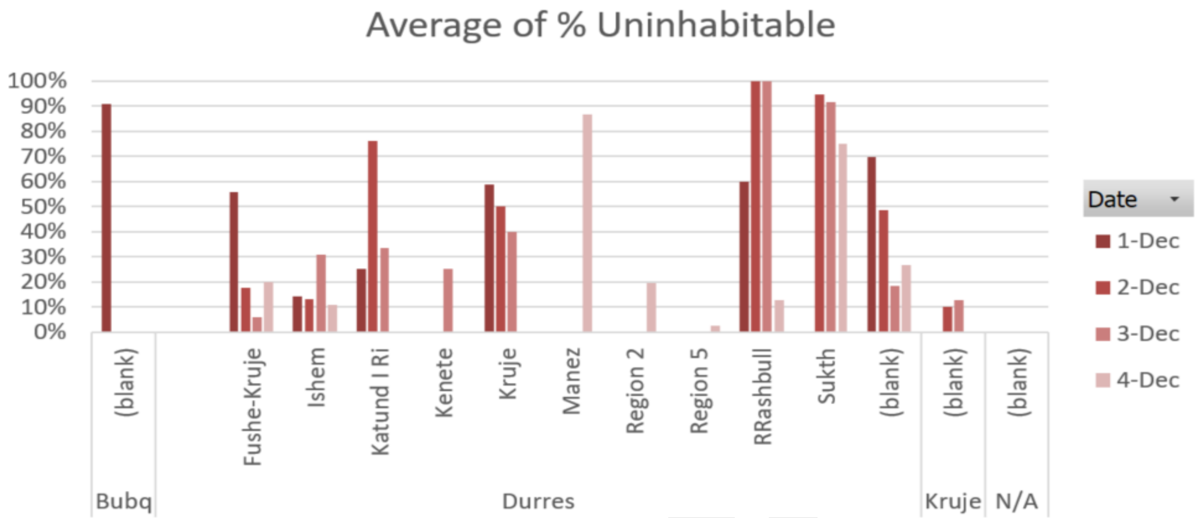


Figure 7: The percentage of buildings classified as uninhabitable by region. When this percentage becomes consistently low it suggests that most of the critical life-safety buildings have been assessed, and that the International Engineers can be reassigned to other priority locations.

A very rough estimate of damaged buildings was made in the initial days, based on estimates of the population affected, to inform decisions on the likely number of Engineers that would be required to conduct damage assessment, and likely priority areas for assessment. By the time of the handover from EUCPT Alpha to EUCPT Bravo, so-far unassessed damage was expected to the South and East of Durres and Tirana, but was expected to be mostly light damage and of lower priority for the International Engineers. Durres remained the clear priority, as it was expected that a significant number of buildings with structural damage still remained to be assessed. Tirana was the second priority and was expected to have more damaged buildings than Durres but that much of the damage would be non-structural. This analysis provided the operational insight that other areas should be investigated and closed-out quickly so as to consolidate International Engineers in Durres and Tirana.

Of the data that was received, sometimes the reported numbers of assessments, numbers regarding habitability and/or numbers regarding damage categories were incomplete or did not agree with each other. The numbers in Table 6 are based on the evening emails of the teams and therefore do not include the assessments of the teams that did not share their data with the DACC. International Engineers reported to the DACC their involvement in 3,189 assessments. This is higher than the sum of habitable and uninhabitable decisions, which sum to 2,817. Therefore, more assessments have been counted than the two options for an assessment result.

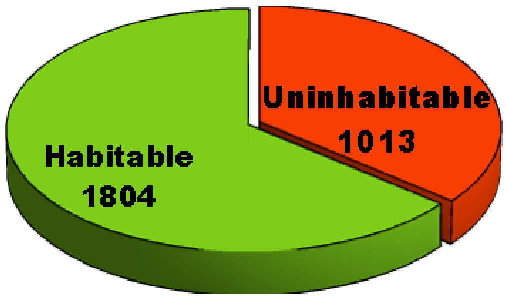
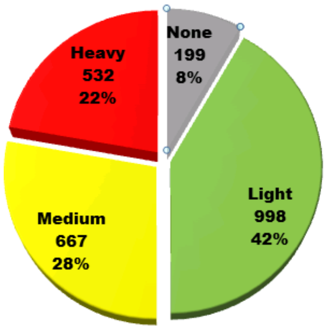
Habitability Decision	Damage-level Decision
	

Table 6. International assessment data. Inconsistencies are discussed in the text.

Table 6 shows that there are more recorded assessments than buildings defined as 'habitable' or 'uninhabitable'. A possible reason may be that "habitability" reflects the decisions related to entire buildings (i.e., 2,817 buildings have been visited) but the 3,189 number may include dwellings within these buildings. The inspection of a multi-storey building containing many apartments may have been treated inconsistently by different counting of the apartment-inspections each as one single assessment but judging the building as "habitable" or "uninhabitable" as a single decision.

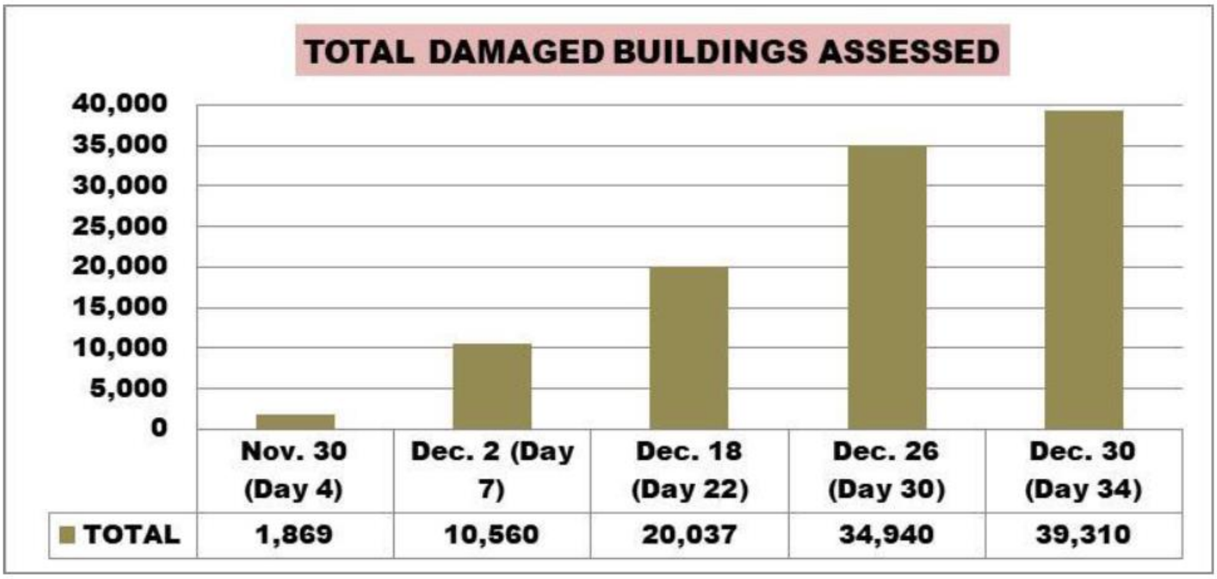
Table 6 also shows that there are more habitability decisions, 2,817, than damage severity decisions, 2,396. There are a number of possible reasons for this inconsistency:

- Perhaps "uninhabitable" was sometimes perceived as a damage category, meaning that a building being obviously uninhabitable was not further classified or counted as 'heavy' damage.
- Some non-damaged or lightly damaged buildings may have been judged as "uninhabitable" because of dangerous adjacent buildings. But for such building no assessment of "none" was recorded because it was undamaged.
- The number of "uninhabitable" (1,013) aligns roughly to the sum of "heavy" and "medium" (1,199). This could be an indicator that the decision of "habitable" was applied for individual apartments. Therefore, buildings categorized "red" or "yellow" compartments consequentially have been judged as "uninhabitable".
- It may be that some assessment teams did not count some habitable buildings in "none" (no damage) because the habitability seemed obvious to the team[1]. By comparing the sum of assessments classified as the damage levels "none", "light" and "medium but habitable" with the number of assessments classified as "habitable", suggests that 421 buildings were either not inspected or were classified as "heavy" damage but "habitable".

Final results. In total, more than 39,000 buildings were reported as assessed under the Albanian-led system of damage assessment coordination. The DACC directly facilitated the coordination of 3,189 building-inspections by 185 International Engineers from 18 countries, adding up to 861 Engineering days.

[1] Adding the "none damaged" decisions plus the "green/light" decisions plus the "yellow but habitable" judgements sums up to 199+998+186=1,383 judgments for habitable buildings. Therefore, 1,804 – 1,383 = 421 buildings either not inspected or red must have been judged habitable

BUILDING DAMAGE ASSESSMENTS - 1



Building damage assessments were completed within 34 days

HOUSING DAMAGE STATS BY MUNICIPALITY

	HOUSING UNITS							
Municipality	Light (D1-2)	Medium (D3)	Severe (D4)	Destroyed (D5)	Light (D1-2)	Medium (D3)	Severe (D4)	Destroyed (D5)
Durrës	27,390	7,043	2,386	360	23.66%	6.08%	2.06%	0.31%
Shijak	1,201	691	1,162	0	11.57%	6.66%	11.20%	0.00%
Krujë	2,284	1,386	1,355	122	11.58%	7.03%	6.87%	0.62%
Lezhë	1,434	659	370	0	4.73%	2.17%	1.22%	0.00%
Mirditë	625	225	27	0	8.07%	2.91%	0.35%	0.00%
Kurbin	1,346	585	416	20	8.99%	3.91%	2.78%	0.13%
Tiranë	24,508	6,872	3,517	189	9.66%	2.71%	1.39%	0.07%
Kamëz	2,126	229	191	0	5.81%	0.63%	0.52%	0.00%
Vorë	1,505	275	877	0	16.86%	3.08%	9.82%	0.00%
Kavajë	2,345	1,016	499	0	6.58%	2.85%	1.40%	0.00%
TOTAL	64,764	18,981	10,800	691	12.13%	3.56%	2.02%	0.13%

	Light (D1-2)	Medium (D3)	Severe (D4)	Destroyed (D5)	TOTAL DAMAGED & TO BE DEMOLISHED	TOTAL Existing
# RES buildings	17,698		4,803		22,501	199,200
% RES buildings	8.88%		2.41%		11.30%	
# Housing units	64,764	18,981	10,800	691	95,236	533,737
% Housing units	12.13%	3.56%	2.02%	0.13%	17.84%	

- Based mostly on data presented in the PDNA as of Jan. 14, 2020
- 95,235 housing units in 22,501 residential buildings were assessed

Figure 8: National damage assessment results, based mostly on data presented in the PDNA [16]**.**

3.4. Summary of DACC Operations in Albania

Table 7, highlights the key activities of the Damage Assessment Coordination Centre (DACC) in Albania.

Component of Damage Assessment Coordination	DACC Operations in Albania
1. Coordination with National Entities and Procedures	• International Engineers only ever operated alongside local Engineers, who completed all paperwork. International Engineers never completed or signed paperwork, they only provided advice to the local Engineer. • International assessors focussed on Rapid Assessments. It was not the goal to use International Engineers for every building, but instead to first focus on those that may pose a risk to life. Advice on demolition, and remedial measures (repairs) was not formally provided by international assessors. • A building placard system was agreed and translated into Albanian. Assessors returned their assessments to the Municipality, and the authorities (e.g., Police) placed placards, enacted safety measures, and asked inhabitants of red-placarded buildings to vacate the property.
2. Procedure for Technical On-Site Assessment of Damage	• The damage assessment forms, methodology and decision criteria were somewhat pre-prepared during the EUCPT deployment to Albania during the Sep 2019 earthquake. However, it needed to be agreed that these procedures would be conducted during the November event. The damage assessment method was therefore unified across the affected area. • The assessment form was based on existing Albanian assessment forms and methods, so as to be as familiar to local assessors as possible. • Necessary additions to the original assessment forms were provided using examples from international standards. In this way nothing new was created, but these components were put together to give assessors quick and consistent guidance. Assessors then had access to the full international manuals for more information. • The form, and guidance on its use, were condensed into a brief field reference note (see annex). • The assessment form and simplified guidance note were as simple as possible, whilst still capturing the key life-safety aspects. • Local and international assessors were provided a training briefing on the agreed assessment forms, methodology and decision criteria.
3. Coordination of Assessors	• The Albanian Damage Assessment Coordination structure was greatly strengthened by the support of the DACC. • International Engineers were utilized from international USAR teams at the end of the USAR phase, and later deployed to Albania as specific damage assessment teams. • To ensure close coordination between national and International Engineers it was useful to establish a representative of the governmental body in charge of the damage assessment inside the DACC. • The DACC facilitated and troubleshooted the daily process of assigning teams of national and International Engineers, and defining their areas of work, and any priority locations. • Logistics organisation was conducted by the assessment teams themselves, including transport and prioritization within their assigned zones. • Collaboration between the local and International Engineers was emphasized as an opportunity for two-way knowledge-share and capacity-building. The local assessors were confident to continue the work after international actors left, and the International Engineers gained valuable exposure and experience in the field, benefiting their work in their home countries and in future deployments.

Table 7: Key Activities of the Damage Assessment Coordination Centre (DACC) in Albania.
(continued on next page)

Component of Damage Assessment Coordination	DACC Operations in Albania
4. Data Management and Analysis	• National data was collected and owned by the Albanian Authorities. The initial paper data-collection system was used initially in Durres, to allow assessments to begin whilst an electronic system was established. This meant that data-collection and analysis was slow in the initial days, limiting a clear operational overview. • In parallel, international teams reported aggregated assessment data to the DACC. This included only assessments conducted directly by international assessors, and was used to aid the forming of an operational overview. • A number of inconsistencies were observed in both the national and international data collected. This could perhaps have been somewhat addressed by stronger data-collection templates, using the same electronic tools, and training. This also highlights the importance of daily analysis of the data to highlight issues which can be fed back to the teams. • Overall, the Albanian Authorities reported assessment of 39,000 buildings. • 185 International Engineers from 18 countries were deployed alongside Albanian assessors, supporting the Albanian-led assessments, and directly conducting over 3,200 assessments.

Table 7 (continued): Key Activities of the Damage Assessment Coordination Centre (DACC) in Albania

4. Discussions and Conclusions

The coordination activities performed to incorporate International Engineers into national activities in the Nepal 2015, Ecuador 2016, and Albania in 2019 earthquakes varied. The challenges faced by the Nepalese authorities were that they were overwhelmed, and so an effective Damage Assessment Coordination (DAC) system was not in-place to best utilize the in-country International Engineers. In contrast, the authorities of Ecuador were able to put in place some of the necessary components of an effective DAC system, and more components were then put in place with the assistance of the international teams. In Albania, the damage assessment process gained from coordination established from international USAR teams.

Upon reviewing these three events, this paper has proposed that the activities for an effective DAC System can be organised into four categories:

1. **Coordination with National Entities and Procedures** found to be crucial for the initial setup of the DACC.
2. **Procedure for Technical On-Site Assessment of Damage**: critical for ensuring consistent and defensible decision-making regarding the severity of damage to a structure, and whether it poses a significant risk to safety.
3. **Coordination of Assessors:** necessary to make optimal use of the national and international resources available to best address the critical priority assessment needs.
4. **Data Management and Analysis:** necessary to enable operational and strategic decision-making.

The main lessons are outlined in Table 8.

Component of Damage Assessment Coordination	**Key General Actions for Damage Assessment Coordination**
1. Coordination with National Entities and Procedures	• Identify who is responsible for damage assessments on a normal basis, and who is responsible for organizing large scale damage assessments during a disaster? Establish face-to-face contact with the relevant parties, including the different Local Authorities in which assessments will take place. • Identify how the international assistance will organize itself and connect with the national system. Discuss needs for International Engineers and processes for requesting and receiving. • Agree the objectives of international assessments. • Discuss the relevant national legal requirements (e.g., jurisdiction for making assessments). • Agree the procedures for requesting Engineers and assessing their qualifications. • Develop the exit strategy and handover.
2. Procedure for Technical On-Site Assessment of Damage	• Identify whether there is already a single set of national procedures and criteria in use for each relevant stage of assessment. • Assess whether existing procedures are sufficient when compared with international standards. If deficiencies are identified, propose how they can be addressed by supplementing national procedures with aspects of international guidance. • Provide the agreed standards in the local language, provide a shortened field-guide, provide training to both national and international assessors. • Observe the assessment procedure in-use and provide supplemental feedback/training to teams as necessary.
3. Coordination of Assessors	• Gather information on the available numbers and capabilities of international assessors. This includes qualifications/experience, transport capabilities/needs and duration for which they will be available. The DACC has to have a system to verify that Engineers used in assessing damaged buildings have the legal qualifications to assess buildings in their home country. • Agree with the National Authority the sectorization of the affected area. Where possible, use existing administrative boundaries (such as postcodes) or other pre-existing delimitation. • Establish contact and identify a point of contact with each municipality that International Engineers are working in. • Have daily planning meetings. Match international with national assessors, such that international teams are never operating alone. • Assign assessment teams to the sectors to be assessed, and define their daily activities. Follow up on plans. • Maintain a database of all engineers and activities and start early planning a handover.
4. Data Management and Analysis	• Identify whether the National Authorities require assistance establishing their own system (preferably electronic) for collation of assessment data. This data remains under the ownership of the National Authority. • Provide international assessors with a data-collection template and establish a timetable/method by which aggregated data on international assessments can be returned to the DACC. Include simple checks in data-collection templates to capture inconsistencies (such as unequal sums for damage-levels and habitability). • Clearly clarify whether assessment data is recorded by dwelling or by building, and ensure that all required fields in assessment forms are completed. This can be enforced if using the same Data Collection Tool by all parties, but must be emphasized and checked if using a paper system. • Establish a system for conducting daily analysis of this data, to inform ongoing operational decisions, and to identify issues/inconsistencies in the data and feed that back to teams. • Link assessment data with other relevant ongoing efforts, such as Post Disaster Needs Assessments.

Table 8: Key General Actions for Damage Assessment Coordination, identified from the case-study events presented in this paper.

The operations of the DACC in Albania positively contributed to the recovery of the affected regions. The DACC was a location where people could go to get information and become part of an organized operation and provided stability within the operations. These operations were possible due to the strong collaboration between EUCPT, UNDAC and INSARAG, and the Government of Albania, especially through its Liaison persons. DACC Standard Operating Procedures can guide how to include international Engineers in future events. DACC procedures should be incorporated into general response procedures of national entities and of international responses.

Acknowledgements

The work of the DACC was possible in Albania due to the strong collaboration between EUCPT, UNDAC, INSARAG and the Government of Albania. Additional thanks are expressed to Carlos Molina Hutt (University of British Colombia) for insights into the 2016 Ecuador earthquake response, and to Antonios Pomonis (World Bank consultant) for data related to both the 2015 Nepal Earthquake and the 2019 Albania Earthquakes.

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6. Annex

6.1. Forms & data-collection templates

Rapid Assessment: Guidance Notes

Table I: Rapid Assessment Inspection Procedure*

1	Examine the entire outside of the structure.
2	Examine the ground and pavement in the general area of the structure for fissures, bulged ground, or signs of slope movement.
3	Enter a building when the structure cannot be viewed sufficiently from the outside and when there is a suspected or reported problem such as non-structural damage (e.g. fallen ceiling or damaged partitions). **Do not enter obviously unsafe structures.**
4	Assess the structure using the criteria in Table II and Table III.
5	Complete the Rapid Assessment Form. Record any restrictions placed on use of the structure on the Rapid Evaluation form. Questionable buildings should be recommended for a Detailed Assessment.
6	Explain the significance of Inhabitable or Uninhabitable postings to building occupants, if they are available. Advise them to leave unsafe buildings immediately, but do not create panic. Unsafe areas must be also evacuated.

**Adapted from ATC-20.*

Table II: Guidelines for defining the level of habitability/useability (Gjendja E Ndertimit)**

	Visual Signs of Damage
Habitable (Banueshem)	• Slight cracks in render (plaster) of the wall and/or ceiling • Slight cracks in walls (load-bearing and/or non-load-bearing), and slight separation between load-bearing and non-load-bearing elements • Hairline, non-diagonal cracks in horizontal reinforced concrete structural beams • Hairline cracks in load-bearing masonry walls, where the cracking covers less than 30% of the wall area
Uninhabitable (Pa Banueshem)	• Total or partial collapse of the building • Major damage and deformation, deviation from the vertical of of load-bearing structure • Severe damage to the beam-column joints • The load-bearing elements show any deformation • Significant cracks (>2mm) in load-bearing elements made of reinforced concrete • Significant (>2mm) cracks in load-bearing walls • Hairline cracks in load-bearing masonry walls, where the cracking covers more than 30% of the wall area • Diagonal cracking or crumbling of the material in the walls between the windows or doors or similar elements of construction • Damage or collapse, or significant *distortion* of the roof • Slight damage, partial or complete *sliding* of the roof • Detachment of large pieces of plaster on walls and ceilings (sufficient to cause harm) • Damage or partial failure of chimneys, parapets • Non-load-bearing walls: Large diagonal cracks, collapse of infill walls and major separation between infill walls and structural elements

***Adapted from: Engineer's Manual, Greek General Directorate for the Rehabilitation of the Impacts from Natural Disasters. Note that the above is guidance only, and the assessor is referred to the AeDES Field Manual for more comprehensive guidance on defining useabillity.*

Table III: Guidelines for defining the level of damage (Niveli Demit Te Shkaktuar)***

Damage Level	Description
Light Damage (D1)	This damage grade does not affect significantly the capacity of the structure and does not jeopardise the occupants safety due to falling of non-structural elements; the damage is light even when the falling of objects can rapidly be avoided
Medium - Severe Damage (D2-D3)	This damage grade could change significantly the capacity of the structure, without getting close to the limit of partial collapse of the main structural components
Very Heavy Damage (D4-D5)	This damage grade significantly modifies the capacity of the structure, bringing it close to the limit of partial or total collapse of the main structural components. This grade is characterised by damages heavier than the previous ones, including the total collapse

****Adapted from Joint Research Centre (JRC) and Italian Civil Protection, Field Manual for post-earthquake damage and safety assessment and short term countermeasures (AeDES), European Commission, EUR 22868 EN – 2007*

See Guidance for Damage Classifications on next page

Rapid Assessment: Guidance for Damage Classifications

Light Damage (Ulet) | Medium – Severe Damage (Mesem) | Heavy Damage (Larte)

DS1	DS2	DS3	DS4	DS5
Grade 1: Negligible to slight damage *(no structural damage, slight non-structural damage)*	**Grade 2: Moderate damage** *(slight structural damage, moderate non-structural damage)*	**Grade 3: Substantial to heavy damage** *(moderate structural damage, heavy non-structural damage)*	**Grade 4: Very heavy damage** *(heavy structural damage, very heavy non-structural damage)*	**Grade 5: Destruction** *(very heavy structural damage)*
Fine cracks in plaster over frame members or in walls at the base. Fine cracks in partitions and infills	Cracks in columns and beams of frames and in structural walls. Cracks in partition and infill walls; fall of brittle cladding and plaster. Falling mortar from the joints of wall panels	Cracks in columns and beam column joints of frames at the base and at joints of coupled walls. Spalling of concrete cover, buckling of reinforced rods. Large cracks in partition and infill walls, failure of individual infill panels	Large cracks in structural elements with compression failure of concrete and fracture of rebars; bond failure of beam reinforced bars; tilting of columns. Collapse of a few columns or of a single upper floor	Collapse of ground floor or parts (e. g. wings) of buildings

Table IV: Damage Level mapped to the EMS-98 Damage Scale . Adapted from Joint Research Centre (JRC) and Italian Civil Protection, Field Manual for post-earthquake damage and safety assessment and short term countermeasures (AeDES), European Commission, EUR 22868 EN – 2007

6.2. Example Assessment data provided by International Assessment Teams

Date	Country	Munici-pality	Admin-Region	Engi-neers	Inspec-tions	Habi-tab.	Unin-hab.	None	Light	Me-dium	Heavy
1-Dec	A	Durres	Ishem	2	35	30	5		3	5	3
1-Dec	A	Durres	Katund I Ri	2	12	9	3			1	2
1-Dec	A	Durres	Manez	2	9	9				3	6
1-Dec	A	Durres	RRashbull	2	10	4	6		5	2	3
1-Dec	B	N/A									
1-Dec	C	Durres			46	14	32		23	20	3
1-Dec	C	Durres	Fushe-Kruje		18	8	10		7	6	5
1-Dec	C	Durres	Kruje		17	7	10		7	10	
1-Dec	C	Bubq			11	1	10		1	5	5
					158	**82**	**76**	**0**	**46**	**52**	**27**
2-Dec	A	Durres	Ishem	2	85	74	11		10	3	10
2-Dec	A	Durres	Katund I Ri	2	50	12	38		12		38
2-Dec	A	Durres	Manez	2	11	11				3	8
2-Dec	A	Durres	RRashbull	2	10		10		5	3	2
2-Dec	B	Durres		2	5						
2-Dec	B	Kruje		6	20						
2-Dec	C	Durres			19	10	9		13	5	1
2-Dec	C	Durres	Sukth		19	1	18		1	14	4
2-Dec	C	Durres	Kruje		22	11	11		11	7	4
2-Dec	C	Durres	Fushe-Kruje		23	19	4		19	3	1
2-Dec	D	Durres			2	1	1		1	1	
2-Dec	D	Kruje			10	8	2		7	3	
					276	**147**	**104**	**0**	**79**	**42**	**68**

6.3. Teams Briefed by the DACC

Overall, from December the 7th to December the 16th, 90 new Foreign Engineers from 10 different countries were briefed in the auditorium of the Municipality of Durres.

Date	Country	Engineers
7th Dec	Romania	18
8th Dec	Poland	18
	Croatia	5
	Italy	9
9th Dec	N. Macedonia	9
11th Dec	Cyprus	6
	Bulgaria	7
	United Kingdom	6
	Czech Republic	4
15th Dec	France	4
16th Dec	Czech Republic	4
	Total:10	Total:90

Table 2: International Engineers briefed by EUCPT Bravo