The following report was submitted to the UN Special Rapporteur for Adequate Housing on 12 March 2021. Please note that sections containing personally identifiable information based on the footage captured with the eyeWitness to Atrocities app and the related metadata have been redacted from this report for security reasons. For the same reasons, Annex II and the interactive Google Earth Pro map will not be accessible.

www.eyewitness.global
To the attention of Mr. Balakrishnan Rajagopal,

We are hereby submitting a report highlighting a number of incidents which took place during the conflict in Ukraine. After careful examination of the circumstances surrounding these events, we have reasonable grounds to believe that a violation of the right to adequate housing has occurred.

This report is based on photographs captured by Truth Hounds/International Partnership for Human Rights (IPHR) and other documenters using the eyeWitness app. More details on the technology system — developed to facilitate the documentation of human rights violations using smartphone technology — are provided in the report. To investigate the incidents, we combined the data collected using eyeWitness technology with satellite imagery and other online open sources, including over 450 publicly available reports in Ukrainian, Russian and English. This innovative methodology allowed us to document the ‘routine’ human rights violations which are a day-to-day reality of an armed conflict, but which are typically neglected due to factors such as access restrictions, security considerations, or the prioritisation of investigative resources towards higher profile incidents.

We are also including an annex with 211 photographs (Annex II) that are an appropriate representation of the damage occurred during the attacks highlighted in this report. The
photographs are provided exclusively for the purposes of any analysis or investigations being carried out by the office of the UN Special Rapporteur on the Right to Adequate Housing. If you intend to share Annex I or II, or the interactive Google Earth Pro map, with other United Nations bodies, external institutions or representatives (domestic or foreign, of any nature), please contact us before proceeding, as we must notify the documenter(s). Ensuring we keep the documenters informed and act with their consent allows us to minimise the risks to local organisations and documenters who may have security concerns about the release of the information.

This report has been prepared by eyeWitness to Atrocities and the Digital Verification Unit at the University of Essex, with the input of Global Rights Compliance.

Yours sincerely,

Wendy Betts
Director
eyeWitness to Atrocities

Dr. Daragh Murray
Digital Verification Unit, University of Essex Human Rights Centre Clinic
1. SUMMARY
2. METHODOLOGY
3. INTERNATIONAL LEGAL FRAMEWORK
   3.1. RELATIONSHIP BETWEEN INTERNATIONAL HUMANITARIAN LAW AND INTERNATIONAL HUMAN RIGHTS LAW
   3.2. WEAPONS USED IN THE ATTACKS
   3.3. APPLICATION OF THE LEGAL PRINCIPLES TO THE TYPES OF INCIDENTS PRESENTED IN THIS REPORT
4. EVENTS WARRANTING FURTHER INVESTIGATION
   4.1. Krasnohorivka | Красногорівка
   4.2. Novoluhan’ske | Новолуганське
   4.3. Avdiivka | Адьївка
5. EYEWITNESS TECHNOLOGY OVERVIEW
   5.1. GENERAL INFORMATION
   5.2. HOW THE EYEWITNESS SYSTEM WORKS
   5.3. HOW WE VERIFY THE AUTHENTICITY OF THE METADATA
   5.4. HOW WE VERIFY THE AUTHENTICITY OF THE FOOTAGE
   5.5. HOW WE KNOW WHO HAS HAD ACCESS TO THE ORIGINAL VERSION
   5.6. METADATA ON THE PDF FILES
6. ANNEX I
1. **Summary**

1. Throughout 2017 and 2018 eyeWitness received 945 photographs showing conflict-related property damage. The images were captured across 14 different locations in Donetsk Oblast (eastern Ukraine), with the eyeWitness app, a mobile documentation technology.¹

2. This report highlights a number of incidents that took place in three different locations during the conflict in Ukraine, and for which there are reasonable grounds to believe that a violation of the right to adequate housing occurred. Using a combination of eyeWitness technology and open source investigations we have been able to document potential human rights violations that would otherwise stay unnoticed.

3. The attacks on civilian homes documented in this report reflect the unfortunate day-to-day reality of conflict, where violations of international law are committed but largely overlooked amidst the overall context of the fighting. The incidents presented here are not the highest profile attacks to have occurred over the course of the conflict in eastern Ukraine, but they do reveal the risks posed to individuals' inalienable human rights by situations of armed conflict.

4. We urge the Special Rapporteur on the Right to Adequate Housing to raise these incidents with the relevant authorities, so that an appropriate investigation may be conducted, and the right to a remedy of those affected ensured.

¹ The eyeWitness app and the full technology system are described in detail in Section 5.
2. Methodology

5. This report is based on three types of information: photographs captured with the eyeWitness app, satellite imagery, and information publicly available on the internet (among others, police reports, OSCE reports, social media posts and local, national and international media reports).\(^2\) The organisation Truth Hounds, supported by the International Partnership for Human Rights (IPHR), have documented the conflict in Ukraine extensively, and their reports have been referenced throughout this submission when they have been used as a source.

6. eyeWitness has developed technology that streamlines the documentation process of core international crimes and human rights violations. More information about the mobile app, the server system and the transmission protocols is provided in Section 5. On a daily basis, the eyeWitness legal team reviews all the media files submitted through the app to the analysis database. They catalogue, tag, and objectively describe the information received so the photo/video/audio recordings can be searched and further analysed.

7. As part of this work, lawyers check for any notes that the documenter may have sent with the footage, look for any insignias, graffiti or other written material on the photographs and videos, and listen to any audio recordings received as a file or as part of a video. They then transcribe and translate all this information into English if necessary. They also establish relationships between media files that can be connected on the basis of the location or the time where and when the footage was taken.

\(^2\) All online sources referenced in the footnotes have been archived and are available upon request.
8. In this instance, the recordings received showing property damage consisted exclusively of photographs. After conducting a visual analysis, we excluded from further evaluation images for which:

   a. The quality or the resolution of the image was mediocre;
   b. The damage to property was not evident or substantial enough; or
   c. The damaged building was not private property.

9. The metadata captured automatically with the eyeWitness app gives us the exact date and time when the photographs were taken, and their location. However, all photographs were taken at a date posterior to the event that caused the damage to the houses. The documenters were only able to provide the exact date of the incident that had caused the damage to the photographed property in three locations out of 14. This is not abnormal. A deficit of information relating to specific events is common in ongoing or post-conflict documentation.

10. We were able to verify the dates of the attacks provided by the documenters through an analysis of historical satellite imagery, by comparing any visual differences on the buildings. For the other incidents, we were able to narrow down the dates on which the attack may have occurred when satellite images were available for a particular location with sufficient frequency, and the property damage was on the roof and significant enough to be visible. All satellite images used in this report were sourced from Google Earth Pro. Each image is captioned with the name of the primary satellite imagery provider and copyright date. More information about the specific dataset and the date of capture should be available via the provider.

3 We conducted the visual analysis of the satellite imagery using Google Earth Pro, however other providers may have images from other dates or better quality.
11. As part of our investigation, we examined online open sources in Ukrainian, Russian and English to identify whether the damage caused to the civilian properties could have been the result of a legitimate military attack. We retrieved and reviewed over 450 publicly available reports in these three languages to gather more information about military presence, activity, objects and targets in each relevant location and timeline. When there were reasonable grounds to believe that there may have been a legitimate military objective in the vicinity, we also researched the weapons’ systems that may have been used during the incidents, in order to assess compliance with international humanitarian law rules relating to the methods and means of attack.

12. In this report, we highlight three locations for which we found reasonable grounds to believe that the circumstances of the attack were in violation of international law (Section 4). For Novoluhans’ke (Новолуганське) and Krasnohorivka (Красногорівка), we were able to match the damage shown in the photographs to the exact date of the attack. For Avdiivka (Авдіївка), we identified 90 attacks that took place since the beginning of the conflict and up to the moment when the eyeWitness photographs were captured, and caused property damage to civilian houses — with the first attack occurring on 7 July 2014 and the last attack on 21 May 2018. We also identified the exact or approximate location of 49 houses that were damaged during these attacks and for which photographs taken with the eyeWitness app are available.

13. In Annex II, we are sharing a subset of 211 photographs that we believe to be an appropriate representation of the damage occurred during the attacks highlighted in this report. Each PDF file contains a preview of the photograph and their associated metadata, and it is named with the internal reference number (hereinafter, Item ID) of the photograph. Should you require the raw files for the photographs, we can provide them. eyeWitness also holds other corroborating footage that has not been included
with this submission because the quality of the images was low, or we did not have the GPS coordinates taken at the time when the photograph was captured.

14. We adhered to the principles of independence, impartiality and objectivity, and to the obligation to ‘do no harm’. Special attention was paid to obtaining informed consent for sharing the images from the documenters who captured the photographs.

3. International legal framework

3.1. Relationship between International Humanitarian Law and International Human Rights Law

15. It is today accepted that both international humanitarian law and international human rights law apply during situations of armed conflict. The precise nature of the relationship between these two bodies of law, and in particular, how the content of the rules applicable to a specific situation are to be determined, is subject to some debate. Successfully resolving this argument is a fundamentally important issue: although certain international humanitarian law and international human rights law rules are broadly compatible, others are not.

16. For example, international humanitarian law permits recourse to direct lethal force against combatants in an international armed conflict, and against individuals directly

---


5 Such as those rules relevant to situations of detention, or the conduct of fair trials. See, for instance, the similarities in this regard between Article 75, Additional Protocol I, and Articles 9 and 14, International Covenant on Civil and Political Rights.

6 See, for example, Article 43, Additional Protocol I.
participating in hostilities in both international and non-international armed conflicts. This is distinguished from the rules on the use of lethal force under international human rights law, which require that lethal force be used only as a last resort, in order to protect life. Evidently, the rules of international law applicable to a particular situation of armed conflict — and thus the type of activity that constitutes a violation of international law — may vary to a significant degree, dependent upon how the relationship between international human rights law and international humanitarian law is resolved.

17. The precise relationship between international humanitarian law and international human rights law is central to the protection of the right to adequate housing during situations of armed conflict. For example, international humanitarian law permits the direct targeting of civilian homes which have been transformed into military objectives, and incidental damage to, or destruction of, civilian homes in the course of an attack on a military objective, when this is not excessive in relation to the concrete and direct military advantage anticipated. On the other hand, international human rights law explicitly protects each individual’s right to an adequate standard of living — of which the right to adequate housing is a central component — and requires the progressive realization of this right.

18. An analysis of relevant case law indicates that there are different steps in the analysis of the relationship between international humanitarian law and international human 

---

8 See, for example, McCann and Others v. The United Kingdom, Judgment, ECHR, App. No. 18984/91, 27 September 1995, para. 194.
9 Article 52, Additional Protocol I, Rules 9 and 10, ICRC Customary International Humanitarian Law Study.
10 Article 57, Additional Protocol I; Rule 14, ICRC Customary International Humanitarian Law Study.
rights law. First, the starting point, or initial point of reference, is determined by the existence of explicit rules designed for the situation. This body of law may be referred to as the primary framework. In some situations, it will be international humanitarian law; in others, international human rights law. Next, the secondary framework must be interpreted in light of the primary framework. However, both bodies of law remain applicable and both may contribute to, and inform, the overall legal regulation of the situation at hand.

Third, location — in terms of proximity to the battlefield or the exercise of State control — may affect the choice of the primary framework. For instance, in non-international armed conflicts, international humanitarian law rules on the use of force may provide the primary framework on the frontline, while international human rights law may provide the primary framework in rear areas subject to the exclusive control of the State.

19. On the basis of this case law, situations of armed conflict may be grouped into two broad categories. On the one hand are situations where international humanitarian law constitutes the primary framework, and international human rights law must be interpreted in light of the relevant international humanitarian law rules. For ease of reference, this has been referred to as the ‘active hostilities’ framework. In these situations, there will only be a violation of international human rights law if there is a violation of international humanitarian law. On the other hand are situations where international human rights law constitutes the primary framework, and international

---

11 The analysis presented here is based on that in D. Murray, Practitioners’ Guide to Human Rights Law in Armed Conflict (OUP, 2016, D. Akande, C. Garraway, F. Hampson, N. Lubell, E. Wilmshurst eds.). See, in particular, Chapter 4. In Georgia v. Russia (II), the European Court of Human Rights diverged somewhat from this analysis when establishing jurisdiction over activities occurring during that phase of the conflict in which intense fighting was occurring. However, this finding relates solely to jurisdiction and not to the actual application of human rights law. Georgia v. Russia (II), Judgment, Grand Chamber, ECtHR, App. No. 38263/08, 21 January 2021.

12 In this sense the case law appears to have moved beyond a strict application of the principle of lex specialis and towards a ‘complementary’ approach, where although one body of law may provide the primary framework in light of its appropriateness to the regulation of the situation at hand, both bodies of law are applicable and capable of informing the overall legal framework.
humanitarian law must be interpreted in light of the relevant international human rights law rules. For ease of reference, this has been referred to as the ‘security operations’ framework. Under the ‘security operations’ framework there will only be a violation of international humanitarian law if there is a violation of international human rights law.

20. The ‘active hostilities’ framework is applicable to all conflict-related activities in an international armed conflict, and to situations of active hostilities involving sustained and concerted military operations and situations where the State does not exercise effective territorial control, in non-international armed conflicts. The ‘security operations’ framework is applicable to all other situations.

21. The ‘active hostilities’ framework is applicable to the incidents under discussion in this submission.\(^{13}\) This means that there will only be a violation of international human rights law if there is a violation of the relevant international humanitarian law rule.\(^{14}\) The international humanitarian law rules most relevant to the incidents presented here are: first, the prohibition of directly targeting civilian objects;\(^{15}\) second, the principle of proportionality;\(^{16}\) and third, the prohibition of indiscriminate attacks.\(^{17}\)

\(^{13}\) The Office of the Prosecutor at the International Criminal Court has indicated that since 2014 there is an ‘armed conflict, involving the persistent use of heavy military weaponry by both sides, including in built-up areas, has since persisted in eastern Ukraine for more than six years’. However, it does not specify whether the conflict is of international or non-international nature. The Office of the Prosecutor, International Criminal Court, Report on Preliminary Examination Activities 2020, para. 276. Regardless of this note, as the fighting occurred between the State and an armed group in exclusive control of territory, along the front line, this situation is classified as one to which the ‘active hostilities’ framework applies. The classification of the conflict as either an international armed conflict or a non-international armed conflict is irrelevant for the purposes of this report, as the rules of international humanitarian law here are widely regarded as applicable to both types of conflict on the basis of customary international humanitarian law.

\(^{14}\) See further, D. Murray, Practitioners’ Guide to Human Rights Law in Armed Conflict (OUP, 2016, D. Akande, C. Garraway, F. Hampson, N. Lubell, E. Wilmshurst eds.), Chapter 4, para. 32.

\(^{15}\) See, Article 52, Additional Protocol I, Rule 7, ICRC Customary International Humanitarian Law Study.

\(^{16}\) See, Articles 51(5)(b) & 57, Additional Protocol I, Rule 14, ICRC Customary International Humanitarian Law Study.

\(^{17}\) See, Article 51(4), Additional Protocol I, Rule 11, ICRC Customary International Humanitarian Law Study.
22. The prohibition of directly targeting civilian objects means that civilian homes cannot be directly targeted. That is, they cannot be the focus of an attack. Civilian objects are all objects which are not military objectives. A military objective is defined as:

In so far as objects are concerned, military objectives are limited to those objects which by their nature, location, purpose or use make an effective contribution to military action and whose total or partial destruction, capture or neutralization, in the circumstances ruling at the time, offers a definite military advantage.

23. Civilian homes have been damaged in all of the incidents discussed in this report. There is no indication that these homes had been transformed into a military objective at the time of the incident. As such, they were protected from direct attack.

24. Although civilian objects may not be directly targeted, in certain circumstances damage to civilian homes may be lawful. This is governed by the principle of proportionality:

Launching an attack which may be expected to cause incidental loss of civilian life, injury to civilians, damage to civilian objects, or a combination thereof, which would be excessive in relation to the concrete and direct military advantage anticipated, is prohibited.

25. This incidental death, injury or destruction is often colloquially referred to as ‘collateral damage’. If the expected damage to civilians or civilian objects is excessive in relation to the military advantage anticipated, then the attack will constitute a violation of the principle of proportionality.

---

18 See, Article 52(1), Additional Protocol I, Rule 9, ICRC Customary International Humanitarian Law Study.
19 See, Article 52(2), Additional Protocol I, Rule 8, ICRC Customary International Humanitarian Law Study.
20 See, Rule 14, ICRC Customary International Humanitarian Law Study.
26. Indiscriminate attacks are those which:

(a) are not directed at a specific military objective;
(b) employ a method or means of combat which cannot be directed at a specific military objective; or
(c) employ a method or means of combat the effects of which cannot be limited as required by international humanitarian law;

and consequently, in each such case, are of a nature to strike military objectives and civilians or civilian objects without distinction.\textsuperscript{21}

27. The direct targeting of civilians, disproportionate attacks, and indiscriminate attacks are recognised as war crimes.\textsuperscript{22} A reasonable suspicion that a war crime has been committed will give rise to an obligation to investigate.\textsuperscript{23}

28. As mentioned above, under the ‘active hostilities’ framework a violation of international humanitarian law will result in a violation of the associated rules of international human rights law. Most relevant are Article 11 of the International Covenant on Economic, Social and Cultural Rights (the right to an adequate standard of living, including housing), Article 17 of the International Covenant of Civil and Political Rights (prohibition of unlawful or arbitrary interference with a person’s home), and Article 1 of Protocol 1 of the European Convention on Human Rights (protection of property).

\textsuperscript{21} See, Rule 12, ICRC Customary International Humanitarian Law Study.
\textsuperscript{22} See Rule 156, ICRC Customary International Humanitarian Law Study.
29. In the situations under consideration in this report, damage to property resulting from the direct targeting of civilian objects, a disproportionate attack, or an indiscriminate attack, constitutes a violation of the right to adequate housing.

3.2. Weapons used in the attacks

30. A variety of different weapons were reportedly used in the attacks discussed herein, all of which are classified as indirect fire weapons. These are different from direct fire weapons, in that they cannot be aimed via line-of-sight to hit a specific target or point on the earth. Some of the weapons used in the attacks, such as artillery cannon or mortar systems, lob ordnance at the target in an arc — and thus work following a process of calibration. They have an associated circular error probable (CEP), meaning that when fired towards a target they have a 50% chance of landing within the CEP (typically measured in metres) of that target. The site of impact is then monitored and the weapons system re-calibrated, so that the weapon ‘zeroes in’ on the exact target.

Artillery gun and mortar systems are capable of obtaining a high degree of accuracy using this process, although this is dependent on a well-trained crew, good firing conditions, and the firing of multiple rounds to ‘walk in’ on the target.

31. The use of heavy artillery in populated areas raises significant concerns. The large CEP associated with heavy artillery (from approximately 100 metres up to a maximum of 300 metres), and the process of ‘walking in’ on a target — whereby multiple rounds are fired before the intended target is hit — makes it highly likely that civilians and/or

---


civilian objects will be hit. Hence, the choice of these weapons raises significant concerns with respect to the principle of proportionality and the prohibition of indiscriminate attack. The number of civilians and/or civilian objects present makes it highly likely that the death, injury or destruction caused by the use of heavy artillery will be excessive in relation to the military advantage anticipated, thereby violating the principle of proportionality. At the same time, the difficulty in effectively directing artillery raises concerns with respect to the prohibition of indiscriminate attacks. In essence, the nature of this weapon indicates that its use in populated areas may have indiscriminate effects. For instance, effectively using artillery to hit a specific target is dependent upon a number of factors, including the skill level of the firing team, and the firing conditions. If a poorly trained team is deployed, or insufficient care is taken, then the attack cannot be considered to be effectively directed against the target.

32. These factors indicate that, in the majority of circumstances, the use of heavy artillery in populated areas will be disproportionate or potentially indiscriminate. Heavy artillery may only be lawfully used in populated areas in exceptional circumstances — namely where the military advantage anticipated from the destruction of the identified military objective is very high.

33. Other weapons are not intended to be aimed at specific targets but are instead launched towards an area. Rocket systems — such as the Grad — are considered to be area weapons: they are directed towards an area, with the intent of neutralizing everything within that zone. This means that they are incapable of discriminating between legitimate targets (such as military objectives) and illegitimate targets (such as civilian objects) in the strike area. The Geneva International Centre for Humanitarian
Demining notes that ‘[u]nguided artillery rockets are generally neither accurate nor precise.’

3.3. **Application of the legal principles to the types of incidents presented in this report**

34. A number of different possibilities arise from applying the prohibition of directly targeting civilian objects, the principle of proportionality, and the prohibition of indiscriminate attacks to the situations involving indirect fire weapons presented in this report.

35. If there is not a military objective that can be identified within the vicinity of the damaged civilian home, on its face, the incident amounts to the direct targeting of a civilian object — irrespective of the type of weapon system used. It would therefore appear to constitute a violation of international humanitarian law and international human rights law.

36. If a military objective can be identified within the vicinity, then the type of weapon used becomes relevant.

a. If an area weapon — such as a Grad rocket system — is used against a populated area then this indicates an indiscriminate attack. These weapons systems are incapable of distinguishing between military objectives and civilians or civilian objects within the strike area, and so cannot adhere to the principle of distinction.

b. If heavy artillery is used against a populated area, this will be unlawful in the majority of circumstances, because of the disproportionate or potentially indiscriminate nature of the attack. The use of heavy artillery will only be lawful in exceptional circumstances (i.e. where the military advantage anticipated is very high, and therefore not excessive in relation to the expected destruction of civilian objects, and death or injury to civilians). In this report, when considering the use of heavy artillery in Krasnohorivka and Novoluhans’ke, we have only included damaged civilian homes which fall outside the maximum CEP associated with heavy artillery (300m).\(^{28}\) This overly cautious approach is intended to mitigate against the (remote) possibility that a high military advantage was attributed to the destruction of the identified military objective, and this objective was appropriately targeted.

4. Events warranting further investigation

4.1. Krasnohorivka | Красногорівка

37. Targeted area: Krasnohorivka is located in the Mar’inka Raion in Donetsk Oblast of eastern Ukraine,\(^{29}\) 20 km west of Donetsk.\(^{30}\) At the time of the attack, Krasnohorivka was under the control of the Ukrainian government.\(^{31}\)

---

\(^{28}\) It is noted, however, that this is the maximum CEP and military experts consulted indicated that a CEP of 150 metres is more likely.


\(^{30}\) Organization for Security and Co-operation in Europe (OSCE) Special Monitoring Mission to Ukraine, Latest from OSCE Special Monitoring Mission (SMM) to Ukraine based on information received as of 19:30 (Kyiv time), 5 June 2015, 6 June 2015, available online at https://www.osce.org/ukraine-smm/162611.

38. **Overview of the attack:** On 3 June 2015, fighting was widespread in the area surrounding the city of Marinka. The attack on Krasnohorivka reportedly started at 04:30 am EET (some sources say around 4.00), and lasted for several hours. Most sources suggest that the incoming fire came from the direction of non-government-controlled Staromykhailivka (16 km west of Donetsk), and that Ukrainian forces returned fire. Reports confirm the presence of Ukrainian military positions near civilian areas at the time of the attack. Satellite imagery prior and after the attack

---

**Latest from OSCE Special Monitoring Mission (SMM) to Ukraine based on information received as of 19:30 (Kyiv time), 5 June 2015, 6 June 2015, available online at** [https://www.osce.org/ukraine-smm/162611](https://www.osce.org/ukraine-smm/162611).


Organization for Security and Co-operation in Europe (OSCE) Special Monitoring Mission to Ukraine, **Latest from OSCE Special Monitoring Mission (SMM) to Ukraine based on information received as of 19:30 (Kyiv time), 3 June 2015, 4 June 2015, available online at** [https://www.osce.org/ukraine-smm/162386](https://www.osce.org/ukraine-smm/162386).


Espreso TV, ‘Бої за Мар'їнку: Терористи розпочали наступ на Донбас. Хроніка’, 3 June 2015, available online at [https://espreso.tv/article/2015/06/03/boyi_za_maryinku](https://espreso.tv/article/2015/06/03/boyi_za_maryinku).


corroborates the locations of firing positions or trenches on the eastern outskirts of Krasnohorivka, and a checkpoint on the road leading to Mar’inka on the southern edge of town. On the basis of this information there are reasonable grounds to believe that at least these military positions were present when the attack took place.

Satellite image showing military positions around Krasnohorivka on 21 May 2015 (13 days before the attack, closest date prior the attack for which imagery is available on Google Earth Pro). The checkpoint is located at GPS coordinates 47.986075, 37.514122, and the trenches are around GPS coordinates 47.994686, 37.537081. [Both map and close-ups © 2020 Maxar Technologies]

39. Means of attack: Sources identified a variety of weapons used in the fighting around Mar’inka, such as rocket artillery and howitzer artillery of 122 mm, 152 mm and 220
mm calibre,\textsuperscript{39} Grads/MLRS rockets,\textsuperscript{40} mortars\textsuperscript{41} (some sources specifically mention 122 calibre mortars),\textsuperscript{42} as well as the use of infantry and tanks.\textsuperscript{43} Krasnohorivka was reportedly hit with heavy artillery.\textsuperscript{44}

40. Property damage: A civilian house in Krasnohorivka suffered damage on the façade and the roof as a result of the attack, with some of the destruction visible from satellite imagery (Annex II: Item IDs 3511 and 3527). The damaged house is located on the southern edge of the town, 460 m from the Ukrainian Forces checkpoint and 500 m from the closest trenches. According to multiple sources, several other houses and


public buildings were also damaged, including two schools and the town hospital (the approximate area has been shaded on the map in green), and the water, electricity and gas supply systems were disrupted.

---


Satellite image showing the house that was damaged during the attack, an approximation of the area that was hit during the attack (areas shaded in green), the military positions around Krasnokrhorivka, and the distance between the house and the positions on 9 June 2015 (6 days after the attack, closest date following the attack for which imagery is available on Google Earth Pro). [Both map and close-ups: © 2020 Maxar Technologies]
Photograph of the damaged house captured with the eyeWitness app (Annex II: Item ID 3527) and close-ups of the satellite images showing the roof of the house before (21 May 2015) and after (9 June 2015) the attack. Full size photographs and their metadata are available in Annex II. [Close-ups of satellite images © 2020 Maxar Technologies]

41. Legal analysis: In light of the information available, it is possible that this attack was directed at either the Ukrainian forces checkpoint or the military trench system. Military experts suggest that the CEP associate with the heavy artillery systems likely used in this attack is a maximum of 300 m. Both of the potential military objectives are significantly outside this CEP, at 460 m and 500 m respectively. This gives rise to two possible conclusions. First, if the attack was, in principle, focused on either of the two potential military objectives, then the manner in which the attack was conducted, and the fact that the targets were located in a populated area, indicate the commission of a disproportionate or potentially indiscriminate attack. Second, it cannot be discounted that the attack was not in fact directed at any military objective, in which case it would constitute the direct targeting of civilian objects. Both scenarios are violations of
international humanitarian law which would give rise to a violation of the right to adequate housing.

4.2. Novoluhans'ke | Новолуганське

42. Targeted area: Novoluhans'ke is located in the Bakhmut Raion in Donetsk Oblast of eastern Ukraine, 53 km north-east of Donetsk. At the time of the attack, Novoluhans'ke was under the control of the Ukrainian government.
43. **Overview of the attack**: The attack reportedly started on 18 December 2017, at approximately 17:00 EET and lasted a few minutes. Most sources indicate that the attack came from the direction of non-government-controlled Horlivka (39 km north-east of Donetsk, 17 km south-east of Novoluhansk'ke), hitting the area shaded on the map in green. Reports confirm the presence of several military positions, including trenches, firing positions and vehicle revetments around the perimeter of Novoluhanske.

---


51 Truth Hounds, Снаряд Під Подушку Хто винен в масованому обстрілі с. Новолуганське 18 грудня 2017 року?, available online at [https://truthhounds.org/shelling-of-novolugansk-18-12-17/](https://truthhounds.org/shelling-of-novolugansk-18-12-17/)


According to one source, the attack may have been carried out simultaneously from Horlivka and the village of Sofiyivka (that used to be known as Karlo-Maxovе, 17 km south of Novoluhansk'ke): Truth Hounds, Снаряд Під Подушку Хто винен в масованому обстрілі с. Новолуганське 18 грудня 2017 року?, available online at [https://truthhounds.org/shelling-of-novolugansk-18-12-17/](https://truthhounds.org/shelling-of-novolugansk-18-12-17/).
Novoluhans’ke, and a dormitory of the Ukrainian Army in the centre of the town. Satellite imagery corroborates the locations of some of these military posts before and after the attack. On the basis of this information there are reasonable grounds to believe that at least these military positions were present when the attack took place.

Satellite image showing the house that was damaged during the attacks and military positions in and around Novoluhans’ke on 16 September 2017 (93 days before the attack, closest date prior the attack for which imagery is available on Google Earth Pro). [Both map and close-ups of trenches below © 2020 Maxar Technologies]

44. Means of attack: 122 mm rockets were reportedly used, fired from multiple launch rocket systems (MLRS) BM-21 ‘Grad’.\textsuperscript{54} 30\textsuperscript{55} or 40\textsuperscript{56} rockets hit the town, with 15 of them impacting the residential sector.\textsuperscript{57}

\footnotesize
45. **Property damage:** A civilian house suffered damage on the façade as a result of the attack (Annex II: Item IDs 6408, 6409, 6426, 6443, 6449, 6450, 6451, 6453, 7148, 7186). The damaged house is located 390 m from the building that was reportedly used as a dormitory for Ukrainian Armed Forces, and 810 m from the closest trenches on the south-western edge of Novoluhans'ke. According to multiple sources, several other houses and some public buildings were also damaged during the attack, including a school, a kindergarten and a medical centre.58 (Annex II: Item IDs 6406, 6407, 6427, 6454, 6455, 6456, 6457, 6459, 6490, 6491, 6492, 6493, 6494, 6495, 7147, 7148, 7186).

---

Satellite image showing the position of the house that was damaged during the attack, the photograph captured with the eyeWitness app, an approximation of the area that was hit during the attack (area shaded in green), the military positions in Novoluhans'ke, and the distance between the damaged house and the positions on 5 April 2018 (108 days after the attack, closest date following the attack for which imagery is available on Google Earth Pro). Full size photographs and their metadata are available in Annex II. [Map © 2020 Maxar Technologies]

46. **Legal analysis:** The weapon system used in this attack, Standard BM-21 Grad MRLS rockets, is an area weapon, inappropriate for use against pin-point objectives, particularly when such targets are located in a populated area (i.e. in known vicinity of civilian objects). This weapons system relies on a large number of rockets to impact over a large area for a certain hit rate on specific targets.  

60 122 mm rockets fired from a ‘Grad’ style MLRS cannot be appropriately ‘directed at’ the potential military objectives identified in Novoluhans’ke. They are incapable of distinguishing between the potential military objectives and the significant number of civilian objects in the

---

surrounding populated residential area, because they are simply directed at the area itself.\textsuperscript{61} Anyone firing these munitions towards a populated area will know that the probability of hitting any potential military objective is low, while the probability of hitting civilian objects in their proximity is high. In circumstances where civilians or civilian objects are in the vicinity, an attack using such weapons cannot be considered to be ‘directed at’ a military objective.

47. This results in two possible scenarios, depending on the object of the attack. If the attack was directed at any of the potential military objectives in Novoluhans’ke, then the choice of munition was clearly unlawful, given the impossibility of distinguishing between the potential military objectives and surrounding civilian objects. In such circumstances, the attack must be considered to be an indiscriminate attack, in violation of international humanitarian law and therefore also of international human rights law. Equally, it is possible that the attack was not directed at specific military objectives, but that Novoluhans’ke itself was the object of the attack. In such circumstances, the attack must be considered to constitute the direct targeting of civilian objects, in violation of international humanitarian law and therefore also of international human rights law.

48. In light of the legal analysis provided in Section 3, and given the available information, there are reasonable grounds to believe that this attack constitutes a violation of international humanitarian law, and therefore of the right to adequate housing.

\textsuperscript{61} Grad-style MLRS are designed to be fired against military objectives (such as a large concentrations of troops), in the open area. They are incapable of being directed at pin point targets. Federation of American Scientists, ‘9K51 BM-21 Grad (Hail) 9A51 Prima Sakr-18 [Egyptian] 122-mm Multiple Rocket Launcher’, available online at https://fas.org/man/dod-101/sys/land/row/bm-21.htm.
4.3. **Avdiivka | Авдіївка**

49. *Targeted area:* Avdiivka is located in Pokrovsky Raion in Donetsk Oblast of eastern Ukraine, 15 km north-north-west of Donetsk. ⁶² During the time of the attacks, Avdiivka was under the control of the Ukrainian government. ⁶³

50. *Overview of the attacks:* Since the beginning of the armed conflict, Avdiivka has been under constant attack. Between 07 July 2014 and 21 May 2018, at least 90 different attacks took place — with shelling continuing throughout June and July 2018, up to the time when the eyeWitness photographs were captured. In Annex I, we provide brief summaries for these attacks, including the date, the weapons systems, the areas impacted, and the property damage that was caused as a result.

51. *Means of attack:* Most of the recorded attacks appear to have employed heavy artillery. When available, we have mentioned the details of the weapons in Annex I.

52. *Property damage:* Several houses were reported as damaged (to varying degrees) in the course of these attacks. In Annex I we have provided a list of 49 civilian properties photographed with the eyeWitness app, and have included their corresponding eyeWitness Image ID, the exact or approximate location of the house, ⁶⁴ and the satellite imagery that is publicly available. For all of these houses, the damage is visible on the photographs and we have embedded GPS coordinates at the time of capture. For 28 of them we have been able to identify in the satellite imagery the roof of the damaged house appearing in the photograph, and we have pointed their exact location on the map. When we were not able to clearly distinguish the precise house in the satellite

---

⁶²Wikipedia, ‘Авдіївка’, available online at [https://uk.wikipedia.org/wiki/%D0%90%D0%B2%D0%B4%D1%96%D1%97%D0%B2%D0%BA%D0%B0](https://uk.wikipedia.org/wiki/%D0%90%D0%B2%D0%B4%D1%96%D1%97%D0%B2%D0%BA%D0%B0).


⁶⁴The full address has been provided when the house numbers are visible on the photographs.
imagery, we have given the most likely location for the damaged house based on the coordinates captured with the eyeWitness app. This means that for instance, the damaged house on the photograph could have been on either side of the road.

Satellite image showing the exact location (yellow pins) or approximate position (orange pins) of the 49 houses that were damaged during the attacks taking place in Avdiivka from the beginning of the conflict up to 27 July 2018 (date when the last eyeWitness photograph was captured in Avdiivka). [Map © 2021 Maxar Technologies and © 2021 CNES / Airbus]
Photographs captured with the eyeWitness app showing damage on the façade of the building (houses number 2 and 5) and damage on the roof (house number 4), overlaid on the satellite image with their exact location. A list with other available photographs for each house is provided in Annex I. Full size photographs and their metadata are in Annex II. [Map © 2021 Maxar Technologies and © 2021 CNES / Airbus]
Photographs captured with the eyeWitness app showing damage on houses number 25 and 48, overlaid on the satellite image with their exact location (house number 48) and approximate location (house number 25). A list with other available photographs for each house is provided in Annex I. Full size photographs and their metadata are in Annex II. [Map © 2021 Maxar Technologies]

53. *Legal analysis:* The attacks on Avdiivka involved heavy artillery and struck civilian objects throughout the town. While it cannot be discounted that individual attacks were, at least in principle, directed towards military objectives, the choice of weapons system is clearly problematic. As discussed above, in Section 3, heavy artillery should not be used against populated areas, except in exceptional circumstances.

54. Two scenarios emerge. First, if the attacks were in principle directed at a military objective(s), then the manner in which the attack was conducted, and the fact that the
targets were located in a populated area, most likely indicate the commission of a disproportionate or potentially indiscriminate attack.\textsuperscript{65} Second, it cannot be discounted that the attack was not directed at any military objective, in which case it would constitute the direct targeting of civilian objects. Both scenarios are violations of international humanitarian law which would give rise to a violation of the right to adequate housing.

\textbf{5. eyeWitness technology overview}

\textbf{5.1. General information}

55. eyeWitness technology is based on two pillars. The first is the mobile camera app, a software for use on a smart phone or tablet that allows the documenter to record photographs, videos, and audio. The app uses the device sensors to capture metadata to help verify the authenticity of the photo/video/audio recordings. Specifically, the app captures data to identify the location, date, and time of the footage. The design of the eyeWitness app also ensures that both the media and their associated metadata cannot be altered or manipulated by the user or a third party.

56. The second pillar is the secure server system set up by eyeWitness, which in conjunction with our transmission protocols creates a chain of custody that can be presented in court. The eyeWitness system is patented in the US. For security reasons, more information on this is available only upon request.

\textsuperscript{65} There is sufficient information available to indicate the widespread commission of indiscriminate attacks, necessitating an investigation. Any claims suggesting the presence of a high value military objective should be raised in the course of an investigation.
5.2. **How the eyeWitness system works**

57. The system developed by eyeWitness is a controlled-captured technology that includes three key features to ensure the photo/video/audio recordings taken with the app can be verified and authenticated. These features are: i) embedded metadata at the point of capture, ii) hashing of the media file at the point of capture, and iii) transmission and storage protocols.

58. *Embedded metadata at the point of capture*: Unlike standard mobile phone cameras, the eyeWitness app records important metadata to confirm the date/time/location the footage was recorded. It then saves the metadata file in an encrypted text file that the user cannot access. The eyeWitness app does not pull the date and time only from the device itself. This is usually the case with a device’s default camera app. Since anyone can change the date and time on their phone, this is not a reliable source of information on its own.

59. The eyeWitness app takes the date and time for each media file from two sources: the device and global positioning system satellites. The raw data is translated into standard date and time format using Coordinated Universal Time (UTC) as the time zone. The location information is recorded from three, independent data sources, if available, to identify the location of each photograph/video/audio.

   a. The eyeWitness app obtains the latitude and longitude where the photograph/video/audio was taken using data recorded from available global positioning system satellites. The raw data is plotted on a map for each photograph/video/audio, using a Google Maps API.
a. The eyeWitness app records the Wi-Fi networks within range of the eyeWitness app at the time the photograph/video/audio was taken. When the media and metadata files are submitted to eyeWitness, the current location of the networks are looked up using a commercial service. These locations are plotted on a map for each photograph/video/audio, using a Google Maps API.

b. The eyeWitness app records identifying information of cellular towers within range of the eyeWitness app at the time the photograph/video/audio was taken. When the media and metadata files are submitted to eyeWitness, the current location of the networks are looked up using a commercial service. The locations are plotted on a map for each photograph/video/audio, using a Google Maps API.

60. The eyeWitness app does not rely on the device’s connection to a mobile network and WiFi to determine location and does not pull metadata from memory. In the event that a camera app cannot find a GPS or phone signal, many camera apps will use the phone’s last known location. However, this may be miles away from the device’s current location. The eyeWitness app regularly clears old data. This ensures the app will not record historic, inaccurate locations, times and dates.

61. Hashing of the media file at the point of capture: The app uses the raw bytes of the media file to generate via an algorithm a unique identifying code ('hash value') that demonstrates that the footage has not been edited or altered in any way. Some camera apps may generate this identifying code after the footage has been taken, which does not necessarily help verify if the media has been altered, as the editing could have taken place before generating the hash value. Additionally, the eyeWitness hash is stored encrypted in a text file inside the eyeWitness app, packaged with the media file and the metadata file, and transmitted to eyeWitness. All photo/video/audio recordings and their metadata captured with eyeWitness are stored encrypted within
the eyeWitness app on the documenter’s mobile device. There are no editing features in the eyeWitness app.

62. **Transmission and storage protocols**: Only photographs/videos/audio captured with the eyeWitness app can be sent encrypted from the app directly to eyeWitness servers. This transmission is encrypted using 256 bit encryption. Media captured with the standard camera of the device or any other apps cannot be saved in the encrypted gallery of the eyeWitness app, and hence, cannot be sent to eyeWitness servers. Only media captured with and sent from the eyeWitness app is stored in the eyeWitness servers. Upon receipt of the footage, eyeWitness calculates the hash value again and confirms that it matches the hash value recorded at the time the footage was taken, ensuring it is the original, unaltered version.

63. eyeWitness safely stores the information it receives in a secure, private file server inaccessible from the public web, until it can be used in an investigation or trial. For security reasons, more information on the eyeWitness server system is available only upon request.

5.3. **How we verify the authenticity of the metadata**

64. Sensor data would be extremely difficult to fake or manipulate using the eyeWitness app. For photographs, sensor data is recorded prior to and at the point the picture is taken in three second intervals. In the case of video and audio, sensor data is recorded up to and during recording at three second intervals. If no data is available for any type of sensor metadata, this will be reported to the backend system as null. Fake data would need to be generated so that all sensor points correlate to known valid data. Someone trying to spoof the GPS coordinates would require access to the same databases that eyeWitness uses for mapping Wi-Fi and cellular data to geolocations.
65. All footage and their associated metadata captured with the eyeWitness app are stored encrypted within the app on the documenter’s mobile device. The user or other third parties do not have access to the metadata files. Finally, any attempts at manipulation that rely on modifying the code are highly infeasible due to the code obfuscation that eyeWitness applies.

5.4. **How we verify the authenticity of the footage**

66. To ensure the footage has not been altered, eyeWitness uses the raw bytes of the media file to generate via an algorithm a unique identifying code (‘hash value’). This hash value is stored in a text file and transmitted to eyeWitness with the media file and the text file that contains the sensor readings. At the time of receipt in the server, the hash value that accompanies the media file is compared against the hash value generated at the time of capture.

67. During the registration of a device, the system automatically creates an asymmetric encryption key that will be used for the footage and metadata. For encryption, eyeWitness uses AES with 256-bit key size and Cipher Block Chaining. Both platforms use standard system functions.

68. Footage taken with the app is stored in the encrypted storage area within the eyeWitness app. The user must use a passcode created during registration to access the secure gallery. The user can then transmit the media directly from the eyeWitness app to the eyeWitness server.

69. The encrypted media and metadata files (sensor readings and the hash value, both in text files) are divided into 512 KB packages and transmitted encrypted to eyeWitness. All communications from the app are completed using SSL / HTTPS protocol. These
files are reconstructed and checked until the submission is completed. The original submission, though moved and uploaded in parts, has never been decrypted nor changed in any way.

70. Once the submission is retrieved, the encryption key is confirmed to verify the submission came directly from the registered instance of the app on the device.

5.5. How we know who has had access to the original version

71. The original encrypted version remains encrypted and stored in a private file server inaccessible from the public web. Once the submission — which comprises the sensor data captured, hash value, and recorded media (photograph/video/audio) — is received, the hash value of the media is checked. The submission is then stored on a server, and a copy is sent to a separate server housing the eyeWitness database for analysis.

72. The legal team of eyeWitness only have access to this database, which exclusively contains a copy of the footage and does not allow editing of either the footage or the metadata. This copy of the media file, along with the associated metadata and the preview PDF file, is what is being provided to you. eyeWitness records all actions performed in relation to the media files. The audit logs are available upon request.

5.6. Metadata on the PDF files

73. The PDF files in Annex II contain the following information about each photograph taken with the eyeWitness app:

- **DEVICE LONG ID**: This is an internal eyeWitness number assigned by our database.
• **DEVICE ID:** This is an internal eyeWitness number assigned by our database. We use this number to identify items sent by the same device.

• **ITEM ID:** This is an internal eyeWitness number assigned by our database. Each photograph/video/audio has its own unique number.

• **TYPE:** Photograph/Video/Audio.

• **TAKEN ON (UTC):** This is the date and time when the footage was recorded according to the device time, converted to UTC.

• **IMPORTED ON (UK TIME):** This is the date and time when the documenter uploaded the file and it was received by our server.

• **HASH MATCHES:** The app uses the pixel value to generate a unique identifying code that demonstrates that the footage has not been edited or altered in any way. This field always reads ‘True’ to indicate the file has not been edited or altered.

• **APP VERSION:** This is the app version running on the device.

• **IS ANNOTATED:** True/False. When the documenter has submitted any notes or has tagged an object or person, you will receive these notes as well. They are included at the end of the page.

• **LATITUDE AND LONGITUDE:** These are the GPS coordinates corresponding to the location where the footage was captured. If the app did not get a satellite lock, it will show ‘No GPS location’.

74. The **map view** shows the location where the footage was captured:

• The **correspond to nearby Wi-Fi networks.**
• The correspond to nearby cell towers.

• If the GPS was on and we collected the coordinates at the time of capture, the map will have as well

<table>
<thead>
<tr>
<th></th>
<th>GPS</th>
<th>No GPS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Date and time</strong></td>
<td>Device date and time converted to UTC.</td>
<td></td>
</tr>
<tr>
<td><strong>Location</strong></td>
<td>Latitude and longitude coordinates.</td>
<td>If available, the app will capture the Wi-Fi networks and cell towers nearby.</td>
</tr>
</tbody>
</table>

6. Annex I

Annex I can be found in this PDF document. Please note, that personally identifiable information has been removed for security reasons.