



YEMENI ARCHIVE

Mnemonic's Yemeni Archive

Attacks on Economic Infrastructure

Report 2022

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AQAP - Al Qaeda in the Arabian Peninsula

GCC - Gulf Cooperation Council

GEE - Group of Eminent Experts

ICRC - International Committee of the Red Cross

ICCPR - International Covenant on Civil and Political Rights

ICESCR - International Covenant on Economic Social and Cultural Rights

IHL - International Humanitarian Law

IHRL - International Human Rights Law

IRGY - internationally recognized government of Yemen (Yemeni government forces)

JIAT - Joint Incidents Assessment Team

NDC - National Dialogue Conference

OIS - Objects Indispensable to Survival

PLC - Presidential Leadership Council

SLC - Coalition led by Saudi Arabia, of which the UAE was also officially a leading state until 2020

STC -Southern Transition Council

About the Yemen Human Rights Forensic Lab

The goal of DT Institute's Yemen Human Rights Forensics Lab (YHRFL) is to increase recognition and protection of human rights in Yemen by providing one-stop access to a comprehensive repository of digital evidence of human rights violations committed by all sides involved in the Yemeni conflict. In addition to working to collect, verify and preserve open-source digital evidence of human rights abuses in cooperation with Mnemonic's Yemeni Archive (Yemeni Archive) project and a coalition of local civil society organizations (CSOs) in Yemen, the YHRFL program analyzed this evidence in light of international human rights frameworks and expects to summarize the key findings in a series of analytical reports, of which this report, on attacks on economic infrastructure, is one of those reports. Other reports will focus on violations against journalists, violations against detainees and the forcibly disappeared persons, and violations against children. The program also supports efforts of local CSO partners carry out international awareness and advocacy activities aimed at promoting the use of documented digital evidence of human rights abuses for use in legal, reconciliation, and transitional justice and accountability processes.

About Yemeni Archive

Yemeni Archive began in 2018 as a programme of Mnemonic, a non-profit organisation made up of human rights advocates, archivists, technologists, and open-source investigators dedicated to preserving, memorialising and adding value to publicly available information related to human rights violations. The programme aims to archive content quickly and methodically before it is removed from the online platforms it is being posted to. Yemeni Archive is dedicated to preserving this important data as digital memory and increasing public access to this essential knowledge. Though it has led to the world's worst humanitarian crisis according to the UN, the conflict in Yemen has often been described as a "forgotten war". Yemeni Archive believes that continued investigation and reporting of human rights violations is imperative to pressuring perpetrators to protect Yemeni civilians.

Executive Summary

This report is based on Yemeni Archive's documentation and analysis of military attacks on four different categories of economic infrastructure: markets, petroleum, water infrastructure, and electricity infrastructure, by all parties to Yemen's conflict. This latest report builds upon Yemeni Archive's 2020 report [Attacks on Access](#), where Yemeni Archive documented 142 Saudi-led coalition (SLC) airstrikes on bridges in territory under control of Houthi forces in Yemen since March 2015. This work complements a number of recent studies by other NGOs and academics that have assessed the role of economic warfare in Yemen's current conflict. While others (International Crisis Group, Sanaa Centre, Mwatana) have analysed how policies of blockade, double taxation, and extortion by the Saudi and UAE-led coalition, the internationally recognized government of Yemen (IRGY), and the Houthis have driven Yemen's humanitarian crisis even more so than direct military attacks, Yemeni Archive's new report details an array of armed attacks physically impacting facilities storing, producing and/or selling infrastructure and goods essential to life.

The data in this report includes 611 separate incidents of attacks on civilian infrastructure and markets, 41% of which caused immediate civilian casualties. The greatest number of incidents (176) in this dataset were carried out in the Houthis' home governorate of Saada in northwestern Yemen, 98% of which were allegedly by Saudi-led coalition airstrikes and/or Saudi ground-to-ground attacks on the border. The five other governorates with the most incidents include: 75 in Taiz, 68 each in Marib and Hudaydah, 66 in Sanaa, and 54 in Hajja. In addition to being the sites of the greatest numbers of total incidents, these six governorates were where the majority of attacks on markets occurred.

In the cases of attacks on markets, and oil/natural gas, Yemeni Archive was able to document more incidents for each of these two categories-283 and 171 respectively- than any other type of object it has reported on thus far.¹ Of the total number of incidents in this dataset, 46% (283) impacted crowded civilian markets. The second most impacted type of facility in this dataset were petroleum resources in the form of gas stations, oil tanks, and fuel trucks, which amounted to 171, or 28% of attacks.

This report presents data, examples, and findings drawn from Yemeni Archive's DT Institute's YHRFL Phase II analysis of open source reporting on ground and aerial attacks constituting probable human rights violations in Yemen. From January 1, 2021, to November 10, 2022, DT Institute engaged its primary field partner, Mnemonic's Yemeni Archive, to discover, preserve, and analyze open-source materials related to the destruction of economic infrastructure in Yemen. The primary focus of this research was into attacks on markets, oil and gas infrastructure, water infrastructure, and electric infrastructure. Yemeni Archive is a dataset of open-source information on reported human rights violations in Yemen intended for use in advocacy, justice, and accountability proceedings. Mnemonic's analysts gathered, coded, and analyzed the data from 2014-2022.¹ DT Institute conducted a second-level review of the data and of specific reported incidents. Phase II analysis resulted in three findings:

¹ See <https://yemeniarchive.org/en/investigations> for other comprehensive reports, including attacks on medical facilities (133), bridges (142), and media infrastructure/journalists (138).

1. **Strong Evidence of Considerable Numbers of Human Rights Violations:** The Archive has aggregated considerable, mutually-corroborating evidence providing very high confidence that hundreds of human rights violations—including aerial bombings, artillery, rocket, and mortar attacks, and ground attacks against oil and gas infrastructure, water infrastructure, electric infrastructure, and, markets –resulting in the killing, maiming, and traumatization of Yemeni civilians, that were committed in Yemen between 2015 and 2022.
2. **Further Evidence and Analysis Needed to Attribute Attacks:** Existing data and analytic gaps did not enable DT Institute or Yemeni Archive to assign verifiable attribution of any attacks at the end of YHRFL Phase II, except for three attacks which the SLC's Joint Incident's Assessment Team (JIAT) acknowledged were carried out by the coalition. The majority (26) of the 29 official SLC and JIAT statements obtained by Yemeni Archive for incidents in this database were characterised by some form of denial of coalition responsibility or role in harm to civilians. Evidence supporting attribution may exist in the Yemeni Archive, and it may be available through other information sources. Visual analysis of residual munitions components (e.g., bomb casings, rocket fins, shrapnel markings, unexploded ordnance) offers a promising approach to support the analytic transition from open-source incident reporting to attribution of attacks to specific perpetrators.
3. **Despite major decline, attacks continue, particularly on oil/gas facilities:** The third key finding is how the extremely high number of incidents (allegedly by the SLC) on all facilities in the first two years of the coalition's intervention (2015/6) have declined. Despite these significant decreases in SLC attacks, there appears to be sustained attacks on oil/gas in particular, albeit with a relative decrease in SLC's alleged share of incidents. In other words, oil/gas have been most evenly distributed chronologically as well as by alleged perpetrator from 2015-2022. Geographically this can also be seen in the case of the oil rich governorate of Shabwah, the only governorate in which our database includes an increase over time in attacks, which have been split in terms of alleged perpetrators.

Introduction

This report by Mnemonic's Yemeni Archive describes 611 attacks impacting economic infrastructure, including water pumps, treatment, and desalination facilities, gas stations and oil ports and trucks, electricity infrastructure, and markets, by all parties to Yemen's conflict since the beginning of the Saudi and UAE-led coalition's (SLC) military intervention in 2015.

The Houthis have maintained control over [70% of Yemen's population, while the IRGY controls 80% of the land](#), where only 30% of the population resides. Given this power disparity, whereby the Houthis control so much of the population but the IRGY, backed by wealthy neighbors with US military support, has decimated Yemen's most heavily populated areas, while [seeking to cut off the economy in Houthi-controlled territory](#). Because these military and political policies have harmed so many Yemenis, the Houthis have arguably been able to sustain a narrative of victimhood while [imposing full blame on the IRGY](#) and the coalition. In turn, this has dovetailed with the ideological source of connection between the Houthis and Iran, from whom they have gained growing military support since the start of the SLC's military intervention in 2015.

Approximately [20 million](#) out of Yemen's population of 30 million currently face hunger. Because Yemen [imports 90% of its food and fuel](#), the SLC's full aerial and naval blockade of Yemen's ports led to an extreme fuel shortage at the start of the 2015 military intervention. Since that time, UAE forces launched a military campaign on Yemen's main port city of Hudaydah in 2018. Despite the Stockholm Agreement that was reached to reduce fighting in Hudaydah, the IRGY, with the SLC's help, has further restricted and delayed fuel shipments going through Hudaydah.

Actual shortages have been greatly compounded by the creation of two central banks after the SLC moved Sanaa's central bank to Aden, as well as the Houthis' double taxation of transported goods, and further inflated retail prices in Houthi controlled areas, where 70% of Yemen's population lives.

Yemenis' high reliance on imported goods, including in mostly rural areas, means that high fuel and transportation costs further raise the price of already inflated food costs. At the same time, limited fuel has contributed to the lack of clean water, given the fuel requirements of wastewater treatment as well as the common use of diesel-powered electric pumps for well water. Fuel availability and prices thus both affect the ability for ordinary Yemenis to access food and water.

Because so much of the economic and humanitarian crisis is centered on Yemenis struggling to access fuel, food, and potable water, Yemeni Archive has focused this report on military attacks hitting facilities for the storage and/or sale of these forms of critical infrastructure to Yemeni civilians. Yemeni Archive aims to document and preserve all kinds of military attacks affecting civilians in Yemen, and for each of these categories, there were dozens if not hundreds of attacks. It was beyond the scope of Yemeni Archive's data collection and analysis to track the impacts of these attacks. Yemeni Archive aimed to systematically preserve evidence of potential human rights violations, and in the case of this dataset, to do so on those attacks related to supply and distribution of food, fuel, and water. Nonetheless, some of the sources that Yemeni Archive compiled for this work do include assessments for individual incidents' impacts in the form of, for example, number of civilians that lost water.

Of the 611 attacks in this report impacting markets, oil/natural gas, water infrastructure, and electricity infrastructure, 251 incidents, or 41%, have associated open source documentation of claims of immediate civilian casualties. The majority of incidents in this database (515) involved weapons allegedly delivered through airstrikes. Although it is beyond the scope of this report to comprehensively assess the medium and long-term impacts of these attacks, it is important to note that the very nature of the impacted sites makes these attacks destructive to civilian life in ways not fully measured beyond those civilians immediately killed and injured in these attacks. Most of Yemen's humanitarian crisis is related to the inability of civilians to afford food and fuel, which stems primarily from a policy-made fuel and currency crisis. In fact, more Yemenis have died from starvation due to the economic crisis of affordability than from direct military causes. The deprivation of Objects Indispensable to Survival (OIS), including food, water and fuel, [is a defining component of the IHL violation of starvation](#). Although this report is not within the scope of addressing the other criterion necessary for the [crime of starvation under ICL](#), which is intentionality, it does speak broadly to International Human Rights Law's (IHRL) obligation for states to protect life and adequate standard of living. The 611 incidents that comprise this report's data involve critical infrastructure essential to adequate standard of living as well as in many cases, the right to life.

According to the [Yemen Data Project](#), from October 2021 through March, 2022, Yemen [experienced its longest sustained period of airstrikes since 2018](#), following the failure of the UN to renew the Group of Eminent Experts' (GEE) mandate on Yemen on October 7, 2021. Since the SLC militarily intervened in March 2015, the Houthi rebels have only gained more control of Yemen and increased attacks on civilians and civilian infrastructure. The international community has largely overlooked the years of previous, and potentially ongoing, human rights violations by the SLC, as well as the Houthis' growing violations, against Yemeni civilians. Within this context of a largely disinterested international audience and the SLC's sense of impunity, the increasingly emboldened Houthis announced on October 2, 2022 their refusal to renew the UN-brokered Ramadan ceasefire begun on April 2, 2022, the previous extension of which had led to some of the greatest reductions in civilian casualties since the start of the conflict.

The 2022 Ramadan (extended) truce begun on April 2, 2022 had been a major step towards peace, leading to a significant drop in civilian casualties. [Saudi Arabia and the UAE had also since provided financial support to the Central Bank of Yemen in Aden](#), to help offset the extreme devaluation of the Yemeni rial and unbearable cost of

living for Yemenis. Yet, monetary conditions remained highly unstable amidst the existence of two central banks in Sanaa and Aden, and the Houthis have continued to exploit this to [extort from Yemeni civilians](#). A key demand the Houthis have made is that the Yemeni government resume full payment of military and civil servant salaries in Houthi-controlled territory. As a response to such demands not being fulfilled, on October 2, 2022, the Houthis, announced they would not allow for an extension of the truce, and [fighting has already been reported](#) to have broken out in the governorates of Marib, Taiz, and Dhalie. It [is expected to resume with particularly high intensity](#) in the internationally recognized government-controlled oil-rich governorates of Marib and Shabwa, where the Houthis justified their [attack of an oil port on November 9](#) with accusations that the Saudi and UAE led coalition has been 'looting Yemen's oil revenues' rather than using them to pay civil servants and officials in Houthi controlled areas. In the meantime, the Houthis have given [no indication of easing their devastating siege](#) of Taiz, and [much of the SLC's international blockade remains in effect](#), with the truce's progress threatening to be reversed.

Organisation of this report

This report is organised as follows: First this report provides an introduction that includes a summary of methodology and note on attribution as well as a description of the YHRFL project and Yemeni Archive. The report then introduces the main findings of the report on indiscriminate attacks against civilian objects. This includes a general legal framing of the right to life, as well as overall trends that the data has been archived, annotated, and analysed. A descriptive analysis of violations committed by alleged perpetrator, area of control, and delivery method follows. The report then introduces specific violations related to attacks on markets, followed by attacks on oil and gas infrastructure. Subsequently, the report describes attacks on water infrastructure and electricity infrastructure. Finally, the report provides a conclusion and a series of Appendices with more information on legal developments, methodologies utilised, limitations of this research, and a list of incidents.

Summary of methodology

The first level analysis consisted of Yemeni Archive analysing the data collected and stored on existing archival infrastructure. The second-level analysis involved an objective review of the data, sources, and methods used by Mnemonic, and analysis of the specific incidents recorded. This included the creation of a detailed tagging guide which researchers used to annotate open-source documentation in a structured format with the purpose of identifying general trends and patterns associated with the datasets contents. This tagging guide is available as Appendix III to this report. The limitations inherent in open-source reporting and analysis are discussed in depth in the Limitations section of Appendix IV.

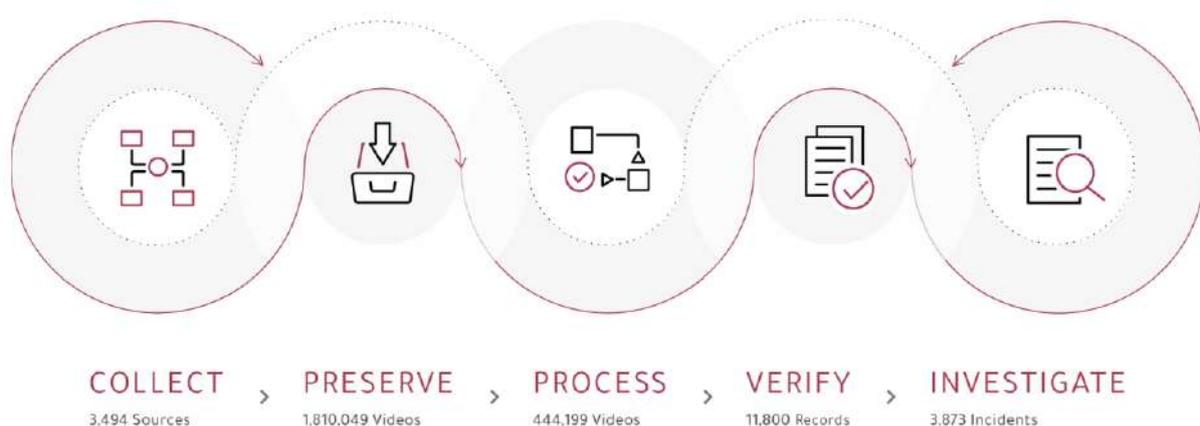


Figure 0.1 Table of attacks on markets over time

See Appendix III for further details on both the Yemeni Archive’s methodologies and Phase II research approach. The next sections provide an overview of the documentation evidence and findings overall trends observed in the data. This includes information on types of attacks, including repeated attacks, double-tap attacks, attacks on fixed and no-fixed objects, and summaries of attacks by alleged perpetrator and delivery method. Following these general trends, the report presents a more in-depth look into specific objects impacted by types of attacks: oil and gas facilities, water facilities, electric, and markets. See Appendix II for a detailed description of relevant law.

For a detailed description of Yemeni Archive’s methodology see the [“Methods and Tools”](#) page on the Yemeni Archive website. In brief, Yemeni Archive collects content from publicly available press reports, social media accounts, and social media channels. It also receives direct submissions from individuals and organisations. Yemeni Archive securely stores records using Diwan—a JavaScript library tool that handles media, media playback, data links, and files—and hashes and time-stamps data to ensure it has not been altered since it was archived. Yemeni Archive extracts, parses, and aggregates metadata from these records.

Building from this database, Yemeni Archive cross-references evidence and seeks to verify the following:

- **The source of the video uploader or publisher.** Yemeni Archive determines whether the source is on a list of established sources with a track record of reliable reporting. If not, Yemeni Archive determines if the source is familiar to the Yemeni Archive team and network, and to what extent the source has produced reliable reporting in the past.
- **The location where the video was filmed.** Yemeni Archive uses basic geolocation to confirm the video was captured in Yemen. Basic geolocation can involve matching visual material from the video (such as terrain features) with satellite imagery, cross-referencing the video with other open-source reports of the incident to determine location, pulling location information from video metadata, etc.
- **Dates and times on which video was filmed and uploaded.** Yemeni Archive uses embedded metadata to cross-reference the date and time of video with reports of the same incident, including international and local news reports, and human rights reports.

For priority cases, including the case studies included in this report, Yemeni Archive uses advanced procedures to verify location and date/time of the video, including dialect analysis, detailed geolocation, contacting local sources, etc. Three factors contribute to Yemeni Archive labeling a case as high priority: high numbers of civilian casualties, an abundance of visual evidence, and high potential impact on public opinion.

Important note on attribution of attacks

Each incident in the database has been assigned an overall confidence rating of 1-3, with 3 being the highest standard of available content offering potential evidence to support the team’s findings of the incident, and 1 being the lowest. Those with scores of 0 were removed from the database. This ratings system was created to give database users an evaluation of the discovered open source information for each incident as a whole. The ratings themselves are assigned based on the robustness and quality of information available for each given incident included in the database, relative to the other incidents that have been documented, archived, and included in this thematic database.

The following graph depicts the distribution of overall confidence ratings, broken down by type of facility impacted:



Figure 0.2 Incident confidence sources by facility type

Mnemonic’s Yemeni Archive included in its methodology not only a confidence score of the overall incident, but also a confidence score for attribution of attacks, also ranked 1 through 3, with 0 as unknown. Perpetrator attribution has been assigned to each incident for which a credible, reliable, and corroborated perpetrator allegation has been identified among the potentially responsible groups: the Houthi rebel movement, the Saudi-led coalition, Pro-coalition forces, IRGY forces, Al-Qaeda in the Arabian Peninsula (AQAP). All perpetrator claims were considered in combination with other information about the attack incident, particularly which group reportedly controlled the attack area (area of control), proximity to any frontlines, and weapons used or delivery method (for example, airstrikes were much more probably attributable to the SLC). The default for the alleged perpetrator tag was “unknown”: if available information did not pass the chosen standard of information threshold for tagging, our researchers tagged “unknown.” Unknown alleged perpetrator scores were tagged as 0.

Detailed methodologies on how confidence scores and attribution confidence scores are provided in Appendix III to this report.

1. Indiscriminate attacks against civilian objects

This section of the report will describe why attacks on markets, oil/natural gas, water infrastructure, and electricity infrastructure are so important. Critical infrastructure that is covered by the [ICCPR's](#) protection of life and [ICESCR's](#) right to be free from hunger and to have an adequate standard of living include food, water (including water installations, supplies and irrigation works), medicine, clothing, shelter, fuel and electricity. Although this report does not make claims on the *intent* to deprive civilians of these goods and infrastructure, it covers incidents in which attacks likely lead to destruction of and/or other limitations on objects essential to life.

[Yemen imports](#) 90% of its food and fuel. As such, by preventing the flow of goods into and throughout the country, the [blockades imposed by the Saudi and UAE-led coalition](#) on Yemen's key international ports, and by the Houthis in the central city of Taiz, as well as Houthi extortion through double taxation and higher retail prices, have all caused the price of food and fuel to skyrocket. As fuel prices have increased, this has even further impeded food and water availability, given rising transport costs of food and water in one of the world's driest countries. According to the [ICRC](#), the fuel shortage caused by border closures was enough to shut down the entire water supplies for the cities of Saada, Taiz, and Hudaydah. Fuel is required both for wastewater treatment and [diesel](#) and [electric](#) powered water pumps, which are common for the 70% of Yemenis living in rural areas.

The humanitarian effects of the Saudi-led coalition's total land, sea, and air blockade of Yemen's ports have been compounded by economic policies imposed by the IRGY and the Houthis. In 2016, with Saudi backing, the IRGY moved the central bank from the now-Houthi controlled capital of Sanaa to Aden, effectively creating a system of two central banks. Next, UAE-backed forces sought control of the major port city of Hudaydah in 2018, [where 80% of Yemen's imports](#) arrive. Although a decrease in fighting between coalition and Houthi forces occurred with the Stockholm Agreement over Hudaydah in late 2018, [Saudi Arabia again helped the IRGY to delay fuel imports](#) beginning in 2019. Since then, the Houthis have banned bills from the new central bank, driving up inflation and blaming the IRGY.

While previous recent NGO work, notably by [Mwatana for Human Rights](#), [International Crisis Group](#), and the [Sanaa Center](#), have produced studies on the non-military economic crisis of intertwined shortages of food, fuel, and water, Yemeni Archive's dataset of attacks on economic infrastructure tracked the role of armed attacks on these resources. In this report, Yemeni Archive also builds upon its 2020 report [Attacks on Access](#), where Yemeni Archive documented 13 incidents in September 2015 in which the SLC appeared to directly target bridges linking the Houthi controlled capital Sanaa to Hudaydah, the key port city responsible for international deliveries of humanitarian aid. Throughout [Attacks on Access](#), Yemeni Archive documented the greatest numbers of SLC attacks impacting bridges in September and October 2015, August 2016, and January 2017, and with a total of 142 SLC attacks on bridges from 2015 to 2019.

By systematically highlighting the immediate civilian casualties and destruction from these military attacks on oil/electric resource facilities, water treatment facilities and well pumps, and markets, this report complements [Attacks on Access](#) by showing attacks directly on resource sites themselves.

This report focuses on attacks by armed groups hitting facilities for the storage and/or sale of infrastructure critical for life, broken down into four categories: 1) (283) markets, 2) (171) oil/gas facilities, 3) (119) water facilities for producing and distributing potable water, and 4) (39) facilities for producing electricity. As stated above, the relationship between Yemenis' struggles during the conflict to access food, fuel, and water are inextricably intertwined. This report is based on data of attacks from 2015 to 2022. The graph below breaks down the number of attacks per month from March 2015 to May 2022.

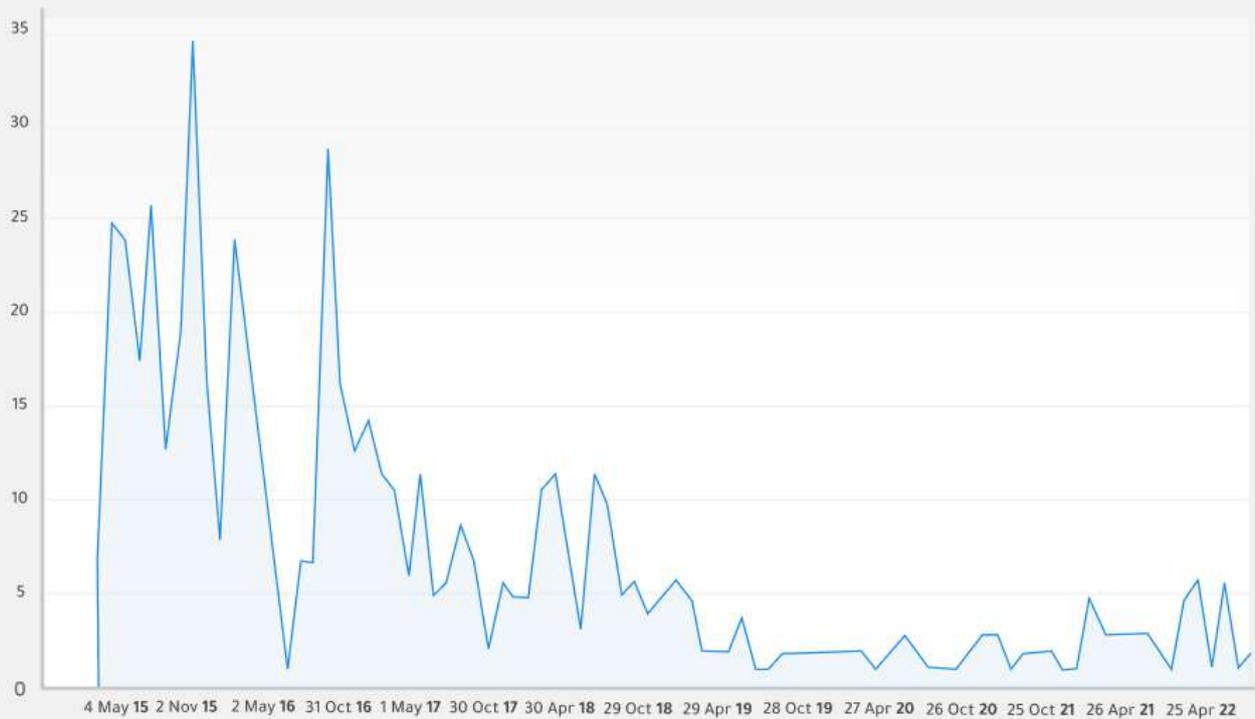


Figure 1.1 Database attacks on economic infrastructure by month 2015-2022

In addition to sheer volume of incidents, and the high percentage of civilian casualties (41% on average in this database), these objects were selected for their importance in the larger context of the humanitarian crisis resulting from the conflict. Previous studies have documented systematic airstrikes on farms by the Saudi-led coalition, as well as the Houthis' takeover of farms. The selection of markets as a food category here both complements these previous works while also holding special importance given the fact that 90% of Yemenis' food is purchased, rather than produced through domestic agriculture. The increase in fuel prices resulting from the various parties' economic warfare on Yemeni civilians have also raised the costs of extracting water and transporting water and food throughout the country, where 90% of food is imported and 70% of the population live in rural areas. Most electricity in Yemen is produced through [oil-fired power plants](#) and diesel fuel.

Although it is beyond the scope of Yemeni Archive's work to assess medium and long-term impacts, these attacks on markets, oil, water, and electricity facilities all come amidst extreme difficulties in food and fuel unaffordability for most Yemenis and limited access to clean drinking water and electricity.

Relevant international law

The current conflict in Yemen is rooted primarily in domestic strife dating to the Yemeni government's previous ['Saada wars' with the Houthi rebels](#) (2004-2010), and sparked by the failings of the [Gulf Cooperation Council \(GCC\)-led political transition](#) known as the National Dialogue, brokered in 2012 in the aftermath of Yemen's 2011 uprisings.

The 2011 Yemeni revolution was, as with others in the region, [driven by local causes](#), with different groups uniting to demand President Ali Abdullah Saleh step down. While the official opposition, [the Joint Meetings Party, hesitated to participate](#), the youth movements at the heart of the revolution were joined by the Southern Hirak movement and the northern Houthi movement. When they succeeded in ousting President Ali Abdullah Saleh, Saudi Arabia created the GCC Initiative and National Dialogue Conference.

The National Dialogue Conference was essentially an [elite pacted transition that failed to incorporate much of the opposition](#) outside preexisting competing power centres in Yemen: President Saleh's and Vice President Hadi's General People's Congress Party on the one hand, and the Joint Meetings Party.

The Houthi movement, which had long standing grievances with Saleh's government, opportunistically seized upon this moment of political failure and forged an alliance of convenience with the newly ousted Saleh. In September 2014, [with the help of Saleh's forces](#), the Houthis took over the Yemeni capital of Sanaa, sending then-President Mansour Hadi fleeing to the southern city of Aden.

In March 2015, a military coalition led by Saudi Arabia and the UAE intervened with the stated goal of returning to power Hadi's internationally recognized government. Since that time, however, factions within the coalition have become divided, and although the UAE announced its withdrawal of troops in 2019, it has continued to back militias that compete and sometimes fight with the internationally recognized government of Yemen's (IRGY) forces, directly contrary to the official stated goal of the coalition in which the UAE has been a leading force since 2015.

Militarily, the Houthis have successfully exploited these growing divisions within the coalition and the IRGY, and the ongoing failure of the IRGY and its Western-backed wealthy Gulf partners to bring their stated goals of stability to Yemen. In turn, the Houthis have exploited a falsely simplistic binary of [Islamic revolution versus the West](#) to grow closer ideologically with Iran.

International humanitarian law (IHL), International Criminal Law (ICL), and International Human Rights Law (IHRL) are all in discussion when evaluating the legality of attacks impacting critical resources and infrastructure that are essential to civilian life during armed conflict.

This dataset documents attacks impeding access to essential resources over time. In addition to the core principle of distinction - dictating that attacks may only be conducted against military objectives and the enemy's armed forces (i.e., not indiscriminately) - the [use of starvation as a method of war](#), specifically, is prohibited under IHL.

This prohibition is criminalised under ICL. Put forward by [Mwatana](#) in their discussion of starvation as a method of warfare in Yemen, while the International Criminal Court (ICC) does not have jurisdiction over international crimes committed in Yemen, the Rome Statute definitions for international crimes are nevertheless relevant. Set out in Article 8(2)(b)(xxv) of the Rome Statute, it is a war crime to intentionally starve civilians by depriving them of objects indispensable to their survival (OIS) and willfully impeding relief supplies during international armed conflict.

Both ICL and IHL (in Article 54 of Additional Protocol I) refer directly to OIS. As a collection of armed attacks affecting key infrastructure - namely water resources, oil/gas, electricity, and markets - this dataset is an open-source survey of the scale of impact the conflict has had on four examples of objects essential to Yemeni civilian life.

[UN General Assembly Resolution 2675](#), which was unanimously adopted and applies to all armed conflicts, can be regarded as evidence of state practice protecting humanitarian law and human rights in conflict. Paragraph 5 of the resolution states: "dwellings and other installations that are used only by the civilian population should not be the object of military operations." The principle of military necessity demands that civilian property may only be destroyed, or requisitioned for use, for necessary military purposes.

Human rights law, however, is especially pertinent to legally contextualise this dataset: a state can be found in breach of its protective duty under IHRL even if criminal intent² cannot be established. Not all state parties to the

² Given the scale and variety of attacks included in this dataset, it was beyond the scope of Yemeni Archive's work for this project to produce clean, open-source data evaluating the intentionality behind the 611 verified incidents.

conflict in Yemen are parties to the major international human rights treaties: the [International Covenant on Civil and Political Rights](#) (ICCPR) and [the International Covenant on Economic Social and Cultural Rights](#) (ICESCR)³. Saudi Arabia, the UAE⁴, and Yemen have all ratified the [Convention on the Rights of the Child](#), which protects the child's right to education (Article 28), right to life (Article 6), and right to survival and development (Article 7). Even in the cases of treaties to which state are not signatories, provisions of these treaties are nonetheless important to examine as influential norms.

The ICCPR and ICESCR impose obligations to protect peoples' rights to life and adequate standard of living, respectively. Attacks impacting markets, water, and energy resources impede the right to an adequate standard of living (ICESCR Article 11.1) and the right to be free from hunger (ICESCR Article 11.2). Article 1, paragraph 2 of the ICCPR provides that people may not be deprived of their means of subsistence. Further, the types of attacks on essential human resources documented in this dataset should also be assessed for their less immediate human rights consequences. For example, the weaponization of water by the SLC and the Houthis directly contributed to the [greatest cholera outbreak on record](#). To protect the right to the enjoyment of the highest attainable standard of physical and mental health, ICESCR Article 12.2 obliges states to prevent, treat, and control epidemic, endemic, occupational, and other diseases.

Despite being clear violations of what should be fundamental rights, these and other resource-focused strategies of war - such as the [targeting of food supply](#) by bombing and via economic policies that render food costs unaffordable for most people in Yemen - are alarmingly commonplace. The data compiled here underscores a serious need for increased scrutiny of such actions, their legality, and what measures could be enforced to protect the lives and livelihoods of the people of Yemen.

Potentially relevant legal measures for incidents in which a state has been determined to be the perpetrator include [Rule 150 of Customary International Humanitarian Law](#), which requires that a state responsible for violations of international humanitarian law make full reparation for the loss or injury caused. For incidents involving attacks on water infrastructure, Principle 10 of the Rio Declaration on Environment and Development states that effective access to judicial and administrative proceedings, including remedy and redress, shall be provided to those impacted by environmental issues.

Overall trends

This report is comprised of 611 incidents involving attacks by armed groups hitting facilities for the storage and/or sale of infrastructure critical for life, broken down into four categories: 1) (283) markets, 2) (171) oil/gas facilities, 3) (119) water facilities for producing and distributing potable water, and 4) (39) facilities for producing electricity. As the graph below shows, this report is based on data of attacks from 2015 to 2022. The graph below demonstrates how attacks on different objects are distributed proportionally to one another and across time. Markets are the most heavily hit, followed by oil/natural gas, water, and electricity.

As the graph below (Figure 1.2) of the timeline of this database's attacks shows, 60% (365) of the total incidents in this dataset were carried out in 2015 and 2016 alone. Nonetheless, attacks by all parties to the conflict have continued into 2022, with 6 allegedly by the Houthis and 8 allegedly by the SLC from January to May 2022.

³ Yemen is a signatory, but Saudi Arabia and the UAE are not. As a rebel militia, the Houthis are not signatories to any IHRL. See Appendix II for more on this.

⁴ UAE signed the Convention on Rights of the Child with reservations to several articles, including Article 7; Saudi Arabia signed it with a vague reservation on articles 'in conflict with Islamic law'

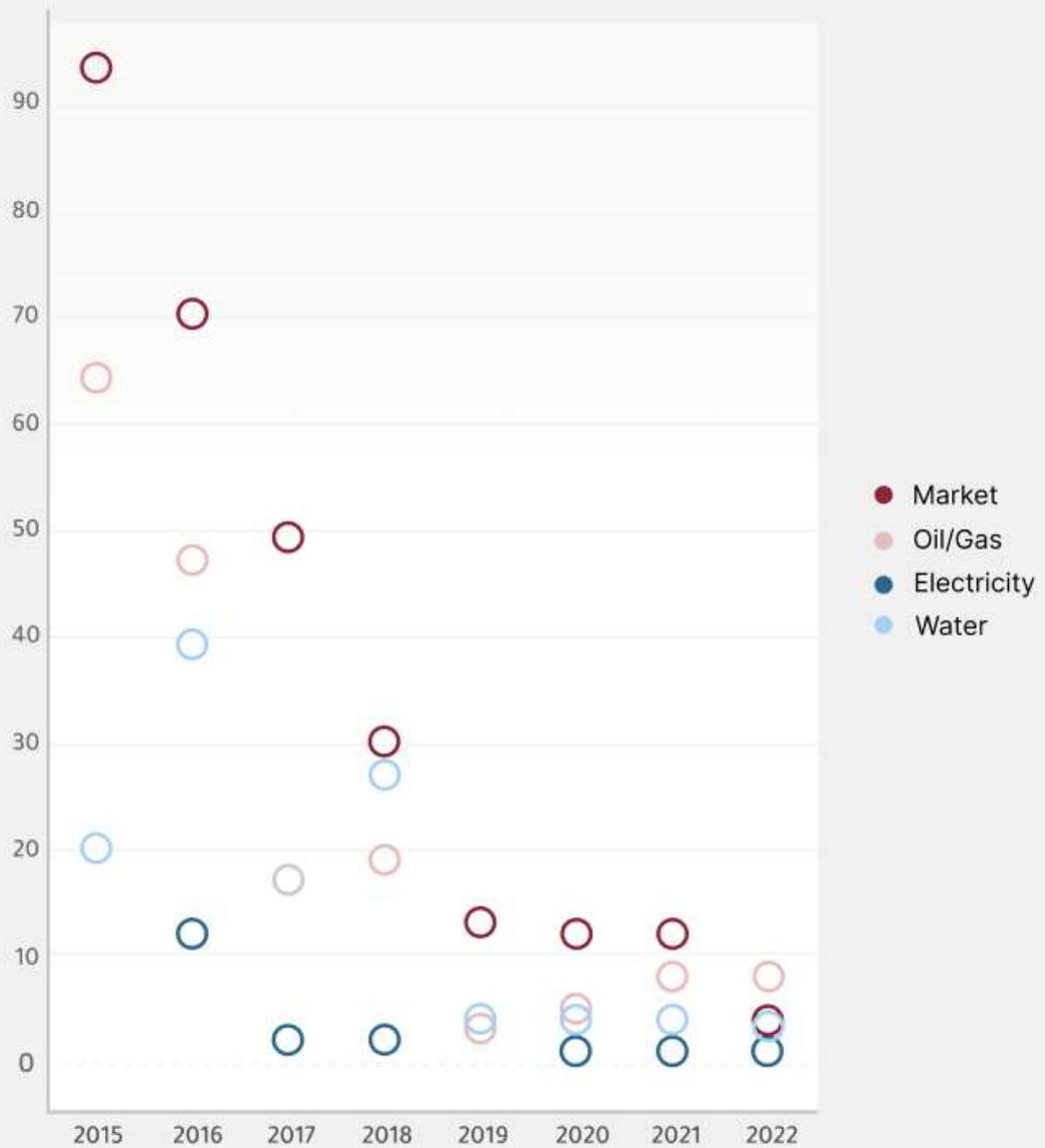


Figure 1.2 Attacks over time by facility type 2015-2022

The greatest number of incidents (176) in this dataset were carried out in the Houthis' home governorate of Saada in northwestern Yemen, 98% of which were allegedly by Saudi-led coalition airstrikes and/or Saudi ground-to-ground attacks on the border. The five other governorates with the most incidents include: 75 in Taiz, 68 each in Marib and Hudaydah, 66 in Sanaa, and 54 in Hajja.

The graph in Figure 1.3 depicts attacks on each type of facility by location.

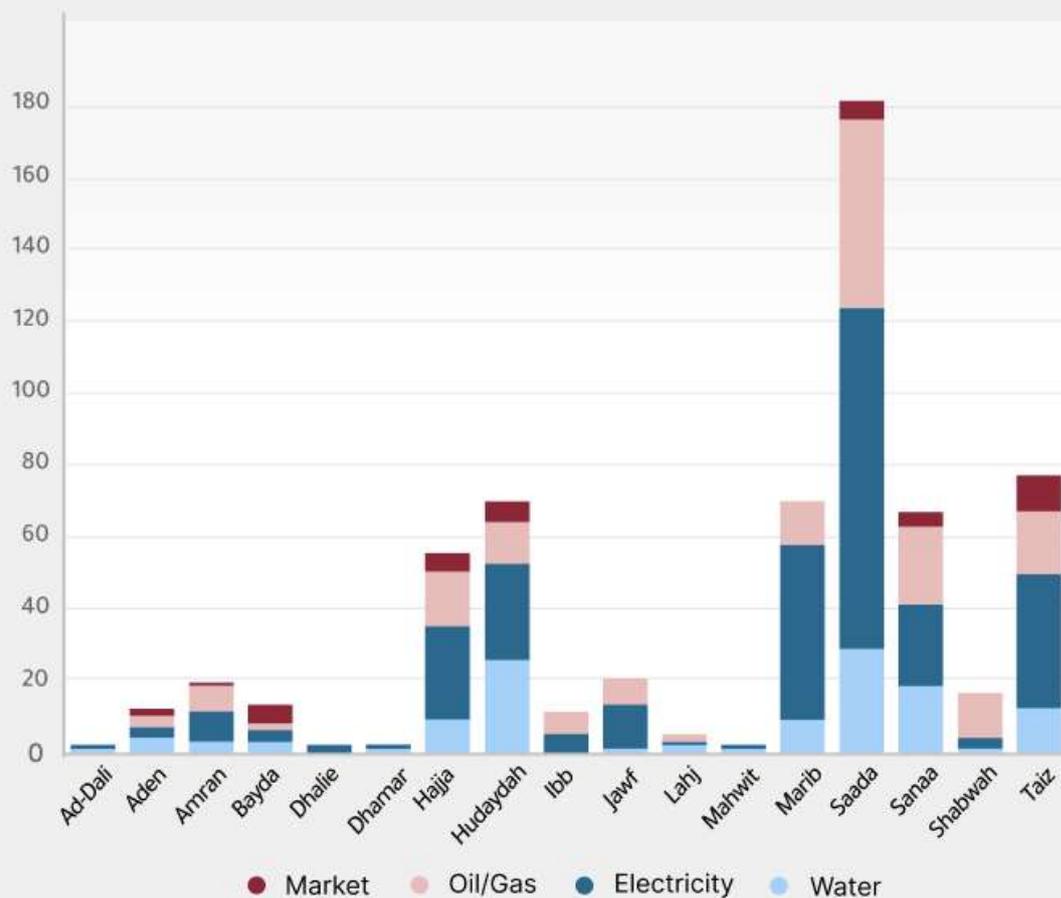


Figure 1.3 Facility type by government

Out of the 611 incidents of attacks on civilian infrastructure and markets, 41% (251) caused immediate civilian casualties. Although the number of overall incidents were lower after 2018, with the greatest numbers in 2015 and 2016, the proportion of incidents with reported civilian casualties over time remained fairly constant. For example, 43% (85) incidents in 2015 were reported to have civilian casualties, and in 2022, there was an even higher percentage with reported civilian casualties, 50% of the incidents (8). The graphic in Figure 1.4 depicts all incidents with reported civilian casualties per year from 2015-2022.



Figure 1.4 Incidents with civilians casualties per year

In the cases of attacks on markets, and oil, Yemeni Archive was able to document more incidents for each of these two categories-283 and 171 respectively- than any other type of object it has reported on thus far.⁵ Of the total number of incidents in this dataset, 46% (283) impacted crowded civilian markets. While assessing casualties went

⁵ See <https://yemeniarchive.org/en/investigations> for other comprehensive reports, including attacks on medical facilities (133), bridges (142), and media infrastructure/journalists (138).

beyond the mandate of Yemeni Archive, open-source documentation relating to these attacks describes 51% of these market attacks having reportedly caused immediate civilian casualties. One third of attacks impacting markets (92) were in Saada, as well as 16% (47) in Marib, 13% (36) in Taiz, 9% (26) in Hudaydah, 9% (25) in Hajja, and 8% (22) in Sanaa.

The second most impacted type of facility in this dataset were petroleum resources in the form of gas stations, oil tanks, and fuel trucks, which amounted to 171, or 28% of attacks. 30% (51) occurred in Saada, 12% (21) in Sanaa, 9% (17) in Taiz, 9% (15) in Hajja, and 7% (12) each in Marib and Shabwah. While assessing casualties goes beyond the mandate of Yemeni Archive, open-source documentation relating to these attacks describes 42% of these petrol attacks having caused immediate civilian casualties. Although the percentage of petroleum incidents was lower than the percentage of market incidents causing civilian casualties, it is possible that a greater number of total casualty numbers resulted from petroleum attacks. The high number of civilian casualties resulting from attacks on gas stations and oil infrastructure is likely due to the explosive nature of petroleum, as open-source documentation describes many of these incidents setting off explosions affecting buildings and vehicles nearby.

Types of attacks

Double Tap

A double tap attack is when, within hours or even minutes after an object or facility is hit, that attack is followed up with a second attack, often worsening civilian casualties and harming first responders at the site (see Methodology in Appendix III for full definition). There were 34 incidents in which a double tap was carried out, 79% of which (27) allegedly caused civilian casualties. 28 of the double tap incidents were allegedly carried out by the SLC, and 22 of these allegedly resulted in civilian casualties. 5 out of the 6 alleged Houthi double tap attacks allegedly resulted in civilian casualties.



Figure 1.5 Double taps with civilian casualties

The following graph shows the chronological distribution of double taps that were carried out over time from 2015-2022. See also the graph in the following section below, which includes double taps by governorate.

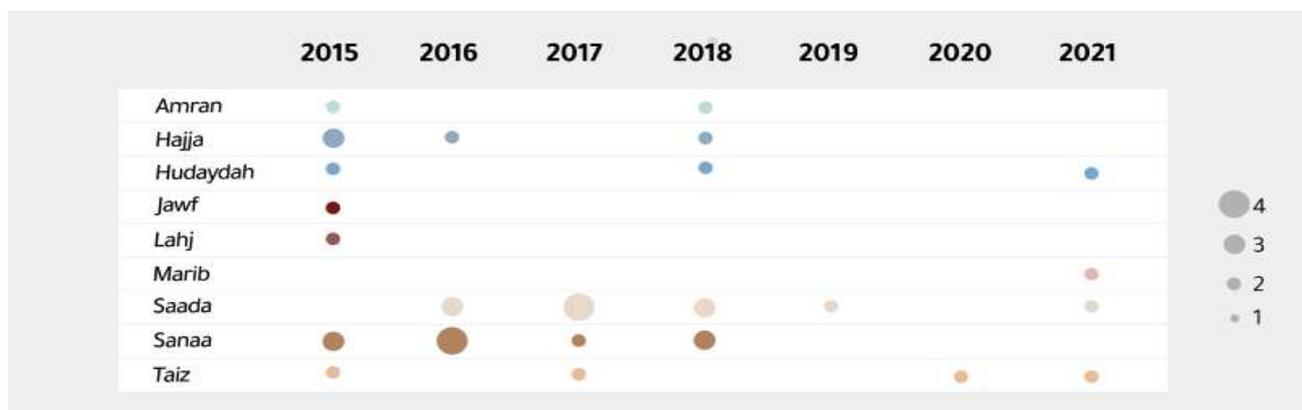


Figure 1.6 Double taps by governorate from 2015-2022

Repeat attacks

In 234 of the incidents in this database, Yemeni Archive found evidence for alleged repeat attacks, or attacks on the same site on separate dates (see Appendix III for full explanation). Seventy-seven (77) of the total 234 repeat attacks led to civilian casualties. A majority of these incidents (158) involved attacks on markets, 92% (146) of which were allegedly carried out by the SLC and affiliated pro-coalition forces, as well as 10 allegedly by Houthi forces, 1 allegedly by the IRGY, and 1 allegedly by unknown forces. As with the rest of the data, the greatest number of these repeat attacks (86, or 37%) allegedly occurred in Saada governorate. 15% (34) were allegedly in Marib, 13% (31) allegedly in Taiz, 9% (22) allegedly in Hudaydah, and 8% (19) allegedly in Hajja governorates. These attacks continued throughout the seven years covered in this database, from 2015 to 2022.

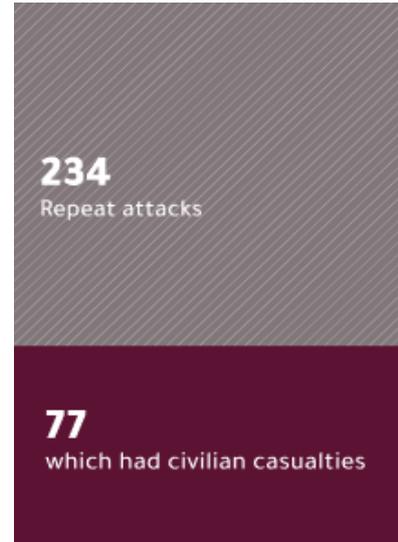


Figure 1.7 Repeat attacks with civilian casualties

The following three graphs depict repeat attacks. In Figure 1.7, the proportion of repeat attacks with civilian casualties, 77 out of 234, is shown. In Figure 1.8, repeat attacks by governorate over time are represented. As the graph shows, repeat attacks fell over time in accordance with the total number of attacks, with the greatest numbers and consistency in the governorate of Saada. The third graph, Figure 1.9, illustrates how repeat attacks per month have continued into 2022, but declined compared with unique attacks since 2015. It compares the number of repeat attacks (234) with unique attacks (377) in the database.

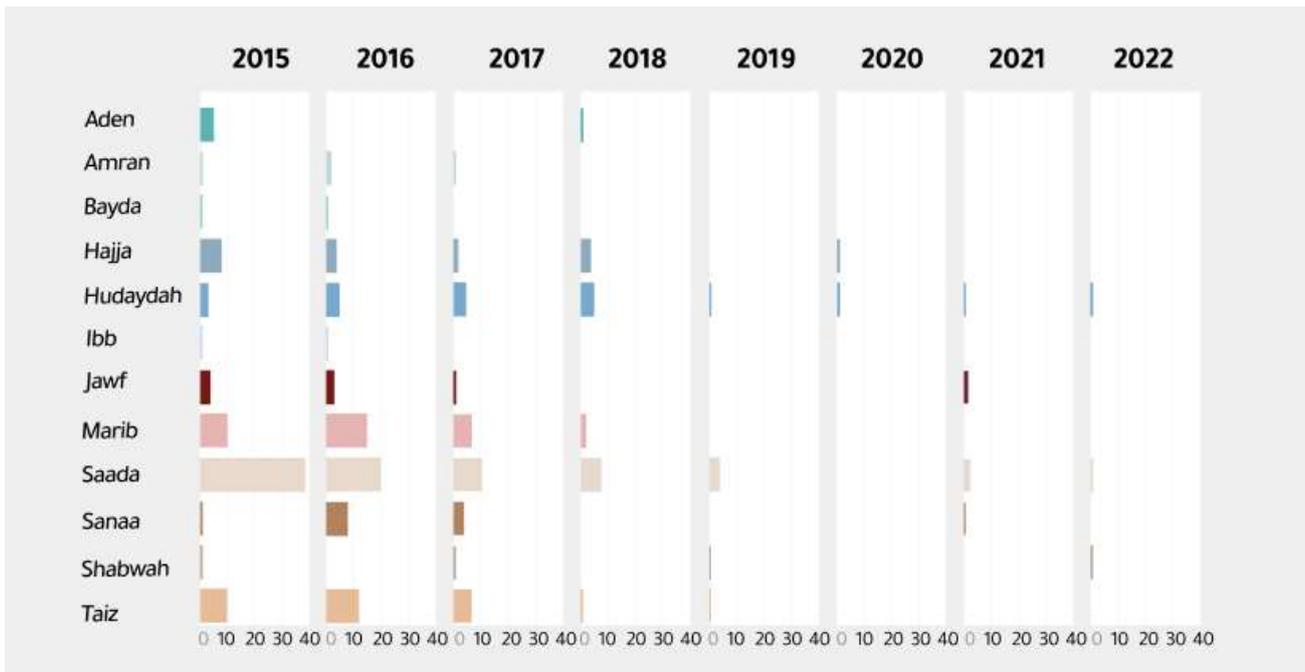


Figure 1.8 Repeat attacks by location over time

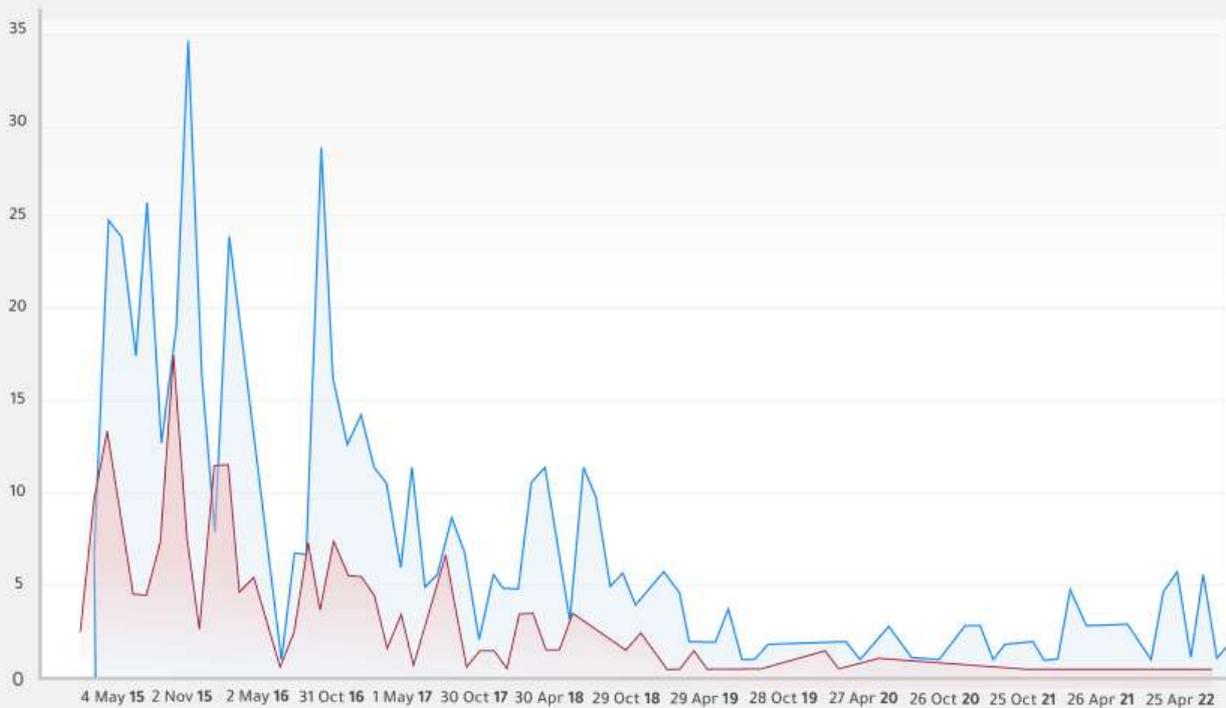


Figure 1.9 Total repeat attacks by month 2015-2022

In Figure 1.9, the red denotes repeat attacks, and blue indicates non-repeat attacks.

Fixed objects and non-fixed objects

The database includes 571 incidents allegedly involving an attack on a fixed object, and 41 allegedly involving an attack on a non-fixed object. There were several incidents labeled TRUE for both 'fixed' and 'non-fixed' because they allegedly involved multiple objects being hit. For example, in incident INF_00552, the SLC allegedly indirectly hit al-Yateem fuel station in Sanaa (fixed) which also included an oil truck (non-fixed). In another case [INF_00622] also involving a double tap on a fuel station and an oil truck in Sanaa, the coalition allegedly directly hit Alsobaha fuel station (fixed) as well as an oil truck (non-fixed).

Where are these attacks happening by Governorate

This section summarises which governorates had the greatest numbers of attacks in this database, with special attention to the five governorates attacked in this database: Saada, Taiz, Sanaa, Hudaydah, and Marib.

Most attacks in this database were allegedly in the governorate of Saada (176), followed by Taiz (75), Marib (68), Hudaydah (68), Sanaa (66), and Hajja (54). The greatest numbers of incidents with alleged civilian casualties were reported in Saada (70), followed by Taiz (45), Sanaa (21), and Marib (19). Whereas there was evidently a drop in attacks recorded here in Saada, Marib, and Taiz after 2017, the greatest number of recorded incidents in Hudaydah allegedly occurred, by contrast, in 2018. This also appears to fit with Yemeni Archive's 2021 database on [Attacks On Media](#), likely explained by a peak in SLC-Houthi fighting prior to the Hudaydah Agreement reached at the end of 2018. This database, however, shows continued attacks in Hudaydah on economic infrastructure after 2018, albeit with a decrease in total numbers since then. The only governorate with an increase in attacks in this database over time is in the oil-rich governorate of Shabwa, which UAE forces and the IRGY regained from Houthi control in early 2022. Over one third (6) of the 16 attacks in Shabwah took place in 2022 alone.

southern port and former southern capital, Aden, as well as the southwestern Red Sea port of Mocha that connects to Taiz city, [Taiz has historically been less isolated than Yemen's north](#) and is considered Yemen's most cosmopolitan city. It is home to Yemen's [most educated, and least tribal](#), population. For these reasons, it was home to much of Yemen's youth movements responsible for initially leading the 2011 revolution, before being [co-opted by tribal elites affiliated with the regime and the Saudi-led GCC Initiative in 2012](#).

The governorate of Taiz stands out in our data as the governorate with the greatest proportion of alleged civilian casualties per incident type - there were 45 incidents with alleged casualties, so roughly 60% of incidents of attacks on economic infrastructure recorded here in Taiz resulted in civilian casualties. By comparison, there were 70 such incidents in Saada. This does not necessarily mean Taiz had the greatest number of civilian casualties in this database, but that a majority of incidents in this governorate led to at least some casualties.

Although more attacks (50) in Taiz were allegedly carried out by the SLC and pro-coalition forces than other parties, there were a higher proportion of incidents allegedly perpetrated in Taiz by Houthi forces (20) as compared with total Houthi attacks (65). More attacks were allegedly carried out by the Houthis in Taiz (20) than in any other governorate, around 31% of the Houthi attacks on economic infrastructure recorded in this database. This data also fits with the general trajectory of the conflict after 2018, with growing numbers of reported Houthi attacks on civilians and civilian infrastructure, particularly in the governorate of Taiz.

The first graph below (Figure 1.2.2) depicts the number of incidents with reported civilian casualties by location. Out of 251 incidents with reported civilian casualties, 70 were in Saada, 45 in Taiz, 29 in Hudaydah, 21 in Sanaa, and 19 in Marib.

In the second graph following it, (Figure 1.2.3), the total number of incidents per governorate is shown. Out of 611 incidents, 176 were in Saada, 75 in Taiz, 68 in Marib, 68 in Hudaydah, and 66 in Sanaa.

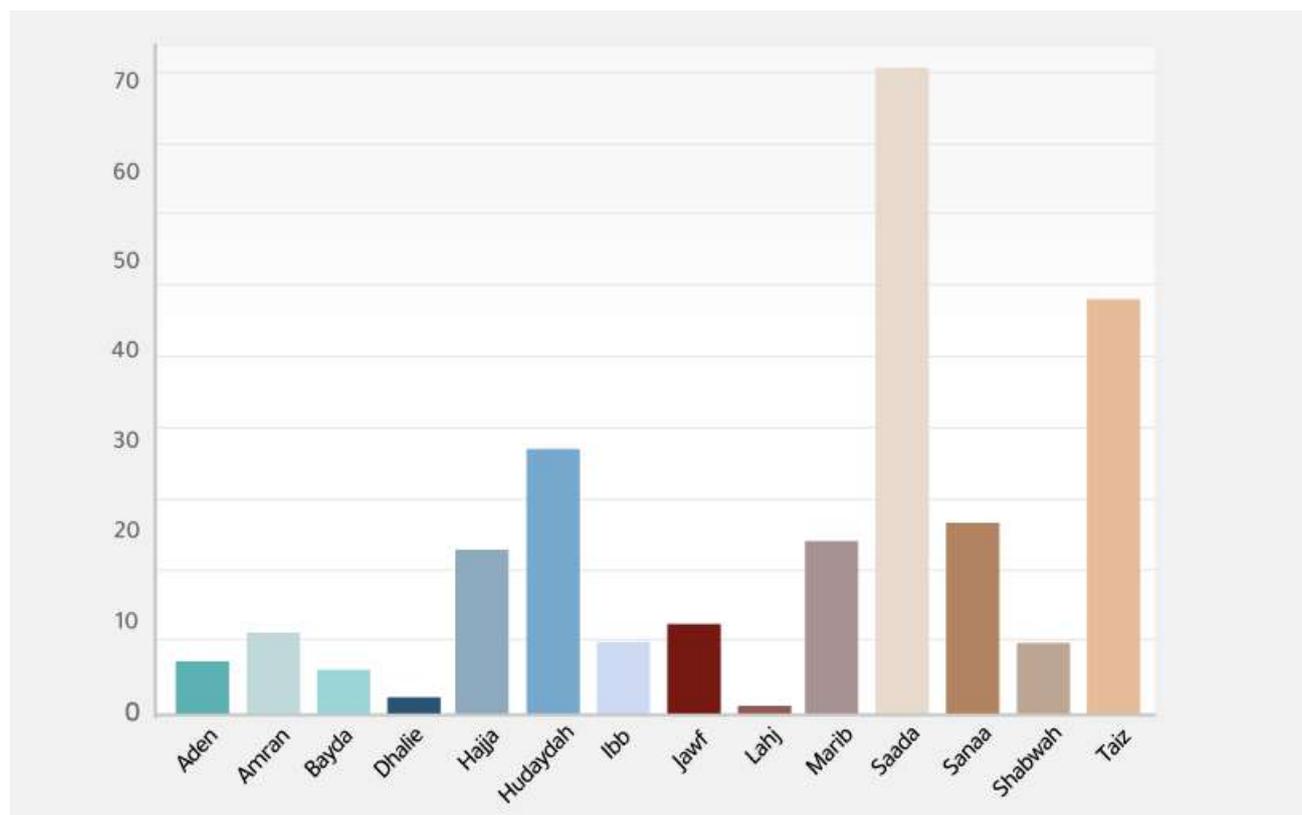


Figure 1.2.2 Reported civilian casualties by governorate

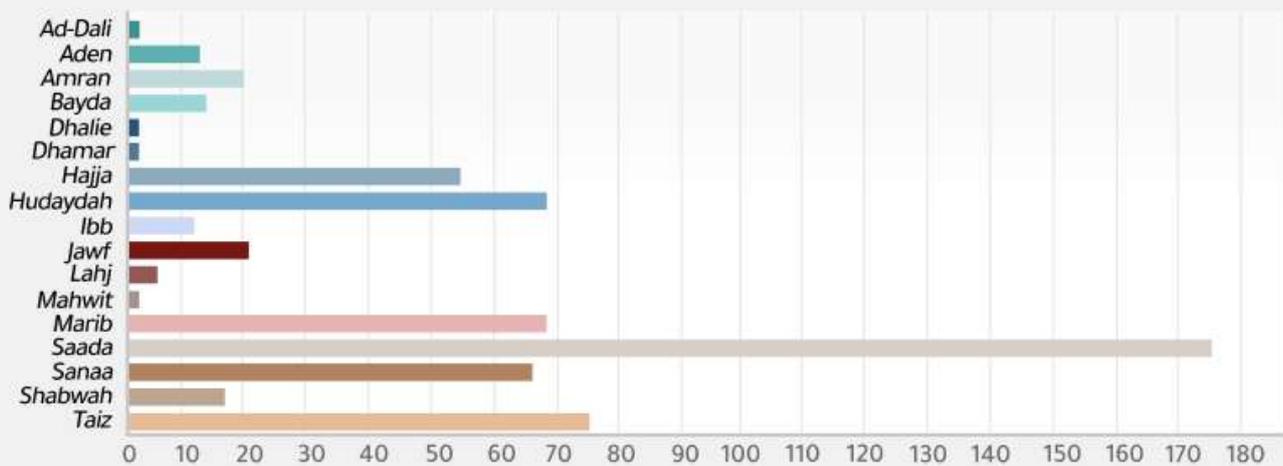


Figure 1.2.3 Total number of attacks by governorate

Sanaa

Sanaa governorate is home to Yemen's capital city of Sanaa, which the Houthis took control of in September 2014. Sanaa city is the country's largest city. As the capital of the government under then-president Ali Abdullah Saleh, Sanaa was the site of some of the largest protests during the Yemeni Spring in early 2011. Since the Houthi takeover in 2014 (with the help during their temporary alliance with Saleh), Sanaa has been a Houthi stronghold. As the Houthi capital, it remains the country's de facto capital. Because the Houthis took control from the IRGY of Sanaa's political institutions, media centers, and government-run infrastructure, it has been a frequent site of attack by the Saudi-led coalition, particularly in the first two years of the military intervention.

Hudaydah

Hudaydah city is Yemen's the second largest city. Fighting between the Saudi-led coalition and Houthi forces in Hudaydah increased during the battle of Hudaydah in summer 2018 and continued throughout the fall, until the [UN-brokered Hudaydah Agreement](#) was signed between Ansar Allah and the internationally recognized government of Yemen in Stockholm in December 2018. The agreement led to a temporary ceasefire and sustained decrease in violence between the Houthis and coalition, as well as some increased economic activity in the city of Hudaydah which is home to several key ports.

Yet, after the end of 2018, Saudi and UAE coalition infighting increased, as did Houthi military expansion and alleged Houthi attacks on civilians. At the same time, the SLC's blockade on Yemen continued to affect entry of fuel and humanitarian aid into the port of Hudaydah, as well as Yemen's other ports, after the 2018 signing of the Stockholm Agreement. With the signing of the Riyadh Agreement and corresponding Ramadan Truce April 2 to October 2, 2022, [more fuel ships entered the port of Hudaydah in spring and summer 2022](#) than in the entire year of 2021. The governorate of Hudaydah is also central to the conflict for its positions as a key commercial centers, with the [Red Sea port in Hudaydah](#) as the location for most of Yemen's imports.

Marib

As the coalition and IRGY's last stronghold in the north of Yemen, Marib has been a central front in the war over the last two years. [Marib provides 90% of Yemen's oil and natural gas](#). As the [coalition pushed back a Houthi offensive](#) on Marib in early 2022, the [Houthis retaliated with attacks on an Aramco oil facility in Jeddah](#). One week later, the parties agreed to the UN-brokered Ramadan truce. Notably, repeated [Houthi violations there were reported](#) during the truce period. Houthi attacks since the failure of the truce renewal on October 2 have centered on oil ports in other governorates as well, such as one on [November 9 in Shabwah](#). The Houthi authorities and [some reports](#) have

claimed that the Arab coalition led by Saudi Arabia and the UAE have ['looted \\$13 billion in Yemen's oil revenues'](#) over the last five years.

Despite decreases in alleged attacks by the SLC on economic infrastructure overall and in Saada governorate in particular, there was more consistency over time in the continuation of attacks in Hudaydah, Marib, and Taiz. The somewhat greater consistency in attacks in these governorates-in contrast with staggeringly high numbers in Saada in the first two years of the SLC intervention followed by decreases-can potentially be attributed to the increase in alleged Houthi attacks since 2015, as also recorded here. With 20 total attacks allegedly by the Houthis in Taiz, 20 in Hudaydah, and 12 in Marib, these three governorates were the sites of the greatest numbers of overall alleged Houthi attacks in this database.

The following graph (Figure 1.2.4) shows the number of attacks carried out in each governorate, broken down by alleged perpetrator. Each governorate is represented by a specific color.

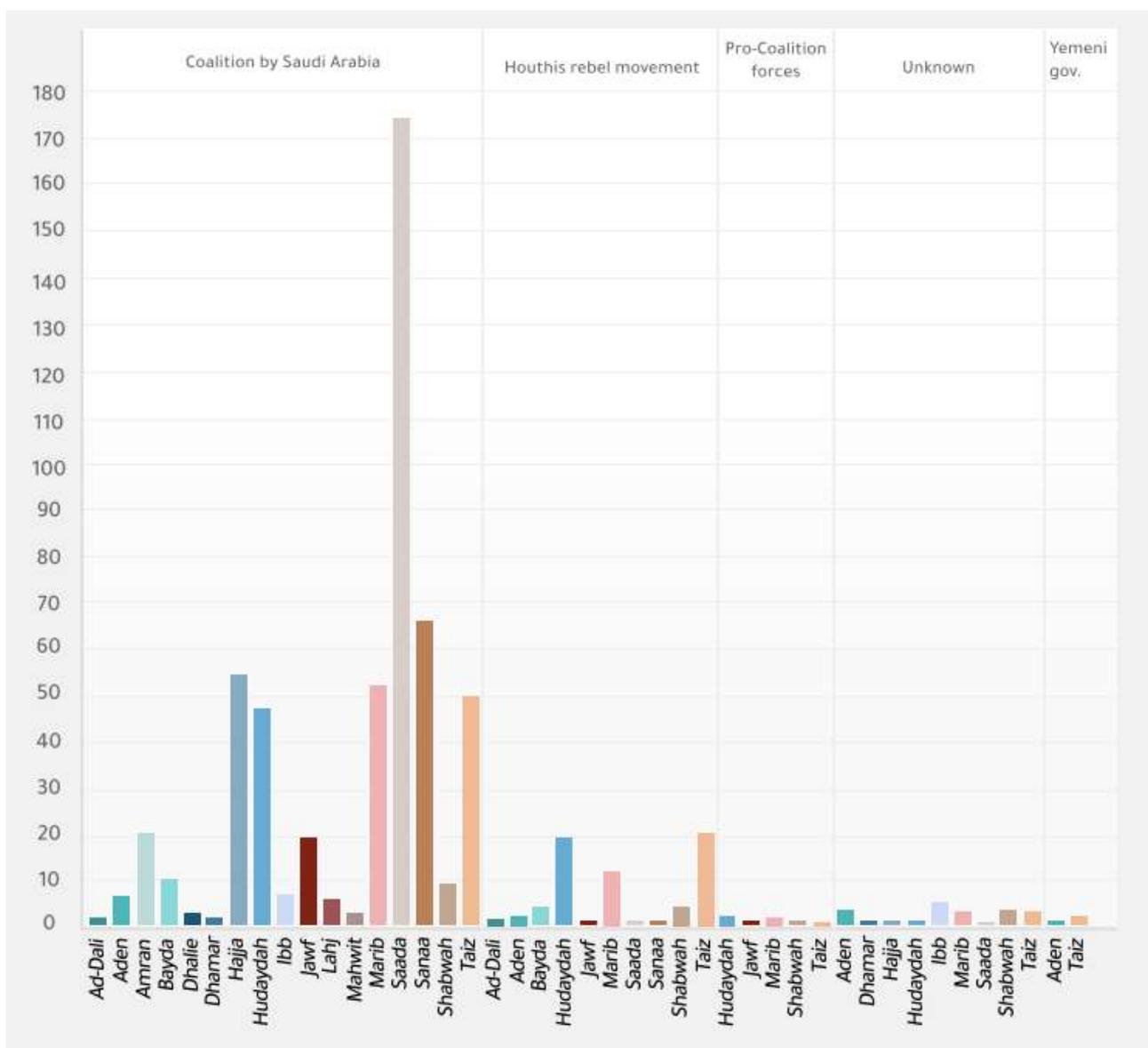


Figure 1.2.4 Attacks by alleged perpetrators in each governorate

Alleged perpetrators

Introduction

According to independent human rights organisations and the United Nations, the Saudi and UAE led coalition (SLC), their affiliated forces, and Ansar Allah Houthi rebels have all been responsible for attacking civilian economic infrastructure, whether intentionally or not. An academic study by [Sowers and Weinthal \(2021\)](#) found that mostly non-state actors, including AQAP, and Houthi forces, attacked energy supplies and facilities between 2011 and 2014. Since the SLC's military intervention in 2015, however, both external states and internal non-state actors have been attacking energy facilities in Yemen. Sowers and Weinthal (2021) also found that most (94 out of 105) attacks on various sources of infrastructure for potable water were carried out by SLC airstrikes. While Yemeni Archive cannot in most cases attribute responsibility to perpetrators with certainty, its records on alleged perpetrators seem to track with Sowers and Weinthal, whose data is based on the Yemen Data Project and ACLED. That is, 90% of attacks on water infrastructure in Yemeni Archive's database, or 107 out of 119 incidents, were allegedly perpetrated by the Saudi led coalition—a similar proportion as found by Sowers and Weinthal's study.

This database includes 611 total attacks, including 515 attacks allegedly carried out by the Saudi-led coalition, 7 by pro-coalition forces affiliated with the SLC, 65 by Houthis, 3 by the IRGY that is backed by the SLC, 21 in which the specific alleged perpetrator is unknown, and one allegedly by AQAP fighting alongside pro-coalition forces. 38% of incidents involving alleged SLC airstrikes were reported to have caused immediate civilian casualties, as did 55% of alleged Houthi attacks. A greater proportion of alleged Houthi attacks were after 2017, possibly reflective of how the Houthis have actually grown in power, destructive capacity, reckless disregard for life, and external military support from Iran since the start of the SLC intervention against them in 2015.

Saudi-led Coalition (SLC)

The Saudi-led coalition (SLC) refers here to the Arab military coalition, [led by Saudi Arabia and the UAE](#), that intervened in Yemen on March 30, 2015 with the stated intention of [restoring the IRGY's then-President Hadi](#) to power. This database includes 522 incidents allegedly carried out by the SLC and affiliated forces. The majority of these (515) were carried out by the SLC, with 7 incidents allegedly carried out by other pro-coalition forces. The vast majority (506) of these alleged attacks involved the use of airstrikes.

The Saudi led coalition has most directly engaged with Yemen through Saudi airstrikes. There are also [Saudi forces on the ground](#) near the Yemeni border with Saada governorate in northwestern Yemen. Key to understanding conflict dynamics, including the Houthis' sustained power, are the intricate divisions and rivalries within the SLC and its affiliated pro-coalition forces. The [SLC officially included UAE forces](#) and UAE-backed militias on the ground until 2020, when the UAE declared its withdrawal of forces from Yemen. In reality, however, UAE-backed militias remain key forces in the Yemen conflict, in many cases being responsible for more military gains over the Houthis than the rest of the coalition and IRGY. This includes the [Southern Transition Council](#) (STC), which the UAE helped to form in 2017. As a major political actor and a rival to the pro-unity IRGY, the STC's status as an internationally recognized key actor became formalized in the [Riyadh Agreement in 2019](#), which was meant to reconcile intra-coalition differences between Saudi Arabia and the UAE. In addition to formalising the STC, the UAE backs militias such as the STC-affiliated Shabwah Defense Forces and Hadrami Elite Forces in the east, the Abu al-Abbas Brigades in the southwest, and the Joint Forces who call themselves the National Resistance in the west. Because the Saudi-led coalition is technically comprised of so many different actors, Yemeni Archive refers to various militias outside those strictly involving Saudi forces, including those backed by the UAE, as "pro-coalition forces".

The 2019 Riyadh Agreement as well as the creation of the 2021 [Presidential Leadership Council](#) have been aimed at power sharing between the IRGY and these different Saudi-backed and UAE-backed forces. Despite these formal agreements and shared interests in fighting the Houthis, tensions and conflict continue among different anti-Houthi forces, most notably between UAE-backed forces in favor of southern secession on the one hand and the Yemeni Muslim Brotherhood, Islah, which has been backed by Saudi Arabia and is a key political party in the IRGY. Increasingly, [UAE-backed forces such as the STC have taken control of Yemen's oil rich areas](#), such as Shabwa, where the STC has fought with Islah as much as it has with the Houthis.

Most attacks by the Saudi led coalition have been in the form of airstrikes, which are coordinated at times with forces on the ground. The SLC's *potentially* greater technological precision does not always lead to avoiding civilian objects, whether intentional or not. For example, in incident INF_00397 (see water investigation), a water rig was hit in an airstrike because, according to the JIAT, it was mistaken for a missile launcher. In 26 other statements by the SLC's JIAT that Yemeni Archive recorded for this database, the coalition either avoided acknowledging impacts on civilians or stated only that an attack in question hit a military target outside of the civilian area in question.

It may be presumptive to say that the SLC's greater capabilities in precision of hitting objects led them to destroy more infrastructure than the Houthis, as this assumes intentionality in all cases. What is more certain, however, is the SLC's greater destructive capacity, through the use of airstrikes carried out with equipment purchased from the US, UK, and Europe. For example, in incident [INF_00091], the SLC allegedly directly hit with an airstrike Abdulwahab Gas Station in Taiz. In response, the JIAT claimed that the coalition had used a guided bomb to hit the building east of the gas station, and that the gas station and surrounding buildings were safe from damage. According to several verified news sources, Yemeni Archive found that the coalition had, in fact, directly hit the gas station.

Regardless of the SLC's intentionality, the JIAT's investigation into the incident either failed to uncover the evidence of the airstrike's larger destructive damage leading to a number of civilian deaths, or indicates that there is a major discrepancy in JIAT reporting. In incident [INF_00625], the JIAT claimed that the coalition had used one bomb accurate and proportional to the target, and that this was a military response to the Houthis having taken over the gas station and placed armed crews inside of it. However, none of Yemeni Archive's other sources found evidence that the Houthis had taken over the gas station. In addressing claims of civilian casualties, the JIAT also stated that it had carried out the attack during the time of Iftar in Ramadan, and that therefore it thought civilians would not have been present at the station. However, this fact offers no absolute guarantee of civilians being absent, and it is quite possible for civilians to have been out and about during Iftar, for example on their way home from work or to a family gathering to break fast. In another incident involving an alleged SLC airstrike on a gas station and fuel trucks [INF_00443], the JIAT responded by stating the coalition had been targeting foreign missile experts and a Houthi leader who was with the vehicles. No mention was made, however, of reports of resulting in civilian casualties or damage to nearby houses.

YOUR SUMMARY FINDINGS RE: SLC that emerged from your data

One third of alleged SLC attacks (174) hit the governorate of Saada. There were 65 attacks allegedly by the SLC and/or pro-coalition forces in Sanaa, 53 in Hajja, 53 in Marib, 49 in Taiz, and 48 in Hudaydah. The coalition's JIAT responded at the time to 29 of this database's incidents, mostly averting blame in some way. This often took the form of acknowledging hitting a military target, but either asserting that no civilians had been nearby and/or the civilian object allegedly hit was not close enough to the military target to be hit, or that armed Houthi forces had taken over the civilian facility. There were three exceptions in which the JIAT explicitly admit to the incident impacting a civilian facility, and apologised for making a mistake. These include MAR_0210 (see Markets section), INF_00659 (see Oil/gas section), and INF_00397 (see water case study in Water section).

For dozens more incidents (76 in total), Yemeni Archive's team found sufficient evidence through external sources to give its highest confidence rating score for attribution to the Saudi led coalition and affiliated forces (see Important Note on Attribution section and Methodology in Appendix III).

Houthis

The Houthis began as a movement from Saada. The son of a Zaydi cleric and activist, Hussein-al Houthi [led what became a rebel movement that began war with the state in 2004](#). The series of battles between Saleh's regime and the Houthis from 2004 to 2010 became known as the [Saada wars](#).

The Houthi movement, known as Ansar Allah, trace the origins of their marginalization to the fall of the Zaydi Imamate in 1962, but the core focus of their grievances have been against the economic and political discrimination that occurred under President Saleh (r. North Yemen 1978-1990; r. unified Yemen 1990-2012). Although a Zaydi Shi'a himself, [Saleh's regime consistently neglected](#) economic development and political representation of the predominantly Zaydi areas of Saada province in northern Yemen. Saleh's image as a Saudi puppet was further exacerbated by the regime's support of Salafism through its [post-1990s unification alliance](#) with the Yemeni Muslim Brotherhood affiliate, the Islah Party.

As explained above, the Houthis exploited the fallout from the 2011 Yemeni revolution to take power and become Yemen's de facto government. After President Saleh stepped down in a GCC-led transition of power to vice-president Hadi in 2012, the Houthis formed an alliance of convenience with Saleh, which lasted until [they reportedly assassinated him in 2017](#). With Saleh's help, and [against the warnings of Tehran](#), the Houthis took Yemen's capital city of Sanaa in September 2014. Since the exacerbation of the conflict in 2015, the Houthis have grown increasingly close with Iran, which has provided them with technology to launch aerial drone attacks, including 5 such alleged attacks in this database. The Houthis control 70% of Yemen's population.

The Houthis are the second most common alleged perpetrator in this database. The relatively much smaller share of alleged Houthi attacks in this database is likely due to several factors, including the fact that the use of airstrikes in the conflict-the [majority of which are reported to have been carried out with US military support](#)-allows the SLC greater destructive capacity in these sorts of hits. In addition, as the de facto government of the majority of Yemen's population, the Houthis arguably have greater incentive for other exploitative tactics beyond the bombing of the population's resources. For example, extensive reporting by [CIVIC](#) and [Mwatana](#) has shown how the Houthis have in many cases taken over Yemeni civilians' farms for their own use. As mentioned in the SLC section above, the plethora of armed militias on the ground in Yemen using small and medium arms, including pro-coalition forces as well as the Houthis, can be more difficult to track than airstrikes.

YOUR SUMMARY FINDINGS RE: HOUTHIS that emerged from your data

The greatest numbers of alleged Houthi attacks (19) took place in the governorates of Hudaydah, Taiz, (20) and Marib (12). 77% (50) of the alleged Houthi attacks involved ground-to-ground attacks, as well as 11% (7) ground attacks, 8% (5) involving airstrikes with drones, and 8% (5) involving unknown delivery methods. In just over a quarter (15) of alleged Houthi attacks in this database, Yemeni Archive found sufficient evidence to assign these incidents its highest score of alleged perpetrator confidence (see Important Note on Attribution section and Methodology in Appendix III).

The Houthis have failed to take adequate precaution and in dozens of cases allegedly hit civilian objects. Their material capacity for destruction has not been as high as that provided by airstrikes at the start of the conflict. This potentially accounts for the lower numbers and proportions of total incidents allegedly carried out by the Houthis, relative to those allegedly carried out by the SLC, in this database. Although there remains a clear

technological advantage on the side of Saudi and UAE coalition forces, the Houthis' own external support from Iran has continued to grow, including through the use of Iranian-made drones. The 65 alleged Houthi attacks in this database offer potential preliminary evidence for the sustained and overall increasing numbers of alleged Houthi attacks over time since 2015.

Unknown Perpetrator

This database includes 21 incidents in which a specific perpetrator was considered unknown. The majority (15) of these incidents took place in markets, which have been a common place for clashes between the Houthis and pro-coalition forces, including but not limited to those coalition forces affiliated with the internationally recognized government of Yemen. Unknown perpetrator attacks included 13 ground attacks, 2 ground-to-ground, 4 unknown delivery method, and 4 involving airstrikes, which were either suspected SLC airstrikes with insufficient evidence or suspected SLC airstrikes in clashes with Houthi forces.

Most incidents in which there was insufficient evidence to label a specific alleged perpetrator involved attacks on the ground with small or medium arms or explosives, and most often in markets. Examples include [MAR_0145], [MAR_0276], and [MAR_0304]. See section on markets for more.

In terms of governorate, the greatest number and proportion of incidents where the Yemeni Archive team labeled alleged perpetrator as UNKNOWN were in Ibb, where 5 out of the total 11 incidents had an unknown perpetrator. Although not on the front lines of the war, researchers have found that the Houthi-controlled province [of Ibb has experienced some of the greatest amount of infighting within Houthi forces](#). Additionally, there were 3 each in Aden, Shabwah, and Marib.

While there were several cases in which some media and eyewitnesses differed over the role of airstrikes, overall (mostly SLC) airstrikes were easier to determine a perpetrator than those involving militias on the ground. One notable exception was [INF_00128], which took place at night and was difficult to determine through visual evidence. It included accounts of both SLC airstrikes and Houthi attacks on a refinery in Aden, during July 2015 when it was known that both parties had been fighting for control of the governorate. In another case in which both major parties were likely culpable, but there were major conflicting narratives in the sources, [MAR_0276], some sources accused the Houthis of attacking al-Thabit market in Saada governorate on July 29, 2019. Others, however, including [Voice of America](#), reported that the SLC had carried out an airstrike on the market that day. The [SLC](#) spokesman and the [JIAT](#) both denied Saudi airstrikes and condemned the Houthi attack on the market. In [INF_00642], there were Houthi snipers allegedly stationed on a water tank, and claims of them attacking the water tank. Several sources stated that the SLC bombed Houthi snipers from an Apache helicopter. This has similarities to other cases of the Houthis using civilians as human shields, albeit in this case, the Houthis allegedly used civilian critical infrastructure as a "shield" against a Saudi airstrike. The team labeled these three incidents unknown for alleged perpetrator, although likely responsibility was with the Houthis as well as the SLC in both instances.

There were also several other incidents involving likely clashes in which there was sufficient evidence to label specific alleged perpetrators as likely. Those involving clashes with multiple alleged perpetrators acknowledged include [MAR_0260: pro-coalition forces and Houthis], [INF_0069603: Houthis and SLC], [INF_00642: Houthis and SLC].

YOUR SUMMARY FINDINGS RE: Unknown Perpetrator that emerged from your data:

This database includes 21 incidents in which a specific perpetrator was considered unknown due to lack of information and/or conflicting sources. The role of various non-state actors, oftentimes with shifting allegiances, in the conflict has made determining a specific alleged perpetrator especially difficult in a number of cases. In addition to incidents with unknown armed men fighting or planting explosives on the ground, there were several cases in which the Houthis and SLC or pro-coalition forces were allegedly clashing with one another. Such cases, where conflicting sources hindered a determination on whether one side or both sides seemed likely to be primarily responsible for a civilian object being hit, were also labeled as unknown perpetrator. Because so much fighting has taken place in or near markets, it is not surprising that most (15) of these 21 incidents occurred in markets.

Delivery Method/Weapons

The majority (515) of the incidents in this database involved weapons allegedly delivered through airstrikes, with seven of these incidents also involving other forms of delivery. Almost all of these (506) were alleged Saudi airstrikes, 4 incidents with unknown perpetrators but suspected to involve Saudi airstrikes, and 5 notable exceptions involving alleged Houthi drone strikes in 2021 and 2022: MAR_0240, MAR_0242, MAR_0335, MAR_0288, and INF_00932, one of which was shooting down an alleged Saudi drone. There were 73 incidents in which ground to ground was at least one of the methods of delivery cited, 25 cases in which an alleged ground attack was cited, and 10 in which the weapon delivery was unknown.

Area of control

Yemeni Archive coded territorial control of each incident by who controlled the area at the time of the incident. As the map below shows, currently most of Yemen's land is controlled by the IRGY and/or pro-coalition forces, including a large STC presence in the south.⁶ This includes IRGY and/or coalition forces' control of much of Yemen's largest governorate, Hadramawt, as well as al-Mahra, most of Marib, Shabwah, Aden, Abyan, and Lahij. Yemen's northern and most populous governorates-Saada, Sanaa, Amran, Mahwit, Dhamar, Ibb, al-Bayda, and Hudaydah, are controlled by the Houthis. Most of Marib is currently under IRGY control, and Taiz is split between the Houthis and the IRGY, as is much of al-Dhalie, Hajja, and al-Jawf. About 70% of Yemen's population has been living under Houthi control for much of the conflict.

Throughout the timeline of this database (2015-2022), territorial control in a number of these governorates has shifted, and some governorates have seen greater levels of contestation. For example, there were a large number of incidents in Marib, most of which allegedly carried out by the SLC were in the district of Sirwah, in the western part of the governorate. Although much of Marib is under IRGY control, Sirwah district has been under [Houthi control](#). The following snapshots from LiveUAMap shows area of control in 2017, 2018, 2019, 2020, and 2021. The red denotes area controlled by the Houthis rebel movement, the blue areas controlled by the SLC and Yemeni government forces (IRGY), and the green by AQAP.

⁶ In August 2022, the UAE-backed STC forces fought the Islah-led IRGY forces in Shabwa, successfully gaining control over their coalition rivals. This map thus does not fully reflect the extent to which the STC has gained control over the rest of the Saudi led coalition and in particular, the internationally recognized government.

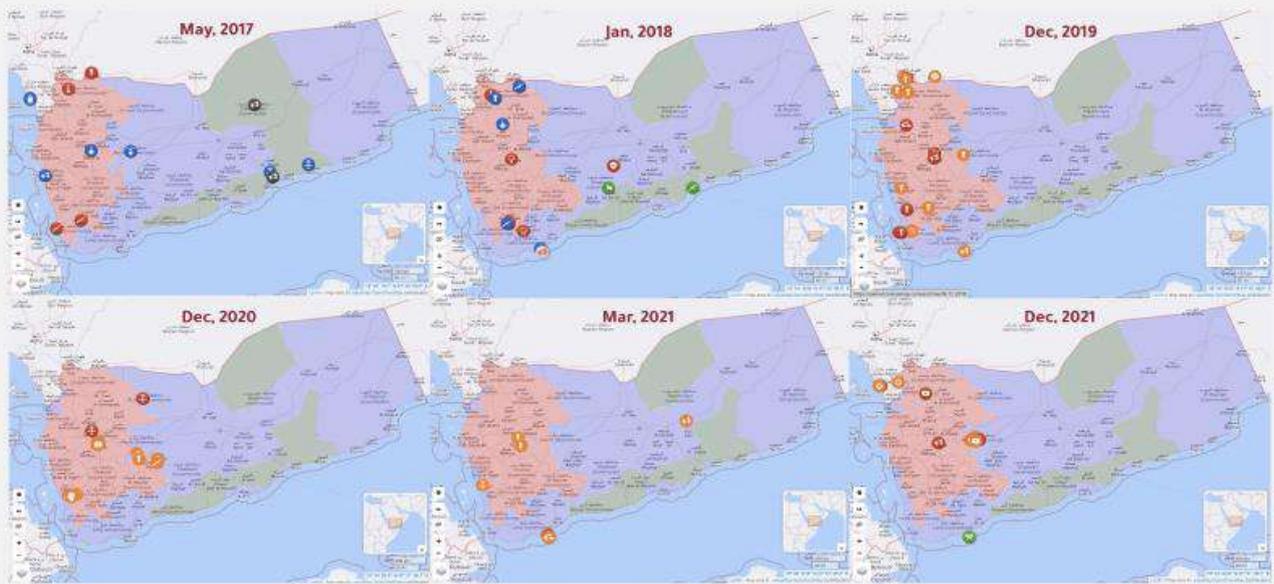


Figure 1.2.5 Maps of territorial control

Most attacks in this database (87%, or 532 incidents) were carried out in territory controlled by the Houthi rebels. Almost all attacks on Houthi-controlled territory were allegedly carried out by the SLC or pro-coalition forces (516). There were also 5 attacks allegedly carried out by the Houthis in their own territory, as well as 10 by unknown perpetrators and 1 by the IRGY.

Other attacks were carried out in territory controlled by the IRGY's forces (42), pro-coalition forces (35), tribal militias (1), and AQAP (1).

Attacks allegedly perpetrated by the Houthis were roughly split between areas controlled by the IRGY (33) and those controlled by other pro-coalition forces on the ground (28).

2. Attacks on Markets

Introduction

This section details the total number of market incidents, including how many allegedly caused civilian casualties, how many were repeat attacks, and how many were double taps, all of which were more heavily concentrated in or near markets than any other object in this database. It includes repeat attacks on markets in Saada and Marib, as well as a more in-depth case study of a market attack in Taiz. It also describes how these attacks were distributed by alleged perpetrator, as well as geographically and chronologically. It concludes with how attacks on markets fit within the larger crisis of starvation driven by limitations on access to and distribution of food for Yemeni civilians.

Markets serve as vital economic infrastructure to Yemenis as places to purchase and sell food and other essentials. Yemen [imports 90%](#) of its food, and so negative impacts on the supply drive the price up when prices have already become untenable for most Yemenis to afford to eat. If for example a market is attacked in a major port city like Hudaydah or the coastal city of Mocha in Taiz [for example: MAR_0145, MAR_0272, MAR_0288, MAR_0297], this might further impact the distribution and cost of food throughout those governorates or even the entire country. Since 2015, the flow of essential goods from Hudaydah's ports have been severely impeded by the SLC's blockade, while the Houthis have held a blockade over Taiz city.

Key findings

There were 283 incidents in this database involving attacks hitting markets. 56% (158) of total market incidents involved a repeat attack, 51% (145) of market incidents resulted in immediate civilian casualties. There were 22 alleged double taps on markets, accounting for 65% of double tap incidents. In line with the rest of Yemeni Archive's data here on economic infrastructure 76% of market incidents were also direct hits. This all reflects the heavy amount of fighting occurring in or near crowded markets, as well as an apparent disregard by the parties to the conflict for civilians' right to safely access food sources.

The following graph shows attacks on markets (orange) compared with attacks on all other facility types (blue) from 2015 to 2022

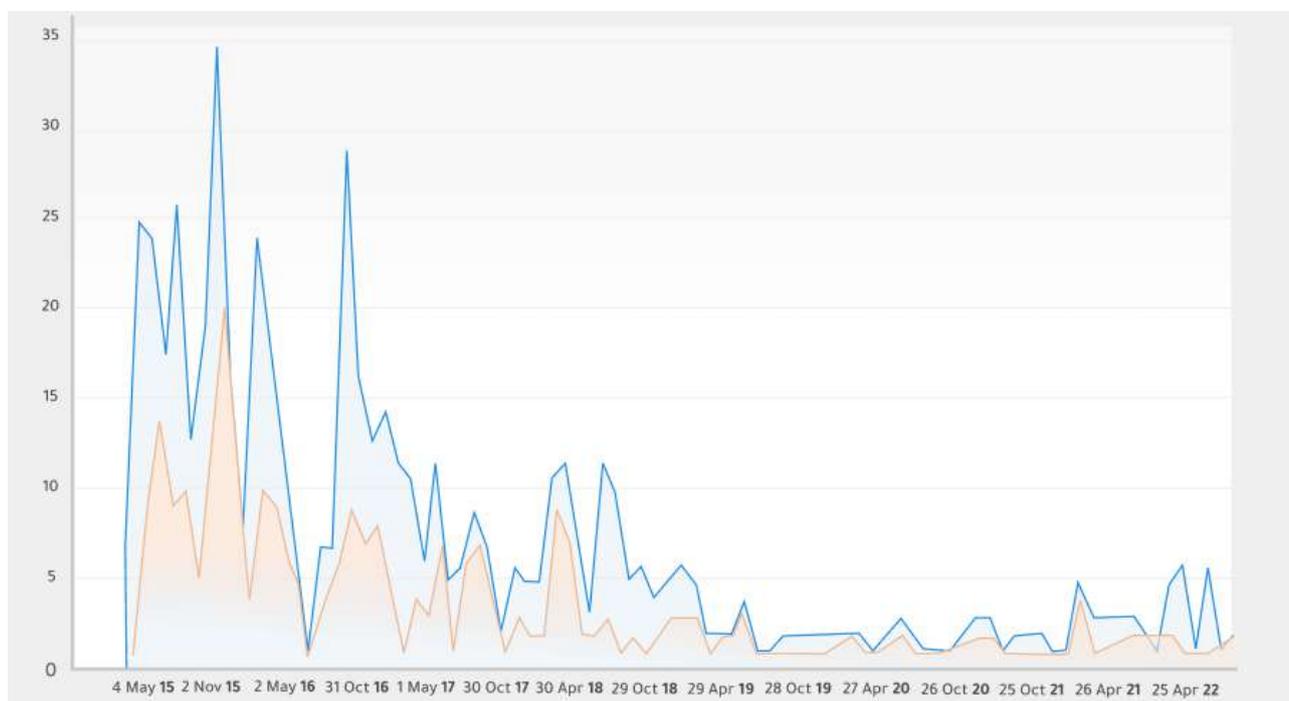


Figure 2.1 Attacks on markets 2015-2022

Markets were the site of the greatest overall number of incidents involving casualties as well as a greater proportion of incidents injuring and/or killing civilians as compared with other objects impacted in this database. This is not surprising given that markets are a place where civilians gather to purchase food and other basic necessities. It is not to be confused, however, with how deadly each incident was in terms of numbers killed or injured each time. Yemeni Archive was not able to verify exact casualty numbers for each incident due to conflicting reports.

One notable mass casualty market incident, which received attention from Human Rights Watch and others, was the [SLC airstrike on market and popular restaurant in Hajja \[MAR_0098\]](#). [According to the UN Human Rights Council, that attack killed 107 civilians.](#) Another mass casualty incident, which stands out as a rare case of the JJAT admitting to a mistake and apologising, was the coalition’s attack on a children’s bus in the middle of a market in Dhayan, Saada. JJAT spokesman [al-Mansour stated that, although the attack of the bus led to the killing of Houthi leaders, this action did not comply with the coalition’s rules of engagement because the target had not posed an immediate threat to the coalition at the time.](#) The JJAT also called on the SLC to provide voluntary aid for those affected by the attack.

As mentioned in the section above on repeat attacks, there were more repeat attacks on markets than on any other object in this database. There were 158 repeat attacks on markets, comprising 56% of market attacks.

The following graph shows total attacks on markets, with the red color denoting repeat attacks (158) and gray showing non-repeat, or unique, attacks, (125), from 2015 to 2022.

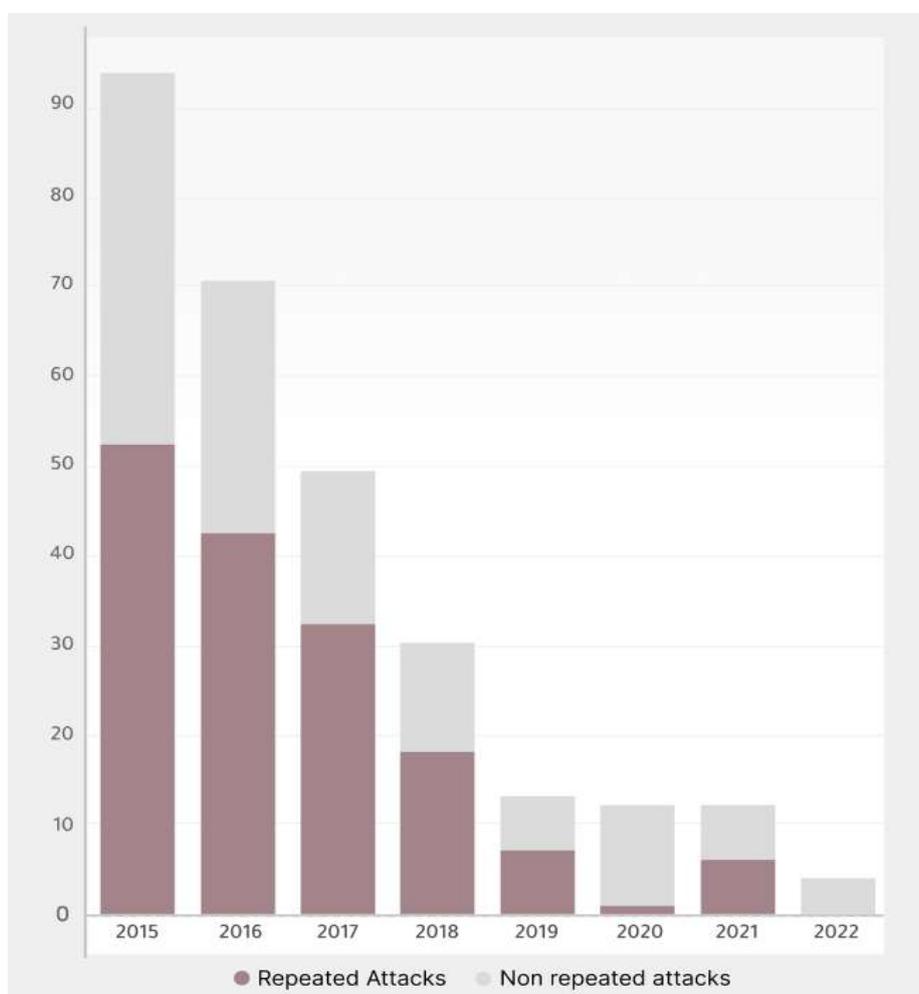


Figure 2.2 Repeat attacks on markets 2015-2022

As the chart below in Figure 2.3 shows, 61 of these repeat attacks on markets reportedly caused civilian casualties over the course of 2015 to 2021. The following chart shows the number of repeat attack incidents that allegedly caused civilian casualties. Its total, 61 incidents, comprise 39% of all repeat incidents in this database.

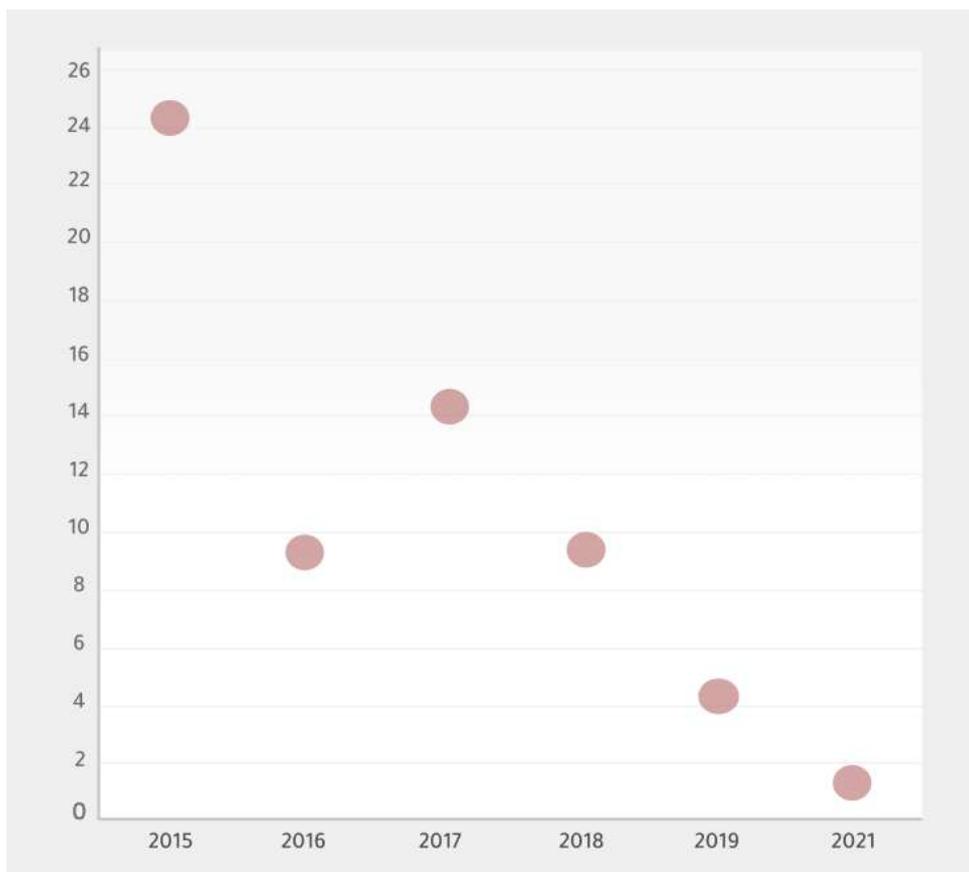


Figure 2.3 Repeat attacks on markets causing civilian casualties

The SLC and affiliated pro-coalition forces were the alleged perpetrators in 83% (234) of market attacks, and the Houthis were the alleged perpetrators in 11% (32). There were 15 attacks (5%) in which a specific alleged perpetrator was unknown, as well as 2 (1%) by the IRGY.

As mentioned in the report's introduction, markets were the site of the greatest number (15) of total (21) unknown perpetrator attacks in this database. This is partially due to the fact that there have often been military clashes in close proximity to residential and market areas, [MAR_0145], [MAR_0276], and [MAR_0304]. There were also 13 incidents allegedly involving explosive devices being planted inside markets by unknown armed men or militias, in some cases with the Houthis suspected, and in others, various 'pro-coalition' forces such as the UAE-backed Abu-Abbas Brigades, suspected. These incidents allegedly involving planted explosive devices include: [MAR_0223], [MAR_0230], [MAR_0319], [MAR_0320], [MAR_0321], [MAR_0322], [MAR_0329], [MAR_0330], [MAR_0334], [MAR_0336].

Case Study Summary:

June 2016 Attack on al-Luqma Market in Taiz⁷

Yemeni Archive was able to identify likely alleged perpetrator in some cases of clashes nearby markets. The Yemeni Archive carried out an in-depth case study on such incident, in Taiz Old City in 2016. The full investigation for this case study is available in Appendix I.

Incident	Shelling a market in Taiz Old City of Taiz governorate
Type	Artillery shelling
Location	Al-Luqma market in Al Bab Al Kabeer, Al Mudhaffar district, Taiz governorate
Date	3 June 2016
Time	Between 03:20 and 03:32 pm local time
Victims	Allegedly 9 killed, including a child and two women, and 11 injured, including a child and two women
Potentially Responsible	the Houthi-Saleh forces

On the morning of 3 June 2016, military confrontations started east of Taiz city, during which shelling of residential neighborhoods continued until midnight. On the evening of 3 June 2016, a crowded popular market in Taiz Old City in Al Mudhaffar district of Taiz governorate was shelled allegedly with artillery, as part of a series of attacks on the city. The shelling on the market caused civilian casualties, including children and women. A school and mosque were also reportedly hit in the same series of shelling that evening.

Taiz Old City is located in Al-Mudhaffar district, in Taiz governorate. Al-Luqma market is on a road linking the eastern part of the Old City with the rest of Taiz city. Every day, thousands of civilians pass this road.

Taiz Old City mostly remained under IRGY control [since the first days of the war](#). The historic Al-Qahira Castle, however, was [controlled by the Houthi-Saleh](#) forces due to its strategic location, overlooking the city, until the Popular Resistance forces loyal to the IRGY took control of Al-Qahira Castle in [August 2015](#).

⁷ See Appendix I for full investigation and open source details



Figure 2.4 Screenshots of market impact site

Above are screenshots from videos by [Yemen Shabab TV](#), [Belqees TV](#), [Belqees 2 TV](#), [Sharjah 24 News](#), images from [Khaled Fouad Al-Binaa](#), and a satellite image from Google Earth, showing how fragmentation flew south, west and southeast. This appears to be in contrast to how mortar fragmentation of the shell might fly in all directions.

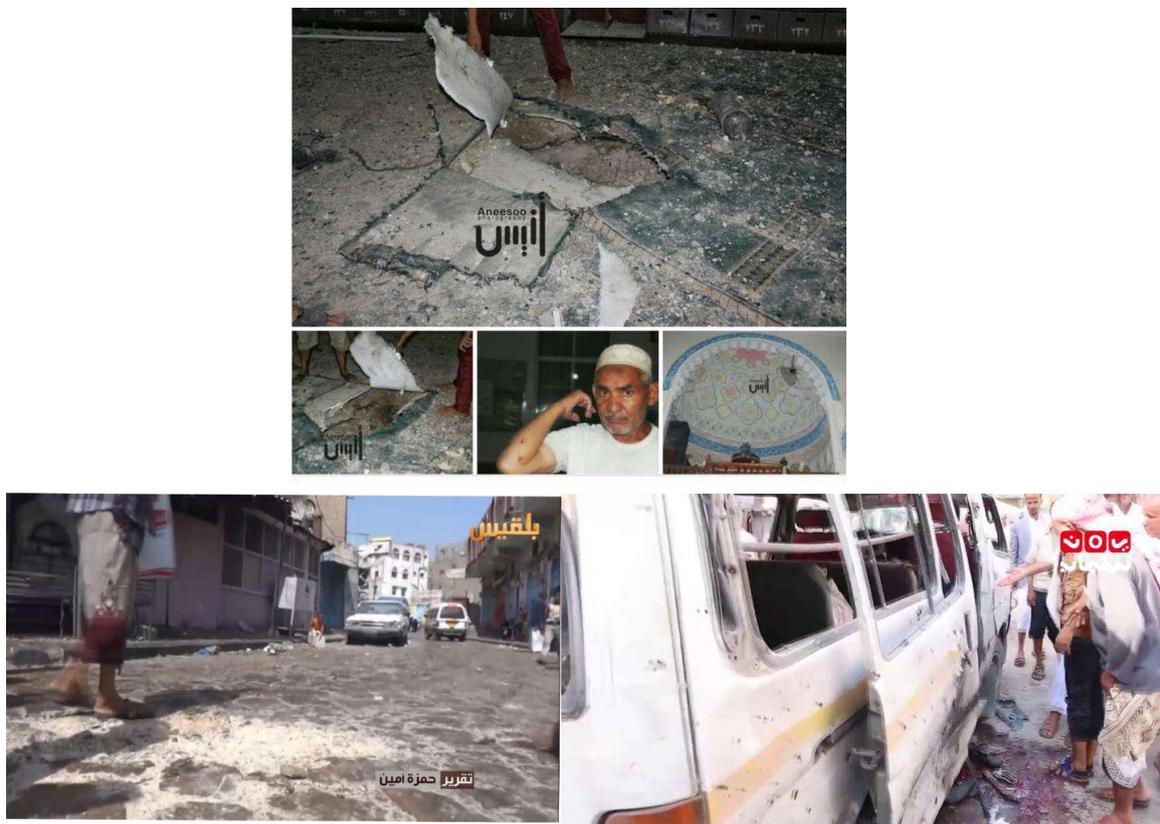


Figure 2.5 Photos of mosque and market impact

These images show what is claimed to be damage resulting from this specific attack on the mosque and the market. The top photo is from a [Facebook post of the mosque](#) after the attack. The bottom left photo of the market is from [Yemen Shabab One](#), and the bottom right photo of the market is from [Belqees Channel](#).

As military confrontations on the eastern front of Taiz continued, on 3 June 2016, the Houthi-Saleh forces allegedly hit [Al-Qahira Castle, which has been used as a military site since the beginning of the war](#) and is next to Hayel School, in which the second shell fell after the shell on the market. [Hayel School is a gathering point](#) for the Popular Resistance, commanded by Abu al-Abbas. That suggests that the Houthis were likely responsible for the attack, as does weapons remnants content obtained for the attack on the mosque.

Analysis of open source content related to this incident found location information and weapons content for two other sites allegedly hit on the same night: Hayel School for girls, 240 meters from the market, and Jamal al-Din mosque, 84 meters from the market.

The Yemeni Archive team's analysis of open-source evidence supported findings that the three shells fell in a straight vertical line, which means that they came from the same cannon.

[Taha Saleh's post](#) shared information about the second shell that fell minutes later near the market. Journalist [Ahmed Al-Basha](#) from Taiz, who documented the incident in Al-Luqma market, stated that the second shell hit the staircase leading to the roof of Hayel School for girls. The location in which the shell fell appears to be at the coordinates [13.571071, 44.009967](#) about 240 meters from the market.

At [about 10:00 pm](#) on the same day, [a third shell](#) fell unexploded on [Jamal al-Din mosque](#), 84 meters from the market. Open source analysis appeared to show evidence that the shell was an old 122mm howitzer shell of type [OF-462A](#). The three impacted sites ([the school - the market - the mosque](#)) formed a straight line, with a negligible horizontal deviation and a difference in vertical distance. The precision of the trajectory of the three shells suggests that the three sites were shelled by howitzers, which are more precise than the other type of weapon suggested by some sources, [Katyusha missiles](#).



Figure 2.6 Photo of unexploded shell in Jamal Al-Din mosque

A photo from [Anis Al Shaer's Facebook account](#), showing the shell that fell on Jamal Al-Din mosque and did not explode

Many civilian casualties were reported in different areas of Taiz city. The estimated number of the victims of Al-Luqma market differed. However, a report by the [Yemeni Coalition for Monitoring Human Rights Violations](#) about the market incident, said that 9 civilians, including a child and two women were killed, and 11 civilians, including a child and two women were injured.

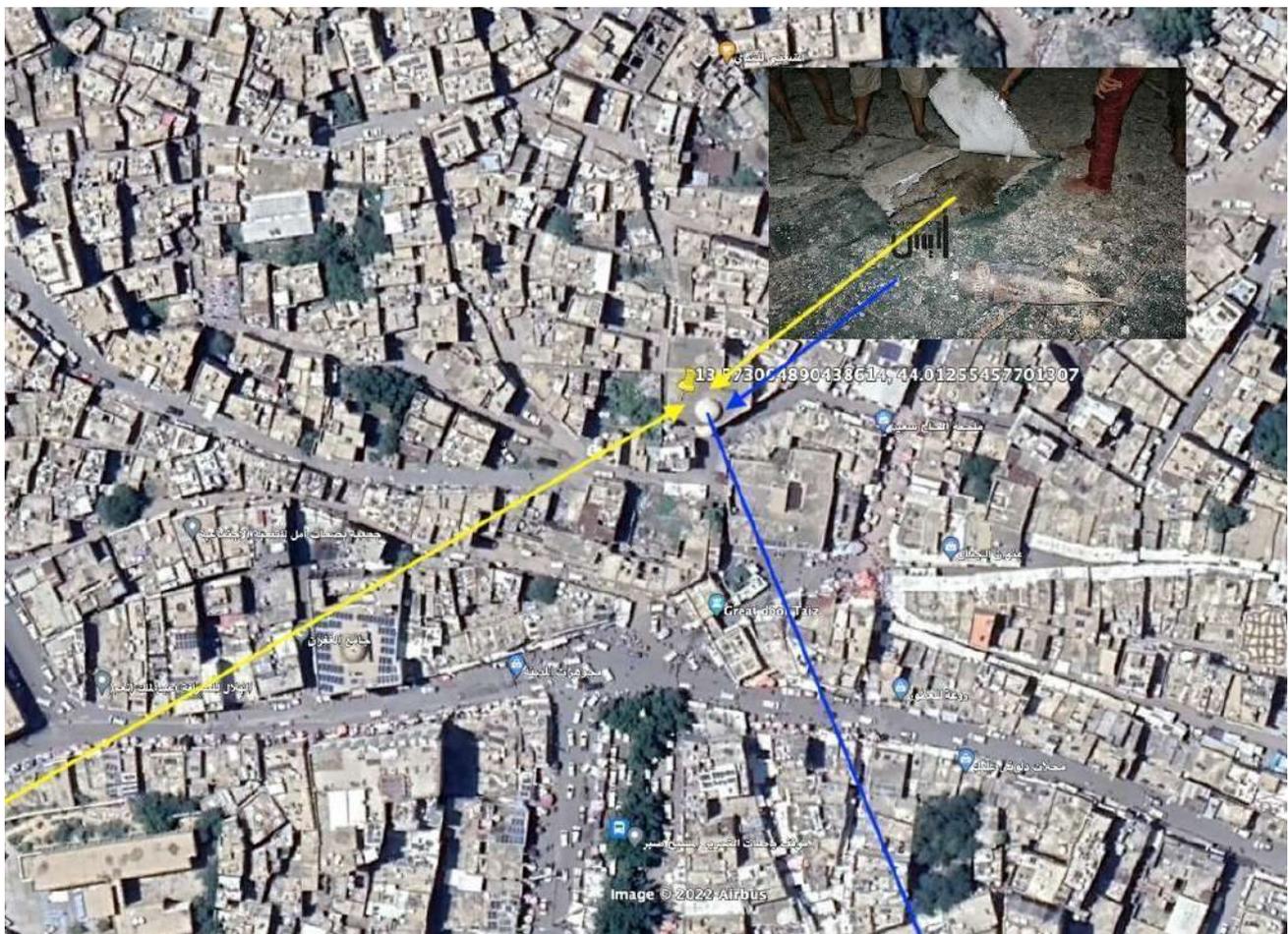


Figure 2.7 Images of shell trajectory

A satellite image from Google Earth, and a photo from Anis Al Shaer's Facebook account the shell trajectory (yellow), and the direction of qiblah/north west (blue)

The lines of engagement between the Yemeni Government and the Popular Resistance forces on one hand and the Houthi-Saleh forces are 2 km away along the line from the market site. This area is under the control of the Yemeni Government and the Popular Resistance forces. While the rest of the area, including the heights and camps, along the same line to Taiz International Airport, is under the control of the Houthis.

Significance of case: Yemeni Archive was able to conduct a deeper investigation for this case with available visual information showing weapons remnants and impact on civilians, including number of reported victims in previously published reports. As explained in the full investigation in Appendix I, Yemeni Archive was able to assign likely attribution to the Houthis as alleged perpetrators based on visual information posted on social media of weapons remnants on a nearby attack on the Jamal al-Din mosque the same evening, as well as known information on area of control and lines of engagement between Houthi/Saleh forces and coalition/IRGY forces at the time of the attack in June 2016. This visual information offered support for the same perpetrator being behind the market, school, and mosque attack that evening. Finally, this incident is a representative example of an alleged Houthi attack on a market in the governorate of Taiz. In Yemeni Archive's database, Taiz was disproportionately affected in terms of the number of incidents with reported civilian casualties, as were attacks on markets.

Where are these attacks happening?

By governorate, one third of all market attacks in this database occurred in Saada (92), 16% in Marib (47), 13% in Taiz (36), 9% in Hudaydah (26), 9% in Hajja (25), and 7% in Sanaa (22). These six governorates also account for more attacks than any others in this database.

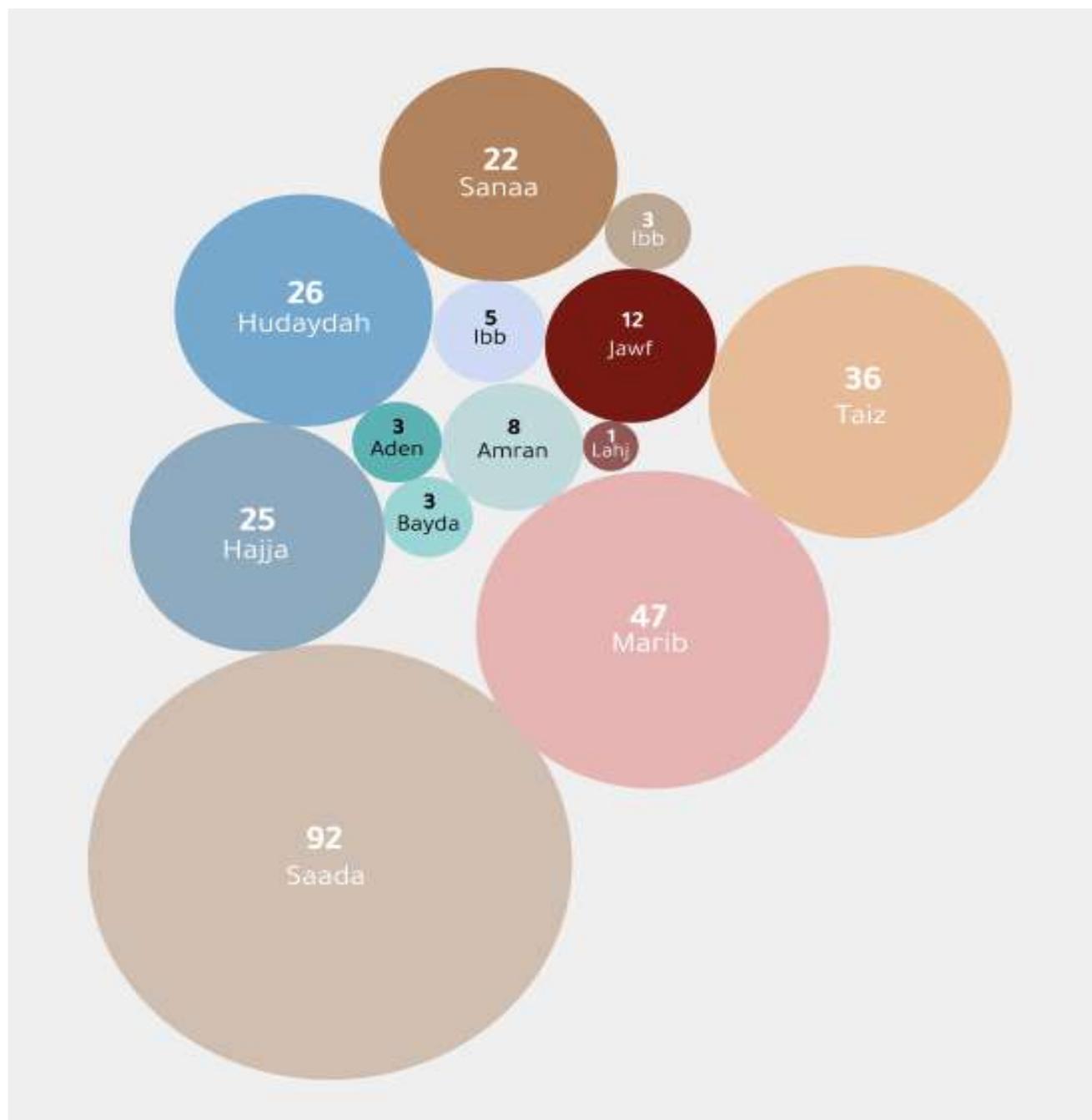


Figure 2.8 Attacks on Markets by Governorate

158 market incidents involved a repeat attack, accounting for 68% of all repeat incidents in this database. Sirwah market in Marib governorate was directly hit allegedly by SLC airstrikes on 28 different occasions between 2016 and 2018.

al-Raqu market near the Saudi border in Saada governorate was directly hit allegedly by artillery from Saudi-led coalition forces on six separate dates between 2017 and 2021. Two of these incidents [MAR_0296 in 2019] and [MAR_0243] in 2021] were also double taps with multiple civilian casualties reported, meaning that attacks would have likely been ongoing even as paramedics arrived to help injured civilians.

Impact of attacks on markets

The current crisis of starvation in Yemen is driven by overlapping factors, including blockades affecting the supply and price of food, fuel, and medicine in a country that imports 90% of its food. [20 million Yemenis](#) (two thirds of the population) currently face hunger and malnutrition. The humanitarian crisis remains the world's largest, and the rate of child malnutrition is [one of the highest](#) in the world. Food scarcity has primarily been driven by high costs and poor accessibility to food and other essential goods rather than actual availability of food. The [frequent attacks on and fighting close to markets](#) in Yemen has further worsened the crisis of accessibility of food for most Yemenis. [65% of the population](#) lives in rural areas, and most rely on markets for accessing food. According to Oxfam, only 40% of rural households, however, live within 20 km of a market. With the highly inflated price of fuel as well as food, getting to a market has already become an immense obstacle to many Yemeni civilians. With repeated damage to markets and the high safety risk of going to a market that the constant proximate fighting brings, the simple act of purchasing food has become a risk to the lives of Yemeni men, women, and children. As for the impact of the related worsening starvation crisis, [women are often disproportionately](#) affected, as they tend to be the first to skip meals in order to increase rations for their family members.

3. Attacks on Oil and Gas Infrastructure

Introduction

This section details the total number of attacks on oil and gas facilities, including gas stations, oil trucks, tanks, and ports. It includes percentages of repeat attacks and double taps, percentages by alleged perpetrators, and how these attacks were distributed geographically and chronologically. It concludes with the long-term humanitarian impact that these attacks likely have on Yemeni civilians by further limiting access to fuel in a country where fuel for transportation of food, water, and medicine, as well as pumping water, is essential for survival.

Yemeni Archive's data tracks attacks on Yemen's oil and gas from 2015 to 2022. The role of oil in the conflict precedes 2015 and has been multifold in terms of physical attacks and policies affecting exports and imports: dwindling export revenue, blockades minimizing the amount of fuel that can be imported and driving up prices, and attacks further driving up prices.

Prior to the start of the current conflict, fossil fuels accounted for over 90% of Yemen's exports. In the years between the 2011 uprisings and the start of the 2015 Saudi-led intervention, [non-state actors frequently targeted](#) oil and gas pipelines with the aim of harming the ruling elites' revenue. [According to the World Bank](#), by 2015, Yemen's exports of fossil fuels dropped from accounting for 70% just one year prior in 2014 (and down from 92% in 2012) to zero. Since the Saudi-led military intervention that year, Saudi airstrikes have been reported to strike a number of oil sites in Yemen, as non-state actor attacks, increasingly by the Houthis, have continued. With 171 recorded attacks on oil and gas facilities allegedly by the SLC and the Houthis, Yemeni Archive's data offers potential evidence for these attacks.

Since the start of the Saudi and UAE-led coalition's 2015 military blockades of Yemen's ports and subsequent Houthi policies further inflating prices, an [extreme crisis of limited fuel availability](#) has been at the heart of Yemen's humanitarian crisis. This has hurt Yemenis economically not only for making fuel so expensive, but in how it has severely hindered transportation of food and the [extraction and treatment of water](#) with diesel-powered fuel pumps as well as energy requirements of wastewater treatment plants.

The graph below shows attacks on oil/natural gas facilities (orange) compared with attacks on all other types of facilities (blue) from 2015 to 2022

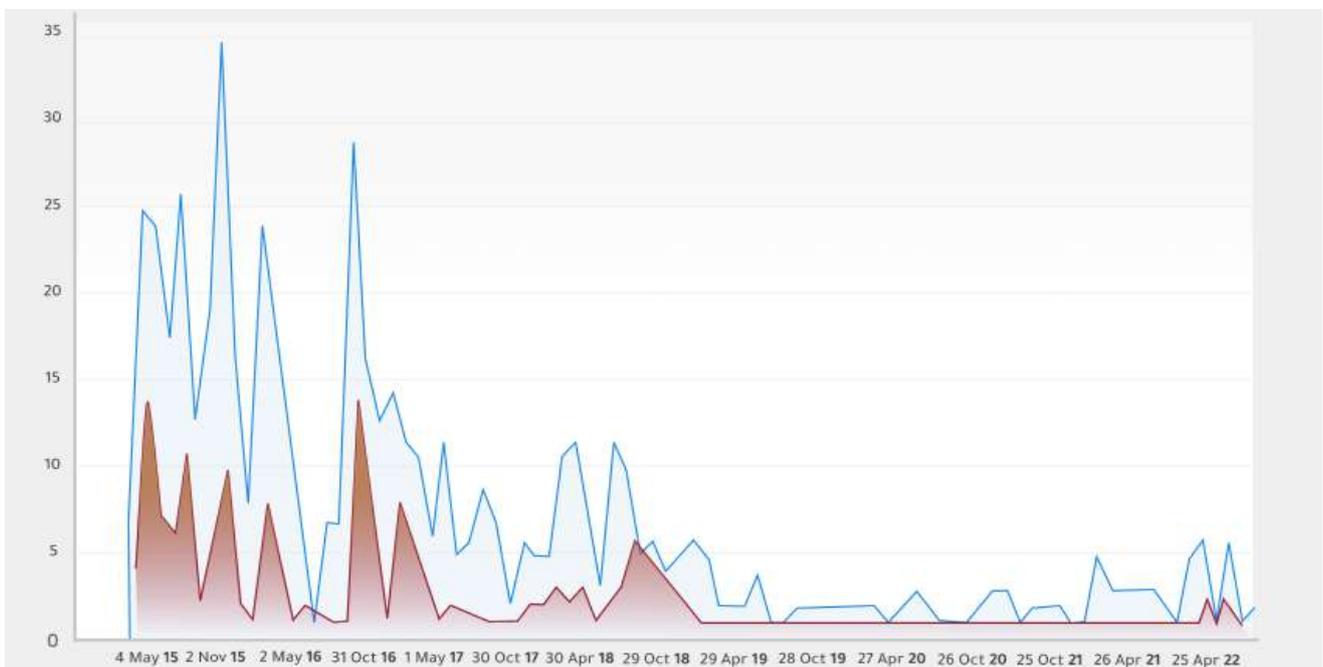


Figure 3.1 Attacks on oil/gas facilities 2015-2022

Key findings

Yemeni Archive’s economic infrastructure data includes 171 attacks on oil and gas facilities, the second most common type of economic facility attacked in this database. Of the 171 attacks on oil and gas infrastructure, 42% (71) caused civilian casualties, and 18% (31) of the oil/gas incidents involved a repeat incident on the same alleged impact site. 8 attacks were double taps, accounting for 24% of all double taps in this database.

The data shows that 89% of these attacks on oil/gas were allegedly by the SLC and affiliated pro-coalition forces, 9% by Houthi forces, and 2% by unknown perpetrators. 131, or 76%, of all attacks on oil and gas in this database were direct hits.

The chart below shows attacks on oil and gas facilities by each alleged perpetrator from 2015 to 2022.

Oil/gas infrastructure Alleged perpetrator	2015	2016	2017	2018	2019	2020	2021	2022
Coalition led by Saudi arabia	59	46	17	17	2	3	2	4
Houthis rebel movement	3	1		1		2	5	3
Pro-Coalition forces				1			1	
Uknown	2				1			1

Figure 3.2 Attacks on oil/gas by alleged perpetrator 2015-2022

Although, as with the rest of the data, more attacks on oil and gas occurred in 2015 than any other year from 2015-2022, followed by a decline in 2017, there nonetheless appears to have been slightly greater consistency in the continuation of attacks on this type of resource by both major parties, as compared with the other infrastructure in this database. For example, as the chart above shows, there were 8 yearly attacks on oil/gas in 2021 and again so far in 2022, including those allegedly by the Houthis as well as the SLC. By comparison, there were 4 on water and 1 on electricity in 2021 and, respectively, 3 and 1 so far this year on water and electricity.

Continued attacks on oil facilities reflect the degree to which battle over control of oil is a key component of the conflict, and a tool of retaliation by both sides. In one incident from March 2022 in this database, for which Yemeni Archive previously carried out an [investigation](#), the SLC justified its attack on an oil port in Hudaydah as a response to Houthi attacks on Aramco facilities in Jeddah.

For many of the incidents involving an oil or gas station allegedly being directly hit by the SLC, there were some sources claiming there were Houthi fighters present who had already taken over the station, and thus denying it was a civilian site. See for example, INF_0612, INF_0625, and INF_00099. When the JIAT or SLC responded to allegations of human rights violations in incidents involving civilian gas stations, it also on at least one occasion denied intentionally targeting a gas station at all. For example, in INF_00091, also a direct hit, the JIAT responded by claiming Houthis had taken over Abdulwahab Gas Station in Radha City, Taiz, and that the SLC hit a building nearby that had Houthi fighters stationed inside. The SLC insisted Abdulwahab Gas Station and civilians were not affected by the bombing.

In a rare admittance of responsibility, on 26 March 2019 [INF_00659], the JIAT responded to allegations of SLC attacking of a gas station by stating that the SLC had inaccurately assessed the possibility of entering a non-military area while upholding its military advantage over the Houthis. The JIAT stated that a defect led the bomb to miss the intended military target by 100 km, leading the bomb to damage the entrance to the hospital, as well as a gas station. In another incident [INF_00690], on 26 March 2022, the official Saudi Press Agency tweeted warnings to Yemeni civilians to avoid oil facilities in Hudaydah, minutes before carrying out airstrikes on the Houthi-affiliated Yemen Petroleum Company as well as a gas station in Hudaydah and other sites in Sanaa. For this incident, for which [Yemeni Archive published](#) an investigation, there was no JIAT statement. Through the [Saudi Press Agency](#) and other [Saudi state funded media](#) on Twitter, the coalition framed this as a military response to Houthi attacks on Saudi oil facilities one day prior.

The high number of incidents with civilian casualties from gas stations and oil infrastructure is likely due to the explosive nature of petroleum, as many of these incidents set off explosions affecting buildings and vehicles nearby. For example, an incident involving an indirect hit on two petrol stations, a number of civilians were killed and injured from the explosions. Yemeni Archive carried out an investigation on this incident, which is available in full in Appendix I.

Case Study Summary:

March 2015 Bombing Fuel Stations and Gas Tank in Yarim⁸

Incident	bombing two fuel stations and a gas tank in Yarim, Ibb governorate
Attack Type	Air Strike
Location	Yarim city, Ibb governorate, Kataf area, Yarim district, Ibb governorate
Date	31 March 2015
Potential munition	unknown
Time	Between 03:20 and 03:32 pm local time
Victims	Allegedly 32 killed, including children and women, 81 injured, including children and women
Allegedly Responsible	the Saudi led coalition

On the dawn of 31 March 2015, social media platforms circulated [news](#) of civilian casualties in airstrikes [attacking gas tanks and fuel stations](#) in separate areas in Yarim district, north of Ibb governorate, as part of a series of air raids launched by the Saudi led coalition, which hit military camps and [points](#) of Houthi-Saleh forces. The strikes came when there was a [stifling crisis of oil derivatives and cooking gas](#) in Yemen, as the war entered its early days. The demand for oil and gas increased dramatically with the large wave of displacement from cities under military battles, in addition to the military acquisition of the governorates' shares of oil derivatives for military needs, as well as the Saudi led coalition's blocking of ships from entering the ports. The prices of oil, diesel and gas rose [skyrocketed in "the black market,"](#) casting more [suffering on civilians.](#)



Figure 3.3 Gas tank impact images

This is a satellite image from Google Earth, of the [area where the gas tank was bombed near a Houthi-Saleh military point](#). It is compared here with screenshots from [Youthstand47's video](#) of the site after the attack.

⁸ See Appendix I for full investigation and open source details

The two tweets (Figure 3.4, below) by Saudi state-run news outlet Almnatiq offered support that Saudi Arabia [confirmed](#) that the Saudi led coalition aircraft hit two fuel stations in Yarim. The strikes were documented by [videos](#) posted by [Abdul-Rahman Qaid Al-Hajari](#) on YouTube. As satellite images show at the site that open source analysis identified earlier, a gas tank was bombed near a military point, which corresponds to the news by [Saudi Almnatiq newspaper](#) that the coalition hit a military point in Yarim. This offers confirmation of the coalition's responsibility for the three strikes.



Figure 3.4 Screenshots of tweets from Almnatiq Newspaper

The above tweet from Almnatiq states that coalition forces have attacked a Houthi militia checkpoint in the Yarim district, south of Dhamar city, killing 18 Houthi militants. It came at 7:28 AM, two hours before Almnatiq's tweet about the coalition's bombing of two fuel station in Yarim.



Figure 3.5 Screenshot from [Abdul-Rahman Qaid Al-Hajari](#) YouTube video of Gas station 1



Figure 3.6 Screenshot from [Abdul-Rahman Qaid Al-Hajari](#) YouTube video of Gas station 2

The attack hit three different locations in Yarim district. One of the strikes hit a gas tank at a military point on the main road in Bab Al Doreen area near the southern entrance to Yarim city (screenshot below), while the other two stations were located in Kataf area in the same district, approximately 10 air kilometers from Yarim city. They are separated by less than 200 meters.

The air strikes on Yarim, which impacted two fuel stations and a gas tank, allegedly killed 32 civilians, including 9 children and two women, and injured 82 civilians, including 7 children and 11 women, according to [a report](#) by the Legal Center for Rights and Development.

An [Amnesty International report](#) documented the incident, stating that 14, including at least 6 civilians, 4 of whom were children, were burned to death in the attacks on the two petrol stations. According to Amnesty, the third raid on a transiting fuel tanker ignited at least 3 civilian houses. On YouTube([1,2,3](#)), videos showed burning cars and people gathering around them. In the videos, ambulances sirens can be heard. The videos also showed a big tanker completely burnt with smoke rising from it, charred bodies and a destroyed food carrier where milk cans can be seen on the ground.



Figure 3.7 Screenshots of Gas Station 1 from [Youthstand47](#) YouTube video, and a satellite image from Google Earth

Station 1

The station was located in Kataf area, south of Yarim district at coordinates: [14.206555, 44.311842](#), based on the visual content in [a video posted](#) by Yarim Youth Forum on Facebook.

Station 2

The station was located in Kataf area, south of Yarim District, at coordinates: [14.208391, 44.314509](#), based on the visual content in the aerial footage of the attack, by [Abdul-Rahman Qaid Al-Hajari](#)'s YouTube channel

Significance of case: This case is noteworthy because it shows how analysis of open source content revealed Saudi admittance of targeting a military checkpoint and fuel stations. By comparing these Saudi tweets with other open source content, Yemeni Archive found support for coalition's targeting of two fuel stations and a gas tank. What otherwise may have been a challenge with the lack of visual content showing weapons remnants, was remedied with open source information including Saudi government statements. This incident also exemplifies a trend throughout the database in which the coalition admits to hitting gas stations but claims they were military targets.

Where are these attacks happening?

Of the attacks on oil and gas facilities, 30% (51) occurred in Saada, 12% (21) in Sanaa, 9% (17) in Taiz, 9% (15) in Hajja, 7% (12) each in Marib and Shabwah, and 6% (11) in Hudaydah. Proportionally, the oil rich governorates of Shabwah and Marib stand out here. Respectively, oil/gas attacks accounted for 69% and 75% of all attacks in Shabwah and Marib governorates in this database. Half of those in Shabwah were in 2022 alone, allegedly evenly split between (3) Houthi and (3) SLC forces.

The chart below illustrates how all attacks on oil/ gas facilities in this database were distributed across Yemen's governorates.

Ad-Dali	1	Jawf	7
Aden	3	Lahj	2
Amran	7	Mahwit	1
Bayda	2	Marib	12
Dhalie	2	Saada	51
Dhamar	1	Sanaa	21
Hajja	15	Shabwah	12
Hudaydah	11	Taiz	17
Ibb	6		

Figure 3.8 Attacks on Oil/gas by Governorate

Impact

In a country that [imports 90% of its food and fuel](#), and which requires diesel to power most water pumps, the extreme shortage of fuel since 2015 has severely diminished the ability to produce and transport critical infrastructure throughout the country. At the same time, the struggle for control of Yemeni oil exports as a key source of government revenue has grown between the Houthi-run government and the SLC-backed IRGY. In addition to directly killing civilians, attacks on oil and gas facilities in Yemen affect one of the country's most essential commodities to life and the right to be free from hunger in Yemen. At the same time, these physical attacks offer the major parties to the conflict the opportunity to magnify blame against the opposite side for political expediency, presumably worsening already extreme polarisation, and prolonging the conflict itself.

Fuel prices in Yemen spiked with the SLC intervention in 2015, and have continued to remain highly inflated due to the conflict and a multitude of political factors caused by the coalition, the IRGY, and the Houthis. The unaffordability of fuel stems from the [SLC's blockade](#) on the port city Hudaydah. At the same time, the Houthis have politically taken advantage of the coalition's blockade by [doubly taxing fuel shipments](#) at Houthi controlled areas (after initial taxation at the port of entry) and raising retail prices to drive up Houthi profits.

Finally, attacks on oil and gas stand out in Yemeni Archive's database as the most consistently sustained attacks on infrastructure. This is especially noteworthy given how the military conflict and economic warfare have increasingly merged. Since coalition-backed IRGY forces regained control of [Shabwah in January 2022](#), the oil rich governorate has experienced coalition infighting. In August 2022, due to intra-coalition differences driven both the [Yemeni Muslim Brotherhood's \(Islah\)](#) role in the IRGY and rivalry over oil resources, [the UAE-backed STC forcibly](#) took control of Shabwah from IRGY forces. Since then, and particularly after the failure of the truce renewal in October 2022, the [Houthis have been disrupting the export](#) of crude oil exports in Shabwah and Hadramawt governorates. They have [argued that Yemeni crude revenues](#) are more than sufficient to pay the withheld salaries at the center of Houthi refusals to renew the 2022 Ramadan truce.

The use of oil as a tool to fight over has been central to the internationalisation of the conflict. Houthi cross border attacks on oil facilities in Saudi Arabia and the UAE, which are outside the scope of Yemeni Archive's data on events inside Yemen, have brought greater international attention to the conflict over the last three years. Yet, sole focus on growing threats Yemen poses to its wealthier Gulf neighbours involved in the conflict overlooks the sorts of attacks inside Yemen that Yemeni Archive has extensively documented here, as systematic attacks on Yemen's own oil and gas facilities, by all parties to the conflict. In other words, recent Houthi attacks on international oil facilities have come alongside what appears to be attempts by both the coalition and the Houthis to seize control of and attack fuel supplies in Yemen, dating to the start of the Saudi and UAE-led intervention in 2015.

4. Attacks against Water infrastructure

Introduction

This section details the total number of incidents involving attacks on infrastructure for drinking water and agriculture, including water treatment and desalination facilities and well water pumps and rigs. It explains the types of attacks in terms of how many were double taps as well as repeat attacks. It also describes how these attacks were distributed by the alleged perpetrators, as well as geographically and chronologically. It concludes with how this evidence lends potential support for claims that attacks on Yemenis' water supply may be systematic, a weaponization of an increasingly scarce essential good.

[The International Committee for the Red Cross](#) estimates that policies such as blockades impeding fuel shipments, failure to pay civil servant salaries, and physical attacks on infrastructure together have culminated in 17.8 million people lacking access to safe water and adequate sanitation services in Yemen. Exacerbating pre-existing issues of government water mismanagement and climate change, [the conflict's effect on the water supply](#) has been a main driver in what has become the [world's largest cholera outbreak on record](#). As of 2019, there had been a total of [2,188, 503 cases](#) of cholera reported.

Key findings

This dataset includes 119 attacks on water facilities, 22% (26) of which allegedly caused immediate civilian casualties. 18% (22) were repeat attacks, and 3% (4) were double taps. As compared with other incidents in this database (76% each), an even higher percentage of attacks on water infrastructure (88%) were direct hits. 90% of the attacks on water facilities (107) were allegedly carried out by the SLC, 8% (10) by the Houthis, 1% by IRGY forces, and 1% by an unknown perpetrator.

The graph below, Figure 4.1, depicts attacks on water infrastructure from 2015-2022. As the graph shows, attacks on water infrastructure in this database were heavily concentrated from 2015-2018, with the most significant decline beginning in 2019.

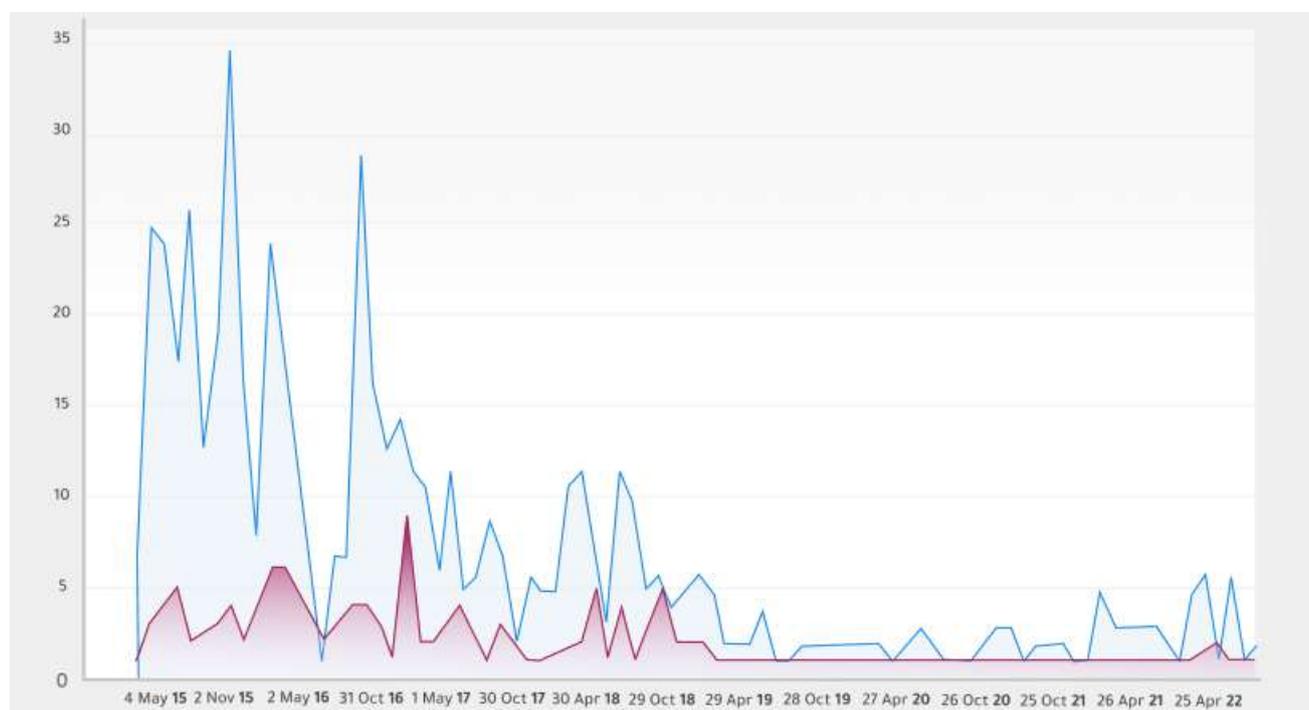


Figure 4.1 Attacks on Water Infrastructure 2015-2022

Where are these attacks happening?

In this database, 24% (28) of attacks on water infrastructure were in Saadah, 21% (25) in Hudaydah, 16% (19) in Sanaa, 10% (12) in Taiz, and 8% (9) each in Marib and Hajja. As a mountainous, semi-arid region that is historically among modern Yemen's most economically impoverished, [Saada is one of many governorates in Yemen that faced water scarcity](#) before the current conflict, and this has [worsened](#) dramatically [since 2015](#). [Mwatana documented](#) 17 SLC attacks on water facilities in Saada from 2015-2020, with one interviewee noting most were in 2015/2016. While this fits with our overall data, we have 28 total attacks on water in Saada, but with a larger number in 2018. Nearly one quarter (28) of the total water related attacks were allegedly by the SLC in the Houthis-controlled governorate of Saada alone.

The following chart shows attacks on water infrastructure distributed by governorate.

This database includes documentation of nearly as many attacks on water infrastructure in Hudaydah (25). This includes 8 allegedly by the Houthis, which comprise most of the 10 alleged Houthi attacks on water in Yemeni Archive's database, all between 2018 and 2021. They include two incidents of a repeat attack on the main water tank for al-Tuhayta city in the south of Hudaydah governorate, [INF_0069612 and INF_00910] in 2018 and 2020.

There were 5 different instances of alleged SLC airstrikes directly hitting water desalination plants in Kamaran Island, Hudaydah in the years 2016 and 2017, before the Hudaydah Agreement was reached in 2018. [INF_00457, INF_00459, INF_00546, INF_00547, INF_0069639]. Roughly half of the 25 total incidents in the governorate of Hudaydah in 2018 were against facilities providing the population's water supply.

In a case study, Yemeni Archive carried out an investigation on the Saudi-led coalition directly hitting a water rig in a double tap attack in Sanaa, which the SLC admit to having mistakenly attacked.



Figure 4.2 Attacks on Water by Governorate

Case Study Summary:

September 2016 Bombing of Beit Saadan Water Rig⁹

Attack Type	Air Strike
Location	Beit Saadan, Ozlat Al-Thulth, Arhab district, north of Sanaa
Date	10 September 2016
Potential munition	US-made Paveway II bombs
Time	The first attack: between 01:28 and 02:55 am. The second attack between 08:40 and 09:00 am
Victims	22 civilians killed, including three children; 20-42 civilians injured
Allegedly Responsible:	Saudi-led coalition
Physical Damage	Water rig damaged to the point of being inoperable. Equipment and vehicles were damaged, and a number of citizens' motorcycles were destroyed, in addition to the room next to the water rig

A number of social media and other open sources reported that, on September 10, 2016, a water rig in the Beit Saadan area of Arhab District, north of Sana'a, was allegedly subjected to a series of air raids. According to social media users and a Human Rights Watch report, the double-tap consisted of two airstrikes, beginning before dawn and continuing until midday, and occurred in an unpopulated area about two kilometers away from the nearest village. The Saudi-led coalition's JIAT, on the other hand, only mentioned the second attack, claiming it was in retaliation for a Houthi attack, and did not reference the preceding airstrike. The alleged second strike hit civilians and paramedics gathered at the site after the first strike, causing dozens of civilian casualties and property losses.



Figure 4.3 Image [posted on Twitter](#) by Sheikh Muhammad Al-Habbari

This image shows the destroyed room at the site of the water rig, thought to be the land guard room after second attack

⁹ See Appendix I for full investigation, including a detailed overview and analysis of documented open-source evidence in connection with this incident.

The bombing was allegedly carried out by Saudi-led coalition aircraft, per JIAT's acknowledgment during a press conference on September 12, 2017, claiming confusion during visual monitoring that supposedly resulted from similarity between the water rig's crane shape and ballistic missile launchers. The documented visual content shows remnants of one type of munition from the water rig location, which belongs to the US Paveway II bomb, made by Raytheon Inc.

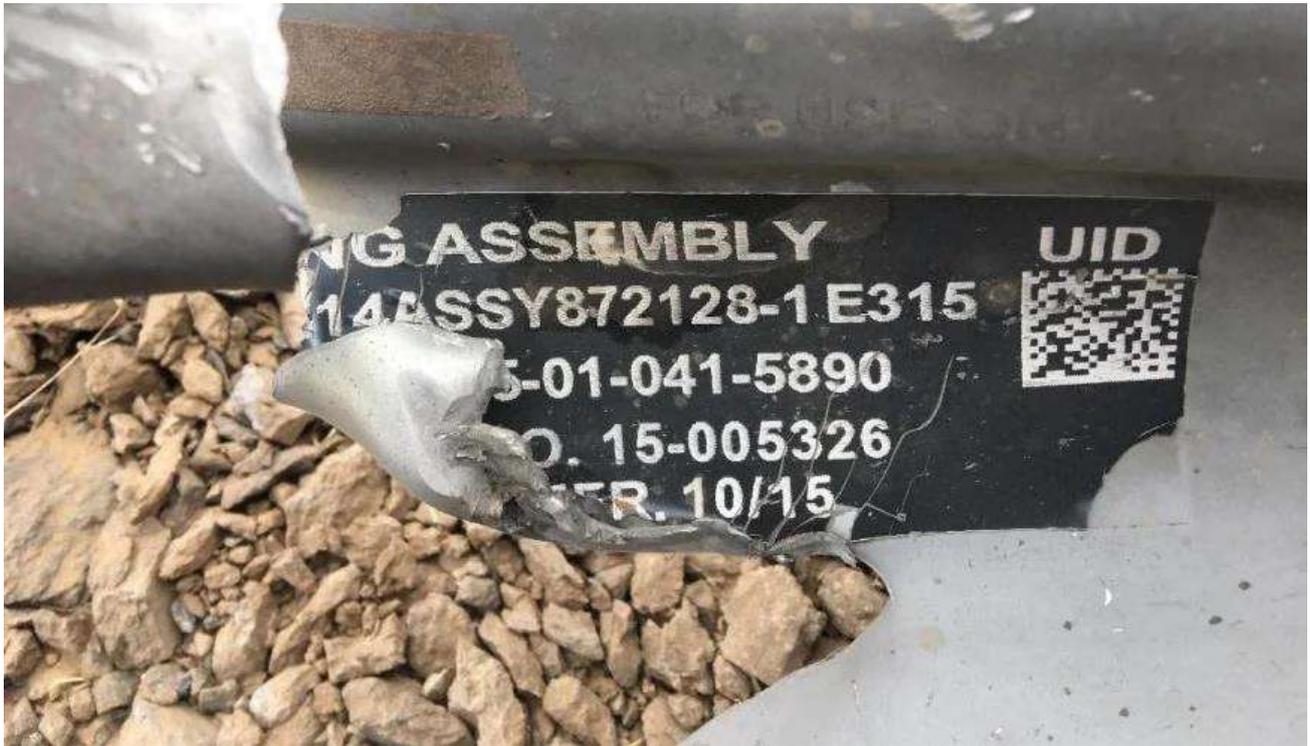


Figure 4.4 A photo of the remnants of the Paveway II bomb used in the attack, found by Human Rights Watch

There are different accounts about the number of victims of the attack in international and local reports, which range from 21 to 31 civilians killed and 20-42 civilians injured, with a number of sources independently confirming the names of 21 or 22 people who were killed. Photos circulated by users on social media on the day of the attack, as well as video reports published on YouTube by channels such as Yemen Today TV, an EU-funded Euronews Arabic, and the Houthi-run al-Masirah TV showed victims' bodies and body parts, including those of children, scattered vehicles, and what appears to be a completely destroyed water rig.





Figure 4.5 Screenshots from the videos posted, respectively, by [Yemen Today TV](#), [Euronews Arabic](#), and [Al Masirah TV](#)

These screenshots offer comparison of the effects of the destruction that resulted from the airstrikes on the water rig, revealed in the videos from Yemen Today TV, Euronews Arabic, and Al Masirah TV. They show consistency from a variety of sources.

Notably, the visual content appears to differ in the level of destruction, which supports Human Rights Watch’s findings that there was a second series of attacks and that the second attack was more destructive than the earlier one. For example, several photos posted on Facebook claim to show the effects of only the first attack, as they reveal what appears to be a land guard room next to the water rig still intact - while later images show the room totally destroyed.

Significance of case The Yemeni Archive team was able to carry out an in depth investigation for this incident with visual evidence showing destruction, including greater damage after the second attack, and weapons remnants, which the team gathered through social media posts, news websites, and a Human Rights Watch report. This was a rare case in which the team was able to attribute with certainty responsibility (for at least the first attack) to the Saudi led coalition, as the coalition’s JIAT had issued a statement acknowledging its airstrike on the water rig for this incident.



Figure 4.6 Photos of control room still in tact

These are photos posted by Abdel-Khaleq Sharhan and Majdi Ahmed Al-Shabibi on Facebook, from different angles, which showed that the room was not totally destroyed, next to the water rig and the vehicles, after the first attack

Impact

There has been evidence alleging that the SLC and Houthis have both systematically attacked water resources in Yemen, including some cases of repeated attacks on the same locations. According to an independent academic study documenting attacks on civilian infrastructure from 2011 to 2019, most attacks on water were carried out by the Saudi-led coalition. Although Yemeni Archive cannot confirm perpetrator attribution in most cases, its data on alleged perpetrator appears to support this conclusion.

While it is also beyond the scope of Yemeni Archive's data and this report to examine the medium and long-term impacts of these attacks on civilian infrastructure, there are particularly noteworthy examples documented by other sources. For example, [UNICEF noted and condemned](#) multiple attacks on the water project in the Nushour area of Saada, including at least two in March 2018, and one in July 2018. Yemeni Archive documented the July 2018 attack in this database (INF_00638), which UNICEF reported cut off 10,500 people in Saada from drinking water in 2018.

[According to the Houthi-run Saba news](#) website, a water tank in al-Nahdin, Sanaa, which Yemeni Archive documented in two incidents [20 May, 2015 INF_00084 and 7 February 2016 INF_00283] had previously been attacked in 20 raids by the SLC. [One other source](#) described the 2016 attack on the al-Nahdin water tank as causing 30,000 civilians to lose access to potable water.

In addition to their own military attacks, the majority of the Houthis' devastation to civilians' water supply has been through [siege tactics and internal resource blockades](#), blocking shipments of water and other resources. AQAP has used a '[carrot and stick](#)' approach, in some cases using water scarcity in the south to gain favor by developing water distribution systems for local populations.

This has all compounded an already fraught situation of low water supplies that the [Yemeni government had created before the conflict](#), through funding wasteful irrigation policies and failing to properly construct and maintain pipes and dams.

5. Attacks against Electric Infrastructure

Introduction

This section explains how many attacks were carried out on electricity infrastructure. It includes percentages of repeat attacks and double taps, percentages by alleged perpetrators, and the percentage that caused civilian casualties. It also includes how these attacks were distributed geographically and chronologically.

Yemen's electrical power [relies primarily on imported diesel and heavy fuel oil \(HFO\)](#). Before the start of the current conflict, [non-state actor attacks on Yemen's energy supplies](#) had become common. The combination of animosity towards Saleh's regime for the US's accidental killing of tribal leaders in airstrikes as well as the 2011 revolution against the regime [led to a spike in non-state actor attacks](#) on Yemen's electricity infrastructure. Spurred by tension between tribes and the regime, groups such as AQAP also opportunistically seized on such moments to increase attacks, with the government responding with its own attacks.

Within this context of growing assaults on Yemen's electricity supply after 2011, the Houthis' seizure of the capital in 2014 and ensuing conflict led to further such attacks. Once the Saudi-led intervention began in 2015, military attacks by state actors on Yemen's energy supplies grew as well.

As explained in the section on oil and gas, Houthi-controlled areas have been negatively impacted by coalition's blockade of international ports. As for areas controlled by the IRGY, [the electricity sector has been widely privatised](#), which has led to high costs for those in government-controlled areas. Amidst these economic limitations on the electricity supply, military attacks on electricity facilities have only further prevented Yemenis from accessing power.

Key findings

This database includes 39 attacks on Yemeni electricity infrastructure, half of which were in 2015 alone. There were 24 incidents involving a repeated attack on the same object or impact site, making electricity infrastructure the object most frequently hit proportionally speaking (61%) in a repeat attack, albeit the one with the fewest overall attacks in this database. There were no reported double taps on electricity infrastructure in this database. As compared with total oil and gas attacks, as well as market attacks, this database has a much smaller share of electricity attacks overall, with 39 of the total 611 on electricity infrastructure. As with most of the other attacks in this database, 76% of these attacks were allegedly direct hits. 9 incidents, or 23%, of the electricity attacks, allegedly caused civilian casualties.

As the graph below on attacks on electricity per year shows, the vast majority of attacks (32, or 82%) on electricity infrastructure occurred in 2015 and 2016.

The following graph (Figure 5.1) shows attacks on electricity infrastructure (in blue), as compared with total attacks on all types of facilities (in red). Figure 5.2 depicts attacks on electricity infrastructure by alleged perpetrator.

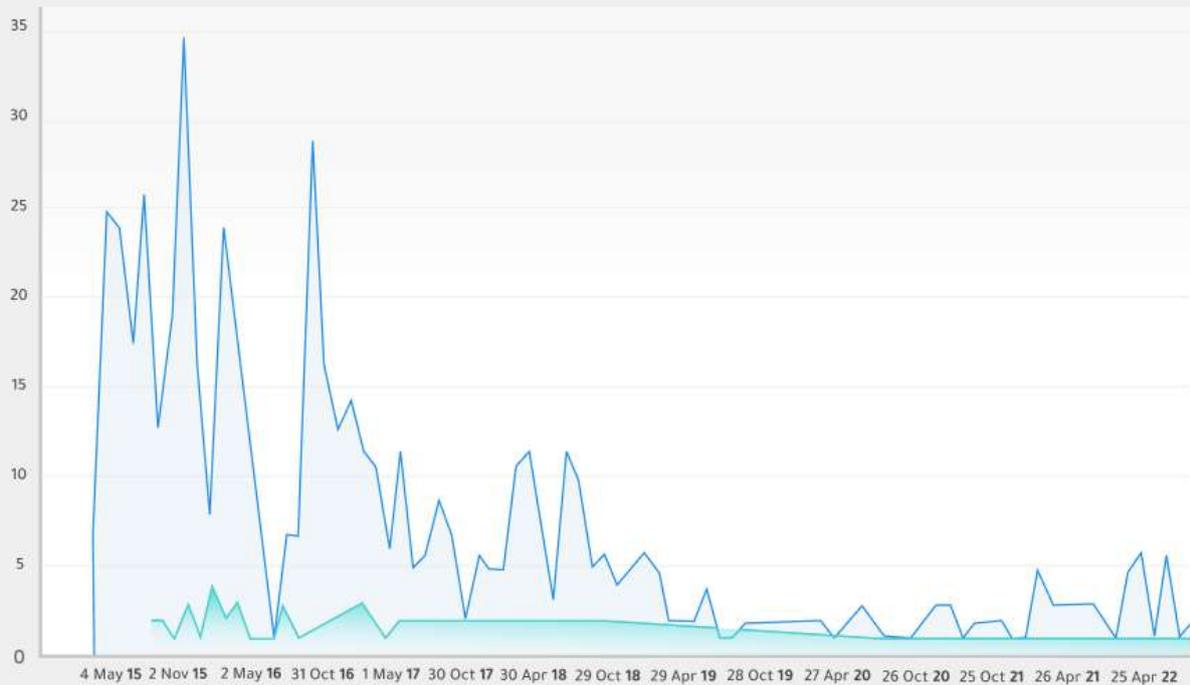


Figure 5.1 Attacks on electricity facilities from 2015-2022

Another interesting point to note about the data on attacks on electricity is the alleged perpetrator. As the graph above shows, the majority in this dataset (30) were allegedly carried out by the SLC. With 8 alleged Houthi attacks on electricity in Yemeni Archive’s data, a greater share of these electricity attacks (20%) may have been carried out by the Houthis as compared with total alleged Houthi attacks (65) on overall economic infrastructure recorded here, roughly 11% of this database.

Most alleged Houthi attacks in this database in 2015 and 2016 were attacks on electricity infrastructure. These include 6 repeat attacks on Osaiferah Electricity Station in Taiz governorate (4 in 2015, 1 in 2016, and 1 in 2017), all allegedly by the Houthis, with one [INF_0069603] involving likely clashes between the Houthis and the internationally recognized government of Yemen. In all of these incidents, the area was under control of the internationally recognized government of Yemen. The Yemeni Archive team carried out an investigation for one of these attacks on Osaiferah Electricity Station, in September 2015. The full investigation for this case study is available in Appendix I.

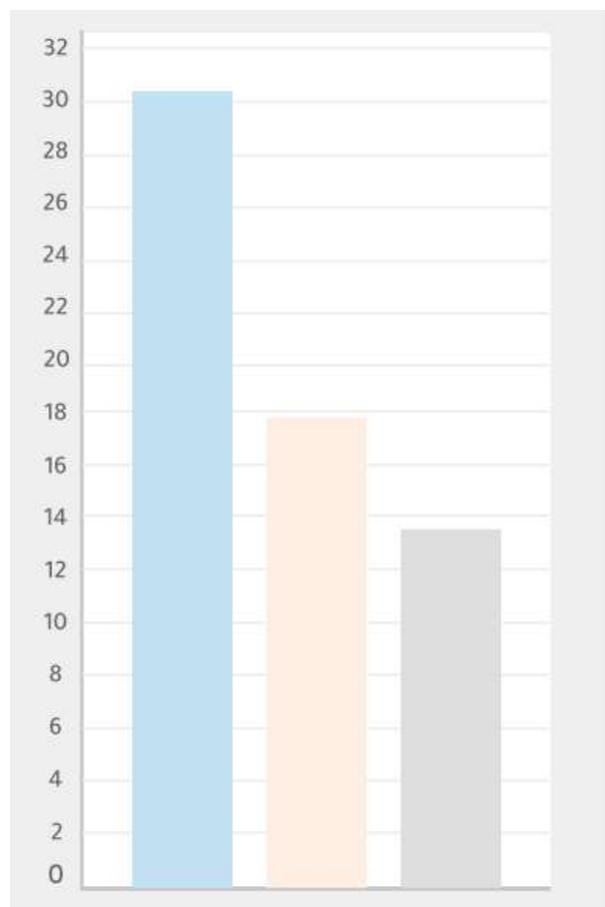


Figure 5.2 Attacks on electricity facilities by alleged perpetrator

Case Study Summary:

September 2015 Attack on Osaiferah Power Station¹⁰ in Taiz

Incident	Shelling the rural power station in Taiz
Attack Type	Missile shelling
Physical Damage	Electrical transformer burned out
Location	Osaiferah, Al-Qahirah district, north of Taiz city
Date	29 September 2015
Time	Between 08:45 - 09:05 am
Potential munition	122 mm BM-21 Grad
Victims	No casualties reported
Probable Responsibility	Houthi-Saleh forces

According to open source information, on the morning of 29 September 2015, alleged artillery and missile shelling hit several areas in Taiz city. The attack hit the rural power plant in Osaiferah area of Al-Qahirah, north of the city, which resulted in burning one of the power transformers and damaging the station's nearby facilities. This event coincided with military confrontations between the Resistance Forces and the government army on one side and the Houthi-Saleh forces in different areas of the city.

This attack on the station was not the first. The station was attacked several times [see incidents INF_0069601, INF_0069602, INF_0069603, INF_0069604, INF_0069605, INF_0069606] since the beginning of the war, and was completely out of service. The station, along with the Mocha station, were the only source of electricity for the governorate and its countryside. As it went out of service, Taiz city lacked government electricity completely. This service was replaced by [commercial \(private\) stations](#), which impose exorbitant prices for electricity services, amounting to approximately (one dollar per kilowatt), in addition to the subscription fees, which are much higher than the financial abilities of people there.

Analysis of open source documentation concerning this incident shows characteristics consistent with Houthi-Saleh force attacks. In [video footage](#) of the site after the attack, Al Jazeera News claimed that the weapon used was a Katyusha rocket (Grad bm-21), a weapon known to commonly be used by Houthi forces. Yemeni Archive's analysis of the munitions used in this attack seem to offer support to [Al Jazeera's reporting](#), although further analysis would be needed to make a definitive conclusion.

¹⁰ See Appendix I for full investigation with open source details



Figure 5.3 Photo of muniton remnants from [Taiz News Network T.N.N Facebook post](#)

This photo shows 6 pieces with internal and external spiral rings connecting the missile parts

Open source documentation of this incident shows that the attack resulted in burning and damaging one of the station's electrical transformers, as well as shattering windows in buildings and containers near the site of the missile strike. There were no reported casualties.



Figure 5.4 Screenshots from [Taiz News Network T.N.N Facebook video](#), showing the burned transformer

Analysis of open-source documentation appears to support claims made by Al Jazeera on the Grad missiles being used. Open-source analysis expanded the possibilities of the missile trajectory in a wider range from the east and north-east directions to ensure not to fall into the error of optical deception because the documentation of the wall was from a side angle. By extending the lines to a distance of 20 km - the range of the Grad missiles - open-source analysis revealed that the farthest point controlled by the coalition's Resistance forces within the area of possible trajectory is located at a distance of 20 km, one kilometer from the power station, while the rest of the area is within the control of the Houthi-Saleh forces. Because this analysis fits with the range of the Grad bm-21 missiles, it offers potential evidence supporting Al Jazeera's claims that the weapon used was a Katyusha rocket (Grad bm-21).

Below is Figure 5.5, a screenshot from [Taiz News Network T.N.N.](#) video on Facebook and panoramic screenshots from [Al-Jazeera](#) video on YouTube showing the possible directions of the missile trajectory based on the impact.



Figure 5.5 Screenshots of possible missile trajectory from T.N.N. and Al-Jazeera

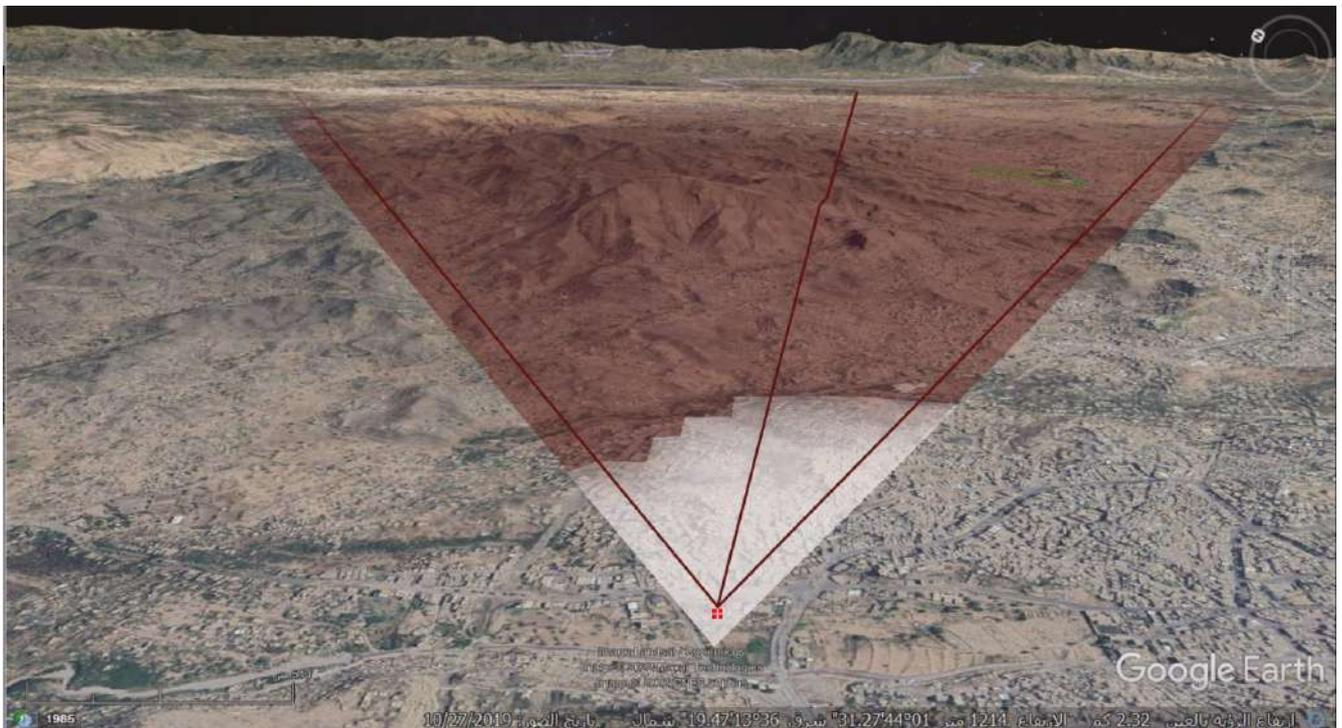


Figure 5.6 Satellite image from Google Earth showing a possible missile trajectory

A satellite image from Google Earth, showing the military control during the shelling period within the possible launch area of the missile.
Brown color: Under the control of the Houthis-Saleh forces

Significance of case Yemeni Archive was able to carry out an investigation for this incident with visual content from social media posts and news sites that corroborated Al Jazeera's reporting on the weapon type used. Based on analysis of visual evidence of the weapons remnants, as well as comparison of the impact site relative to areas controlled by the coalition's Resistance forces at the time of the attack, Yemeni Archive also found content that challenges the possibility of the Resistance forces having been the perpetrators of the attack.

Where are these attacks happening?

In this database, 26% (10) of electricity attacks occurred in Taiz, the governorate in which the case study above took place. In addition, 15% (6) in Hudaydah, and 13% (5) each in Saada, Sanaa, Hajja, and Bayda.

Impact of attacks on electricity

Most attacks on electricity in this database occurred in 2015 and 2016. This fits with recent [academic research](#) on the trajectory of attacks on Yemen's energy infrastructure. The Houthis' attacks on electricity fit a preexisting pattern of non-state actors attacking energy infrastructure as a means of weakening the state's legitimacy, especially after the 2011 uprisings. As fighting between the Houthis and the state increased in 2014, Houthi attacks on energy infrastructure likely surpassed those by other non-state actors.

Beginning with the Saudi-led coalition's intervention in 2015, attacks by both non-state and state actors increased. Although it cannot attribute attacks to specific perpetrators with certainty, Yemeni Archive's evidence on the chronological timeline of attacks from 2015-2022 corroborate these patterns, as do its findings on alleged perpetrators.

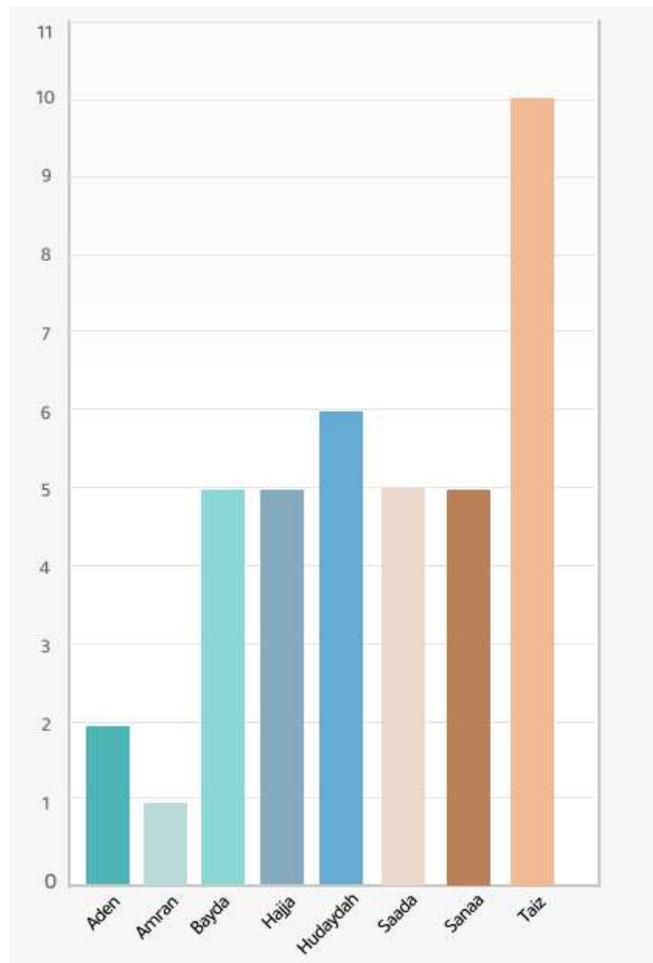


Figure 5.7 Attacks on Electricity Infrastructure by Governorate

Conclusion

This report has detailed attacks on markets, oil and natural gas, water infrastructure, and electricity infrastructure in Yemen from 2015-2022 by all parties to the conflict. It is based on Yemeni Archive's database of open-source documentation of 611 attacks on these four categories of economic infrastructure. For each type of infrastructure in this report, the Yemeni Archive carried out one in-depth open-source investigation of an attack, two of which were alleged to have been carried out by Houthi-Saleh forces and two of which were alleged to have been carried out by the Saudi led coalition. These four case studies took place in the years 2015 and 2016. In-depth investigation of all 611 incidents was not possible, but open sources were compiled for each incident, and the Yemeni Archive team provided summaries based on its assessment of these sources for all 611 incidents. These summaries and other details-such as whether it was a repeat attack, double tap, or involved civilian casualties-are available in Yemeni Archive's database for all incidents.

Yemeni Archive focused this report on a database comprised of these four categories of economic infrastructure because of the high number of incidents it uncovered, and the fact that other organisations, including the UN, have found evidence for systematic attacks on civilian objects critical to the livelihoods of Yemenis. As an extremely dry country that imports 90% of its food and fuel and struggles with water scarcity, attacks on markets and

infrastructure providing these goods and services would likely have further decreased supplies for surrounding areas and contributed to price increases. Furthermore, the essential role of fuel in pumping water and shipping water and food throughout Yemen, where most of the population live in rural areas, cannot be overlooked.

Although Yemeni Archive's team did not carry out assessments of medium and long term impacts of any of these incidents-such as measuring civilian life harmed through the loss of water resources - its work includes references to a number of other sources that have done this in select cases. It also has shown throughout this report how armed attacks on goods and infrastructure critical for human survival have occurred within the larger political and economic context of policies contributing to starvation in Yemen. These include the Saudi and UAE coalition's blockades of Yemen's international ports since 2015, the Houthis' blockade of Taiz since 2015, the IRGY's creation of a second central bank, and Houthis' extortion through additional price inflation and double taxation of essential goods.

It was beyond the scope of Yemeni Archive's work to determine whether these incidents were systematic or intentional. Yemeni Archive does not claim to have comprehensive data. However, the hundreds of incidents, and thousands of sources, offer potential support for and in many cases corroboration for others' claims of human rights violations. With further analysis on means of attribution, such as additional weapons analysis, Yemeni Archive's work could offer potential evidence for supporting claims of violations of international humanitarian law (IHL).

Although more incidents were recorded in the first two years since the Saudi led intervention than the remaining years, attacks have continued to be recorded by all parties to the conflict until the year of this report's publication, 2022. According to the [Yemen Data Project](#), from October 2021 through March, 2022, Yemen [experienced its longest sustained period of airstrikes since 2018](#), following the failure of the UN to renew the Group of Eminent Experts' (GEE) mandate on Yemen on October 7, 2021. UN member states' voting against the GEE's renewal has been widely cited by [independent observers](#) and [human rights organizations](#) as the result of a lobbying effort by Saudi Arabia and the UAE. The GEE was responsible for accountability of all human rights violations in Yemen's conflict, including those by the Houthis as much as by the coalition.

According to one estimate by [ACLED](#), the initial months of the UN-mediated Ramadan truce from April to October 2022 saw the most dramatic decline in fatalities in Yemen since January 2015. Since the failure to renew the 2022 Ramadan truce on 2 October, however, fighting has been expected to resume with especially high intensity in Yemen's oil rich areas, which are currently mostly controlled by pro-coalition forces.

Since 2015, Yemen's oil production, which was never high to begin with, has dwindled to a negligible amount. Over the last month, the Houthis have attacked [several of Yemen's oil ports](#), including one in Shabwah, which is the only governorate that Yemeni Archive's economic infrastructure database found to have an increase in the number of attacks over time. The [Houthis are anticipated to continue attacking](#) oil exports controlled by the IRGY and the coalition in Shabwah, Marib, and Hadramawt as an exploitative tactic with demands for the IRGY to use that limited oil revenue to pay [Houthi civil servants' salaries](#). At the same time, intra-coalition differences that were at the core of the 2019 Riyadh Agreement and 2021 formation of the Presidential Leadership Council, continue to erupt in armed attacks. Having recently seized control of Shabwah from their nominal allies in the IRGY, UAE-backed secessionist STC forces are expected to carry on with fighting the IRGY for control of [oil in Hadramawt](#), Yemen's physically largest governorate.

The continuing attacks on Yemen's minimal oil resources seem to offer all sides to the conflict points of accusation against one another, further driving polarization. In the meantime, civilians continue to suffer not only from ongoing armed attacks on infrastructure, but untenable food and fuel prices.

APPENDIX I - CASE STUDIES

For each of the four types of economic infrastructure affected by armed attacks that this report covers, the Yemeni Archive team carried out in-depth investigations. They are referenced in this report's Markets, Oil/Natural Gas, Water Infrastructure, and Electricity Infrastructure sections. These four case studies of, respectively, attacks on Markets, Oil/Natural Gas, Water Infrastructure, and Electricity Infrastructure, are included here.

Markets Case Study

Incident	Shelling a market in Taiz Old City of Taiz governorate
Type	Artillery shelling
Location	Al-Luqma market in Al Bab Al Kabeer, Al Mudhaffar district, Taiz governorate
Date	3 June 2016
Time	Between 03:20 and 03:32 pm local time
Victims	Allegedly 9 killed, including a child and two women, and 11 injured, including a child and two women
Potentially Responsible	the Houthi-Saleh forces

Introduction

On the evening of 3 June 2016, a crowded popular market in Taiz Old City in Al Mudhaffar district of Taiz governorate was shelled allegedly with artillery, as part of a series of attacks on the city. The shelling on the market caused civilian casualties, including children and women.

About the area

Taiz Old City is located in Al-Mudhaffar district, in Taiz governorate. The city has several main gates, including Bab Musa and Al-Bab Al Kabeer. Al-Luqma market is located 130 meters from Al-Bab Al-Kabeer. The Old City's residents shop from this market throughout the year. The market is on a road linking the eastern part of the Old City with the rest of Taiz city. Every day, thousands of civilians pass this road.

Taiz Old City was one of the areas which the armed confrontations did not reach, and it was within the geographical area under the control of the Government Army and the Popular Resistance [since the first days of the war](#), except for the historic Al-Qahira Castle, which was [controlled by the Houthi-Saleh](#) due to its strategic location, overlooking the city. The Popular Resistance forces loyal to the IRGY took control of Al-Qahira Castle in [August 2015](#).

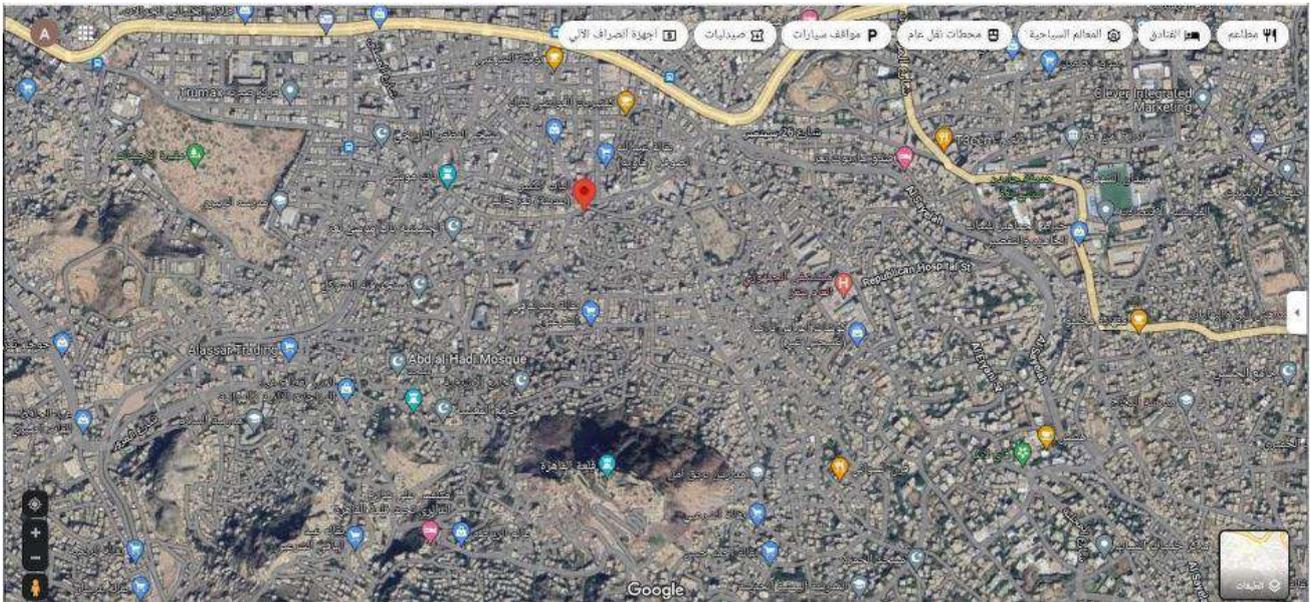


Figure A100 A satellite image from Google Maps, showing Al-Qahira Castle overlooking the Old City, Bab Musa (western entrance) and Al-Bab Al-Kabeer (eastern entrance).

The Incident

On the morning of 3 June 2016, military confrontations started east of Taiz city, during which shelling of residential neighborhoods continued until midnight. In the evening, one of the shells fell on Al-Luqma market, near Al-Bab Al-Kabeer, the eastern entrance to Taiz Old City, killing and injuring civilians, including children and women.



Figure A101 A screenshot of Tariq Fouad Al-Banna's Facebook post.

This Facebook post explains that a massacre occurred in the crowded Al-Bab Al-Kabeer Market, located in the center of Taiz, leading to dozens of victims. It claims that violent confrontations had begun that morning in the Al-Kamb neighborhood, east of the city.



Figure A102 A screenshot of Taiz Issue Facebook post

This facebook post claims that, in Taiz, the Houthi militia and Saleh forces fired five separate shells, hitting Al-Masbah and the old city. The last of these shells fell in the Al-Darba neighborhood, next to Al-Rahman Mosque and Alam Al-Marakat, wounding 3 people.



Figure A103 A screenshot of Salim Alzubiery's Facebook post

This Facebook post claims that, in Taiz, a shell had just recently fallen on a crowded street, Street 26, which is in front of the Yemeni Bank for Reconstruction and Development. It states there were reports of casualties.



Figure A104 A screenshot of Mohamed Mahyoub Ahmed Ali's Facebook post

This Facebook post claims that a mortar shell had fallen on Street 26 in Taiz. It claims 4 were injured, including a child who was selling oil.



Figure A105 A screenshot of Jamal Al Asmar's Facebook post

This Facebook post states that 'even the mosques were not spared in Taiz today'. It claims that 3 shells hit the mosque within 15 minutes' time. The picture displayed is from the Jamal Al-Din Mosque in the Ishaq neighborhood in Taiz.

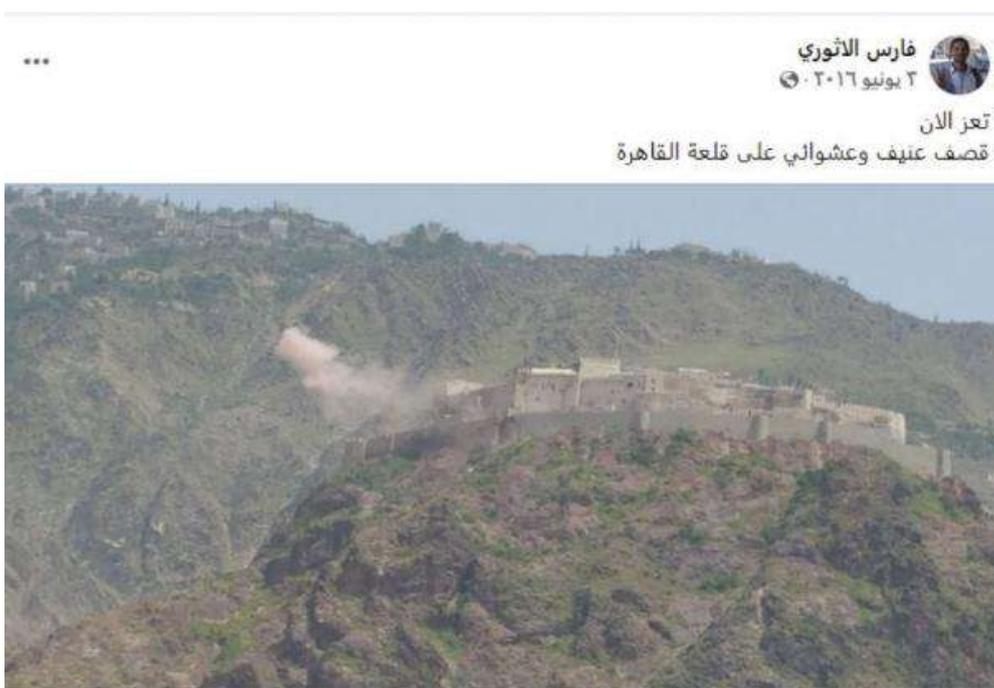


Figure A106 A screenshot of Faris Al-Athori's Facebook post

This Facebook post states that at the time of the post, a random violent bombing was being carried out in Taiz, on the Qahira Citadel (castle)

Geolocation of the incident

Based on the visual content in YouTube videos by [Al Jazeera Mubasher TV](#) and [Belgees TV](#) that showed the market, Yemeni Archive identified the location in which the shell fell at coordinates: [13.572639, 44.011874](#), 130 meters south of Al-Bab Al-Kabeer within the wall of Taiz Old City.



Figure A107 Screenshots from YouTube videos by Al-Jazeera Mubasher TV and Belqees TV, and a satellite image from Google Earth showing the market location in Taiz city center

Incident date and time

Fares Al-Athori [published](#) on Facebook a photo showing the moment a projectile fell in the city. By analysing the image, it is clear that the smoke was rising from Al-Luqma market behind Al-Bab Al-Kabeer. Al-Athori's post was one of the first reports about the incident on 3 June 2016 at 03:32:55 pm, based on the Unix Timestamp Converter analysis tool. The time range for shelling was between 03:20:00 - 03:32:55 pm, local time.



Figure A108 Screenshot of Fares Al-Athori's Facebook post

This Facebook post claims that at the time of the post, there was Katyusha shelling on the city in Taiz.



Figure A109 Screenshot from Unix Timestamp Converter, showing the time the post was published at 03:32:55 pm, 3 June 2016



Figure A110 Satellite image from Google Earth, and a photo from Fares Al-Athori's Facebook showing the location of the projectile impact. Smoke can be seen in the photo

3 June coincides with 27 of Shaban month of the Islamic calendar, that is, three days before the start of Ramadan, which is observed by Muslims as a month of fasting. As Al Jazeera's reporter mentions in [this video](#), markets in the days before the start of Ramadan get heavily crowded with people buying food and goods for Ramadan supplies. In Yemen, the shopping peak time starts after 3 pm, which means that the market at the time of the attack was at its peak time.

Potential munition used:

Analysis of open source content related to this incident did not find photos or videos of the remnants of the projectile. However, several news reports show the extent of the destruction in the stone pavements 6-8 metres from the impact point. Screenshots below from their reports show how the debris was scattered around the site. Based on analysis of these open sources, it seems unlikely that the projectile was a mortar shell.

Below, in Figure A111, are screenshots from videos by [Yemen Shabab TV](#), [Belqees TV](#), [Belqees 2 TV](#), [Sharjah 24 News](#), images from Khaled Fouad Al-Binaa, and a satellite image from Google Earth, showing how fragmentation flew south, west and southeast. This appears to be in contrast to how mortar fragmentation of the shell might fly in all directions.



Figure A111 screenshots from videos of mortar fragmentation

By tracing the incidents on the same day in Taiz city, it was found that [Taha Saleh's post](#) (Figure A112) shared information about a second shell that fell minutes later near the market. Journalist [Ahmed Al-Basha](#) from Taiz, who documented the incident in Al-Luqma market, stated that the second shell hit the staircase leading to the roof of Hayel School for girls. The location in which the shell fell appears to be at the coordinates [13.571071, 44.009967](#) about 240 meters from the market.



Figure A112 Screenshot of Taha Saleh's Facebook post

This Facebook poster claims that when he had gone to photograph the first shell in the old city (Taiz), the second shell landed next to himself and these other civilians. He describes the attacks as heinous massacres, with many dead and even more wounded. He describes a state of terror and fear in the city.

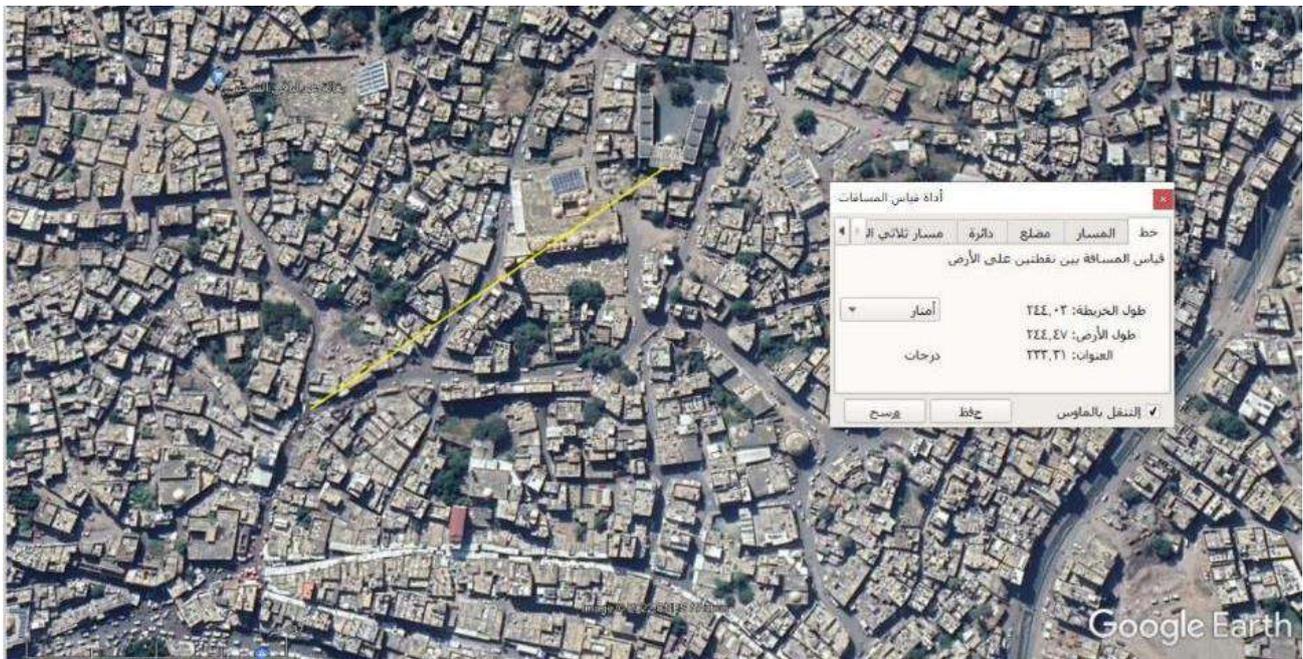


Figure A113 Satellite image from Google Earth, showing the distance between Hayel complex school and Al-Luqma market.

At [about 10:00 pm](#) on the same day, [a third shell](#) fell unexploded on [Jamal al-Din mosque](#), 84 meters from the market. Examination of open source analysis appeared to show evidence that the unexploded shell was an old 122mm howitzer shell of type [OF-462A](#). By comparing the visual evidence of the shell from the mosque (Figure A113) with existing photos of 122mm howitzers, (Figure A114) the Yemeni Archive team found that it looked similar to a 122mm howitzer. The three impacted sites ([the school](#) - [the market](#) - [the mosque](#)) formed a straight line, with a negligible horizontal deviation and a difference in vertical distance. The precision of the trajectory of the three shells suggests that the three sites were shelled by howitzers, contrary to what [some sources suggested](#) that the shell which hit the market was a Katyusha missile (BM-21 grad). Katyusha missiles are “blind weapons” and lack precision.



Figure A114 Photo from Anis Al Shaer's Facebook account, showing the shell that fell on Jamal Al-Din mosque and did not explode



Figure A115 Photo from 1939-45 Collectibles Ammunition Facebook account, showing projectiles 122mm OF-462 and O-462A

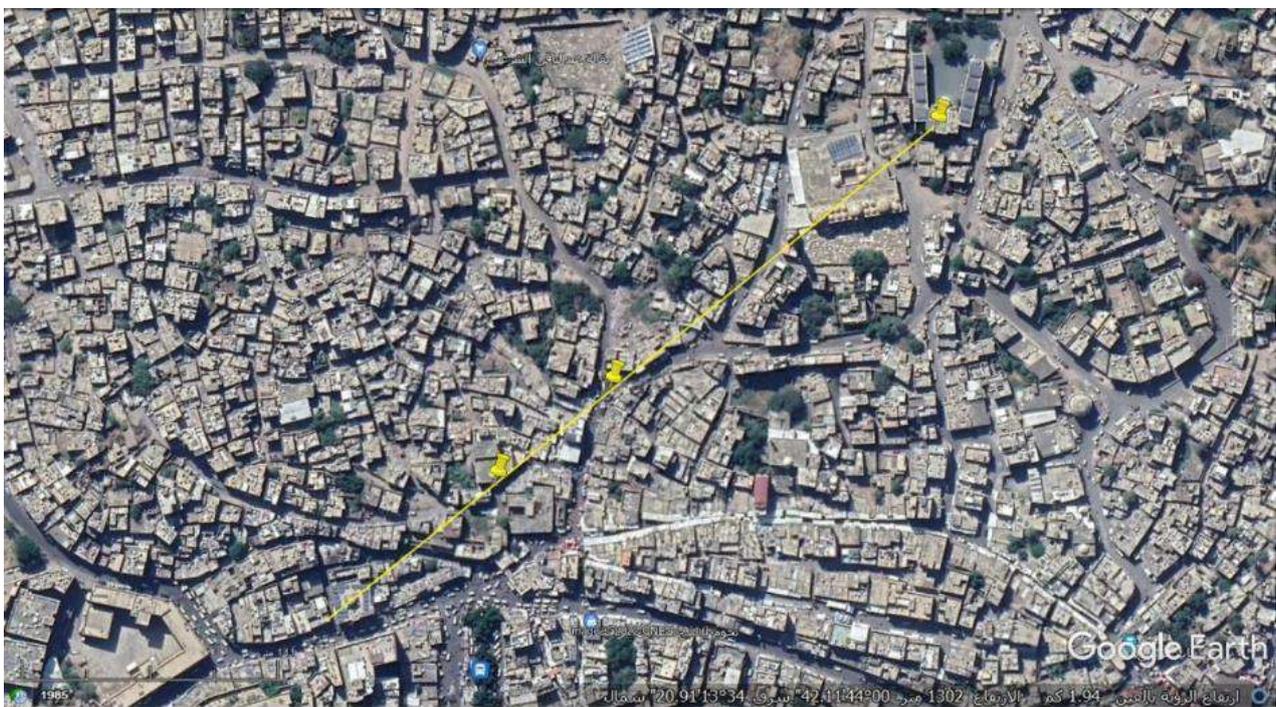


Figure A116 Satellite image from Google Earth, showing the three impact sites in a straight line, on the same day the market was shelled

Victims:

Many civilian casualties were reported in different areas of Taiz city. The estimated number of the victims of Al-Luqma market differed. However, a report by the [Yemeni Coalition for Monitoring Human Rights Violations](#) about the market incident, said that 9 civilians, including a child and two women were killed, and 11 civilians, including a child and two women.

Killed:

كشف أسماء وفيات واقعة قصف سوق اللقمة بالبواب الكبير

م	اسم الضحية	العمر	مكان الواقعة	التاريخ	موضع الإصابة
١	أرزاق جميل محسن الوصابي	٧	باب الكبير	٢٠١٦/٠٦/٠٣	شظايا في أجزاء متفرقة
٢	منصور صالح محمد الصمدي	٥٣	باب الكبير	٢٠١٦/٠٦/٠٣	شظايا في أجزاء متعددة
٣	سامي عبدالله علي حزام	٣٠	باب الكبير	٢٠١٦/٠٦/٠٣	شظية أتلفت الرأس بالكامل
٤	حمادة محمد هزاع الوبلي	٣٥	باب الكبير	٢٠١٦/٠٦/٠٣	شظية بالبطن الجهة اليسرى
٥	فاكهة أحمد سعيد فارح	٥٥	باب الكبير	٢٠١٦/٠٦/٠٣	شظايا بالصدر
٦	مصطفى حمود محمد ملهي	١٧	باب الكبير	٢٠١٦/٠٦/٠٣	شظايا عدة مع بتر القدمين
٧	صفية علي عبده عبادي	٥٥	باب الكبير	٢٠١٦/٠٦/٠٣	شظايا في أجزاء متفرقة
٨	أسامة عبده علي	١٨	باب الكبير	٢٠١٦/٠٦/٠٣	شظايا في أجزاء متفرقة
٩	عادل علي الدريمي	٢١	باب الكبير	٢٠١٦/٠٦/٠٣	شظايا في أجزاء متفرقة

Figure A117 Screenshot from Yemeni Coalition to Monitor Human Rights Violations report showing details of those killed in Al-Luqma market

Injured:

كشفت أسماء جرحى واقعة قصف سوق اللقمة بالبواب الكبير

م	الاسم	العمر	مكان الواقعة	التاريخ	موضع الإصابة
١	حنان مهيبوب أحمد علي	٢٥	باب الكبير	٢٠١٦/٠٦/٠٣	شظية في ركبة الرجل اليسرى
٢	دلال ماجد أحمد عبدالله	١٢	باب الكبير	٢٠١٦/٠٦/٠٣	شظية في الصدر
٣	ماجد محمد أحمد الحاج	٢١	باب الكبير	٢٠١٦/٠٦/٠٤	شظية في ساعد اليد اليمنى والصدر
٤	محمد سلطان سعيد مصلح	٢٠	باب الكبير	٢٠١٦/٠٦/٠٣	شظية في كتف اليد الأيسرى
٥	محمد عبدالجبار	٢٣	باب الكبير	٢٠١٦/٠٦/٠٣	شظايا في البطن وركبة الرجل اليسرى
٦	مقبل مرشد غالب غلاب	٦٠	باب الكبير	٢٠١٦/٠٦/٠٣	شظية في الرأس الجهة اليسرى
٧	حسام عبده قائد	١٨	باب الكبير	٢٠١٦/٠٦/٠٣	حروق في القدم الأيمن
٨	شرف محمد ثابت	٦٩	باب الكبير	٢٠١٦/٠٦/٠٣	شظايا في أجزاء متفرقة من الجسد
٩	صفية محمد بجاش ناصر	٥٠	باب الكبير	٢٠١٦/٠٦/٠٣	شظايا في أجزاء متفرقة من الجسد
١٠	عبدالله عبده أحمد علي	٤٠	باب الكبير	٢٠١٦/٠٦/٠٣	شظايا في اقدم لرجل اليمنى
١١	ضياء أحمد قسامي	٢٨	باب الكبير	٢٠١٦/٠٦/٠٣	شظايا في الرأس والرجل

Figure A118 Screenshot from Yemeni Coalition to Monitor Human Rights Violations report showing details of those injured in Al-Luqma market

Allegedly responsible

As mentioned earlier, the Yemeni Archive team's analysis of open-source evidence supported findings that the three shells fell in a straight vertical line, which means that they came from the same cannon. A photo from Anis Al Shaer's Facebook [post](#) (Figure A119, below) inside the mosque showed the projectile impact angle, and prayer rugs with inscriptions indicating northwest direction.

...

انيس الشاعر



٠٢٠١٦/٠٦/٠٢

حتى مساجدنا لم تسلم
ها هو صاروخ كاتيوشا سقط على مسجد جمال الدين ولكنه لم
ينفجر
الحق أضرارا في المسجد وما يزال رأس الصاروخ موجود
وباروته حوله
ليلة ممنهجة لتدمير تعز بشكل كامل
صور أولية التقطتها من داخل المسجد
شاركوا وافضخوا جرائم مليشيا الموت الإجرامية
#انيس



Figure A119

Prayer rugs in mosques have an inscription pointing to the mihrab (a niche in the wall of a mosque). A mihrab indicates the qibla/the direction towards Mecca city in Saudi Arabia. The qibla location in Mecca city can be determined using [Google's Qibla Finder](#). Based on the qibla direction to northwest of the impact location, and the projectile impact angle, analysis of the open-source content determined that the shell came from the northeast and along the straight line linking the three impact sites.



Figure A120 Prayer rugs in mosques have an inscription pointing to the qibla in Mecca city. A screenshot from Google Qibla Finder, showing Mecca northwest of the impact location in Jamal Al-Din mosque

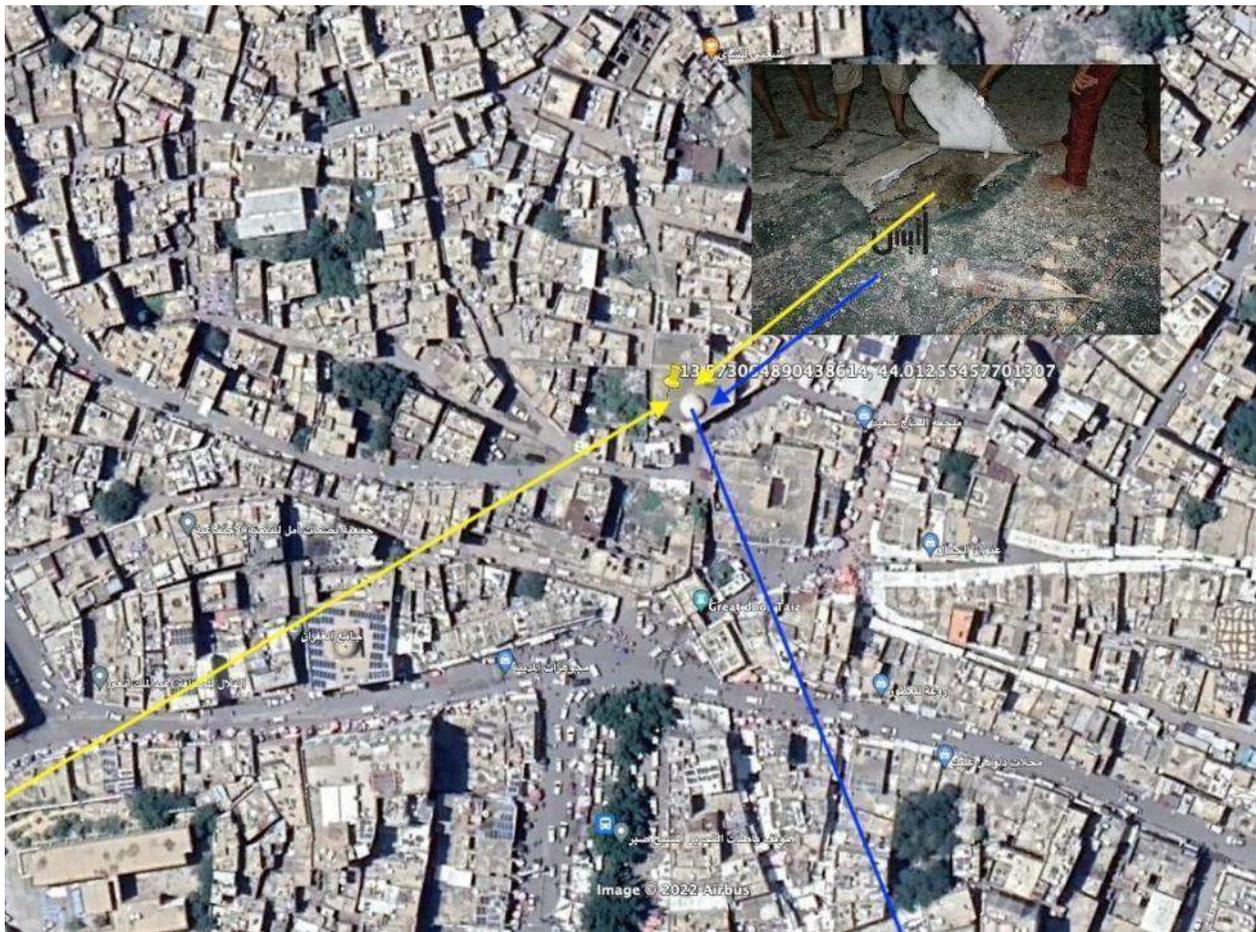


Figure A121 Satellite image from Google Earth, and a photo from Anis Al Shaer's Facebook account show the shell trajectory (yellow), and the direction of qiblah/north west (blue)

The lines of engagement between the Yemeni Government and the Popular Resistance forces on one hand and the Houthi-Saleh forces are 2 km away along the line from the market site. This area is under the control of the Yemeni Government and the Popular Resistance forces. While the rest of the area, including the heights and camps, along the same line to Taiz International Airport, is under the control of the Houthis.



Figure A122 These images show what is claimed to be damage resulting from this specific attack on the mosque and the market. The top photo is from a Facebook post of the mosque after the attack. The bottom left photo of the market is from Yemen Shabab One, and the bottom right photo of the market is from Belqees Channel.

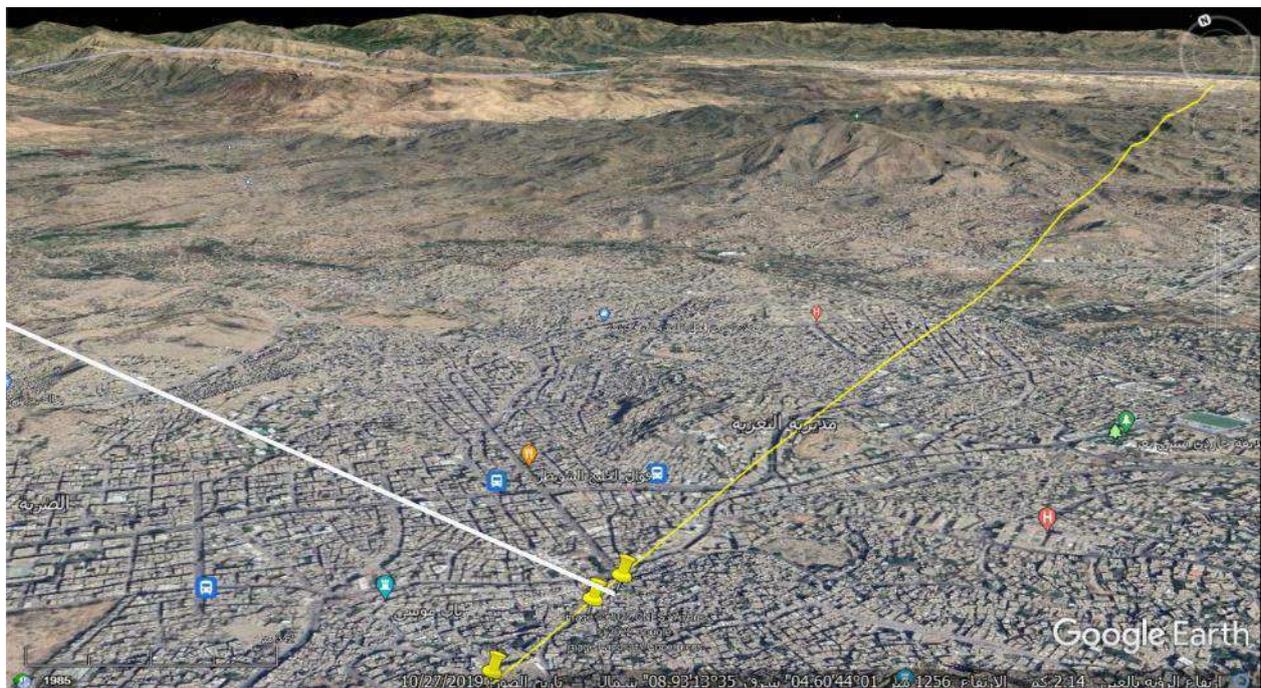


Figure A123 Satellite image from Google Earth, showing the shell trajectory (yellow), and the direction of qiblah/northwest (white)

The satellite image below shows the lines of engagement, between the Yemeni Government and the Popular Resistance forces on one hand and the Houthi-Saleh forces on the other, are 2 km away along the line from the market site. This area is under the control of the Yemeni Government and the Popular Resistance forces. While the rest of the area, including the heights and camps, along the same line to Taiz International Airport, is under the control of the Houthis.



Figure A124 Satellite image from Google Earth, showing areas of military control and lines of engagement. brown color: the Houthis.white color: IRGY and Popular Resistance Forces

As military confrontations on the eastern front of Taiz continued, on 3 June 2016, the Houthi-Saleh forces apparently hit [Al-Qahira Castle, which has been used as a military site since the beginning of the war](#) and is next to Hayel School, in which the second shell fell after the shell on the market. [Hayel School is a gathering point](#) for the Popular Resistance, commanded by Abu al-Abbas. That suggests that the Houthis were responsible for the attack.

Conclusion

Analysis of open source documentation offered potential supporting evidence for the conclusion that the Houthi-Saleh forces were likely to have directly shelled with 122 mm howitzers a mosque in Taiz Old City of Taiz governorate, on the evening of 3 June 2016. Because the market and the school were both found to be in the same line of trajectory as the mosque, Yemeni Archive's analysis offers potential supporting evidence for 122 mm howitzers having shelled the market and school as well. However, further analysis would be needed to state this conclusively. The only picture of the ammunition that the Yemeni Archive team obtained was inside the mosque, because it had not exploded. The ammunition that hit the market and the school had exploded, and so no visual evidence of ammunition remnants for these first two impact sites was located. The attack on the market reportedly killed 9 civilians, including women and one child, and injured 11 civilians, including women and a child.

Oil/Natural Gas Case Study

Incident	bombing two fuel stations and a gas tank in Yarim, Ibb governorate
Attack Type	Air Strike
Location	Yarim city, Ibb governorate, Kataf area, Yarim district, Ibb governorate
Date	31 March 2015
Potential munition	unknown
Time	Between 03:20 and 03:32 pm local time
Victims	Allegedly 32 killed, including children and women, 81 injured, including children and women
Allegedly Responsible	the Saudi led coalition

Introduction

Two fuel stations and a gas tank were hit by alleged airstrikes at dawn on 31 March 2015, in separate areas of Yarim district, north of Ibb governorate, causing dozens of civilian deaths and injuries, and physical damage in civilian property.

The strikes came when there was a [stifling crisis of oil derivatives and cooking gas](#) in Yemen, as the war entered its early days. The demand for oil and gas increased dramatically with the large wave of displacement from cities under military battles, in addition to the military acquisition of the governorates' shares of oil derivatives for military needs, as well as the Saudi led coalition's blocking of ships from entering the ports. The prices of oil, diesel and gas rose [skyrocketed in "the black market,"](#) casting more [suffering on civilians](#).

About the area

Yarim district is located north of Ibb governorate in central Yemen, on the administrative borders with Dhamar governorate, from which the two main roads that link north and south of Yemen and pass to Al-Dhalie - Aden and Ibb - Taiz. This is the same road through which almost all the Houthi-Saleh military forces passed in the early days of the war when it advanced to the southern governorates as well as the governorate of Taiz.

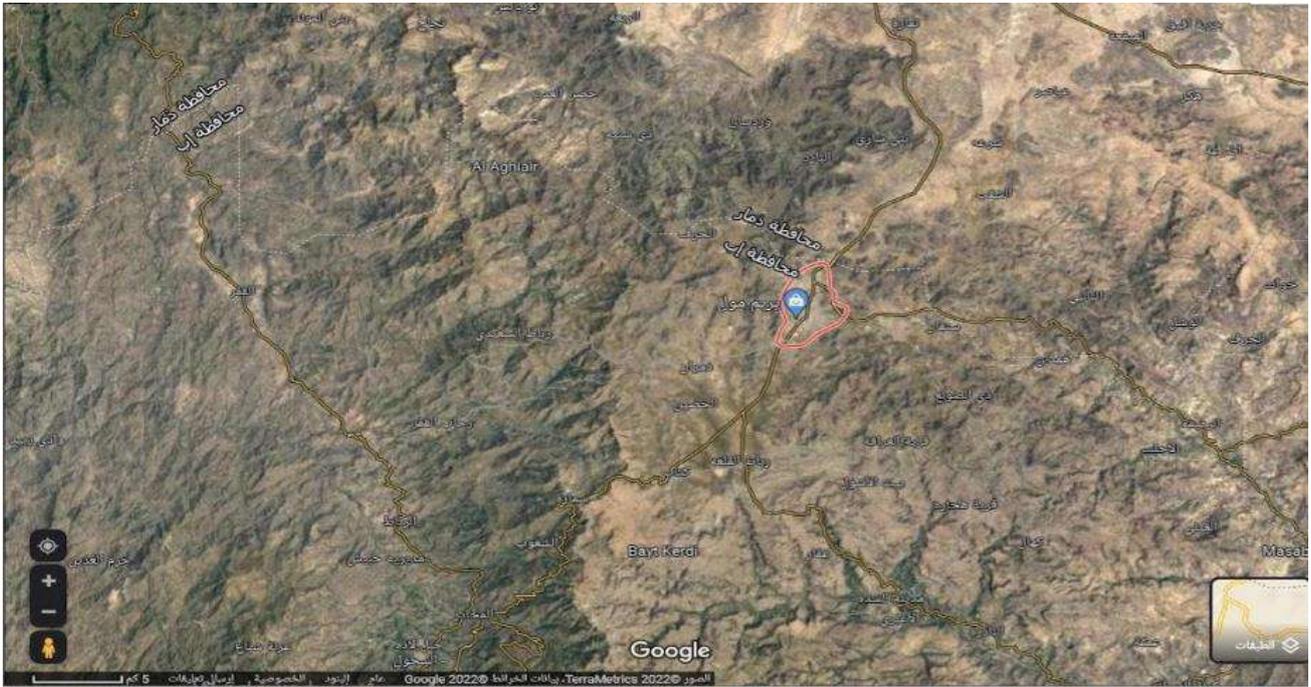


Figure A200 Satellite image from Google Maps of Yarim city

The incident

On the dawn of 31 March 2015, social media platforms circulated [news](#) of civilian casualties in airstrikes [attacking gas tanks and fuel stations](#) in separate areas in Yarim district, north of Ibb governorate, as part of a series of air raids launched by the Saudi led coalition, which hit military camps and [points](#) of Houthi-Saleh forces. An [Amnesty International report](#) documented the incident, stating that 14, including at least 6 civilians, 4 of whom were children, were burned to death in the attacks on the petrol stations. According to Amnesty, the third raid on a transiting fuel tanker ignited at least 3 civilian houses. On YouTube(1,2,3), videos showed burning cars and people gathering around them. In the videos, ambulances sirens can be heard. The videos also showed a big tanker completely burnt with smoke rising from it, charred bodies and a destroyed food carrier where milk cans can be seen on the ground.



Figure A201 Screenshot of a tweet by Saudi AlMnatiq Newspaper

This tweet by Saudi AlMnatiq Newspaper says that coalition forces have just bombed the 15th Infantry Brigade in Zinjibar, raided the 33rd Brigade in Al-Dhalee, and hit two fuel stations in Yarim, Ibb. It does not specify whether the fuel stations were part of a military checkpoint. This is significant because Al-Dhalee (108 km away) is not in very close proximity to Yarim.



بوابة اليمن الاخبارية
@boabtalyemen

...

بوابة #اليمن الاخبارية
قصف طيران #عاصفة_الحزم يطال مدينة يريم وسط اليمن لأول مرة
وانباء عن عدد من الضحايا بينهم مدنيين

Translate Tweet

8:06 AM · Mar 31, 2015

1 Retweet

Figure A202 Screenshot of a tweet by Boabtalyemen

This tweet states that Operation Decisive Storm warplanes (in reference to the name of the SLC's military intervention launched in 2015) have bombed the city of Yarim in central Yemen for the first time. It claims there are reports of civilian casualties.

Date and Time

The first tweet of this bombing in Yarim found was a tweet by [adel amer](#) at 02:21 am. After that, there were reports of civilian casualties and the attacking of gas stations and gas tanks, which indicate that the bombing may have started after 02:00 at dawn.



Figure A203 Screenshot of adel amer tweet

This tweet describes bombing currently happening in Yarim, believed to belong to forces moving towards Kitab (14.7 km southwest of Yarim).

Geolocation of the incident

The attack hit three different locations in Yarim district. One of the strikes hit a gas tank at a military point on the main road in Bab Al Doreen area near the southern entrance to Yarim city, while the other two stations were located in Kataf area in the same district, approximately 10 air kilometers from Yarim city. They are separated by less than 200 meters.

The main road at Bab Al Doreen area:

The location of the impacted site in Bab al-Doreen area was geolocated to the southern entrance to the city of Yarim, at coordinates: [14.278952, 44.365831](#), based on the visual content in a video published by [Youthstand47](#) on YouTube.



Figure A204 Screenshots from Youthstand47 YouTube video, and a satellite image from Google Earth

Station 1

The station was located in Kataf area, south of Yarim district at coordinates: [14.206555, 44.311842](#), based on the visual content in [a video posted](#) by Yarim Youth Forum on Facebook.



Figure A205 Panoramic photo from Yarim Youth Forum video on Facebook and a satellite image from Google Earth

Station 2

The station was located in Kataf area, south of Yarim District, at coordinates: [14.208391, 44.314509](#), based on the visual content in the aerial footage of the attack, by [Abdul-Rahman Qaid Al-Hajari](#)'s YouTube channel



Figure A206 Screenshots from Abdul-Rahman Qaid Al-Hajari's YouTube video, and a satellite image from Google Earth of the station shown in the video

Potential ammunition:

Unknown. As of the time of publication, no documentation in which munitions or munitions remnants allegedly used in this incident were located.

Victims

The air strikes on Yarim, which impacted two fuel stations and a gas tank, allegedly killed 32 civilians, including 9 children and two women, and injured 82 civilians, including 7 children and 11 women, according to [a report](#) by the Legal Center for Rights and Development. See Figure A207 for the list of killed and A208, below, for the list of injured.

أسماء وبيانات الضحايا الذين قتلوا بسبب القصف على يريم

م	الاسم	النوع	العمر	الحالة	المحافظة	مكان الواقعة	تاريخ الانتهاك
١.	سنان علي أحمد	طفل	سنة	قتيل	إب	يريم	٢٠١٥/٣/٣١
٢.	شيماء عبده حميد العماري	طفلة	سنة	قتيلة	إب	يريم	٢٠١٥/٣/٣١
٣.	عماد ياسر عبده العماري	طفل	سنة	قتيل	إب	يريم	٢٠١٥/٣/٣١
٤.	حنان محمد عبد الحميد العماري	طفلة	٤	قتيلة	إب	يريم	٢٠١٥/٣/٣١
٥.	رقية عدنان محمد نصاري	طفلة	٦	قتيلة	إب	يريم	٢٠١٥/٣/٣١
٦.	رجاء محمد صالح الجحافي	طفلة	١١	قتيلة	إب	باب الضورين-يريم	٢٠١٥/٣/٣١
٧.	سمية صالح الجحافي	طفلة	١٣	قتيلة	إب	باب الضورين-يريم	٢٠١٥/٣/٣١
٨.	سارة ياسر الجحافي	طفلة	١٤	قتيلة	إب	باب الضورين-يريم	٢٠١٥/٣/٣١
٩.	سهيل محمد الحكيم	طفل	١٤	قتيل	إب	يريم	٢٠١٥/٣/٣١
١٠.	شيماء عبد الجبار عوض	أنثى	١٨	قتيلة	إب	يريم	٢٠١٥/٣/٣١
١١.	سلطان إبراهيم محمد	ذكر	٢٠	قتيل	إب	باب الضورين-يريم	٢٠١٥/٣/٣١
١٢.	شمسان زيد الطويل	ذكر	٢٠	قتيل	إب	يريم	٢٠١٥/٣/٣١
١٣.	صدام عمر علي الأهدل	ذكر	٢٠	قتيل	إب	يريم	٢٠١٥/٣/٣١
١٤.	فايز علي ناجي أبو قشة	ذكر	٢٠	قتيل	إب	باب الضورين-يريم	٢٠١٥/٣/٣١
١٥.	لبنان علي الحاج	أنثى	٢٥	قتيلة	إب	يريم	٢٠١٥/٣/٣١
١٦.	ياسر عبده أحمد العماري	ذكر	٢٥	قتيل	إب	يريم	٢٠١٥/٣/٣١
١٧.	خلود هاجر محمد الأشرم	أنثى	٢٦	قتيلة	إب	يريم	٢٠١٥/٣/٣١
١٨.	عبد الله حسن منصور البعداني	ذكر	٢٦	قتيل	إب	يريم	٢٠١٥/٣/٣١
١٩.	عمر محمد حمود نصاري	ذكر	٢٨	قتيل	إب	يريم	٢٠١٥/٣/٣١
٢٠.	مجيب يحيى علي القحم	ذكر	٢٨	قتيل	إب	يريم	٢٠١٥/٣/٣١
٢١.	محمد سعيد حفظ الله السماوي	ذكر	٢٨	قتيل	إب	يريم	٢٠١٥/٣/٣١
٢٢.	أمين عبده علي الحكيمي	ذكر	٣٠	قتيل	إب	يريم	٢٠١٥/٣/٣١
٢٣.	سلطان ضبعان	ذكر	٣٠	قتيل	إب	يريم	٢٠١٥/٣/٣١
٢٤.	عبده عثمان المخلافي	ذكر	٣٠	قتيل	إب	يريم	٢٠١٥/٣/٣١
٢٥.	عماد خالد الحكيم	ذكر	٣٠	قتيل	إب	يريم	٢٠١٥/٣/٣١
٢٦.	عماد عثمان سرحان المخلافي	ذكر	٣٠	قتيل	إب	يريم	٢٠١٥/٣/٣١
٢٧.	عدنان محمد حمود نصاري	ذكر	٣٤	قتيل	إب	باب الضورين-يريم	٢٠١٥/٣/٣١
٢٨.	صالح راجع الجحافي	ذكر	٦٥	قتيل	إب	يريم	٢٠١٥/٣/٣١
٢٩.	الحبيشي	ذكر		قتيل	إب	يريم	٢٠١٥/٣/٣١
٣٠.	علي حمود العماري	ذكر		قتيل	إب	يريم	٢٠١٥/٣/٣١
٣١.	ماجد أمين ثابت	ذكر		قتيل	إب	يريم	٢٠١٥/٣/٣١
٣٢.	ناجي مصلح الضراب	ذكر		قتيل	إب	يريم	٢٠١٥/٣/٣١

Figure A207 List of killed from the Legal Center for Rights and Development report

م	أسماء الجرحى	المنوع	العمر	الحالة	المحافظة	المديرية	تاريخ الانتحاح	م	أسماء الجرحى	المنوع	العمر	الحالة	المحافظة	المديرية	تاريخ الانتحاح
١٠١	محمد علي عبدالله اللهيبي	ذكر	جروح - حروق	أب	يريم	٢٠١٥/٣/٣١	١٠٢	سالم علي عبدالله اللهيبي	ذكر	جروح - حروق	أب	يريم	٢٠١٥/٣/٣١		
١٠٣	شفيق الله الجحلي	ذكر	جروح - حروق	أب	يريم	٢٠١٥/٣/٣١	١٠٤	طارق أحمد العنسي	ذكر	جروح - حروق	أب	يريم	٢٠١٥/٣/٣١		
١٠٥	طارق علي الجحلي	ذكر	جروح - حروق	أب	يريم	٢٠١٥/٣/٣١	١٠٦	طالب مهدي الحطري	ذكر	جروح - حروق	أب	يريم	٢٠١٥/٣/٣١		
١٠٧	عبدالحق أحمد العناني	ذكر	جروح - حروق	أب	يريم	٢٠١٥/٣/٣١	١٠٨	عبدالرزاق عبدالله منصور	ذكر	جروح - حروق	أب	يريم	٢٠١٥/٣/٣١		
١٠٩	عبدالسلام الكحيل	ذكر	جروح - حروق	أب	يريم	٢٠١٥/٣/٣١	١١٠	عبدالعزيم محمد محمد	ذكر	جروح - حروق	أب	يريم	٢٠١٥/٣/٣١		
١١٢	عبدالله دهيش مانع	ذكر	جروح - حروق	أب	يريم	٢٠١٥/٣/٣١	١١٣	عبدالله صالح محمد اللهيبي	ذكر	جروح - حروق	أب	يريم	٢٠١٥/٣/٣١		
١١٤	عبدالله منصور الجماعي	ذكر	جروح - حروق	أب	يريم	٢٠١٥/٣/٣١	١١٥	عبدالله صالح محمد منصور	ذكر	جروح - حروق	أب	يريم	٢٠١٥/٣/٣١		
١١٦	عبدالله دحان الدعوس	ذكر	جروح - حروق	أب	يريم	٢٠١٥/٣/٣١	١١٧	علي محمد العماري	ذكر	جروح - حروق	أب	يريم	٢٠١٥/٣/٣١		
١١٩	علي عبدالله صالح	ذكر	جروح - حروق	أب	يريم	٢٠١٥/٣/٣١	١٢٠	علي محمد حسن ناصر	ذكر	جروح - حروق	أب	يريم	٢٠١٥/٣/٣١		
١٢٢	عمار محمد الدولة	ذكر	جروح - حروق	أب	يريم	٢٠١٥/٣/٣١	١٢٣	فارس أحمد طه	ذكر	جروح - حروق	أب	يريم	٢٠١٥/٣/٣١		
١٢٥	فارس محمد مجاهد عثمان	ذكر	جروح - حروق	أب	يريم	٢٠١٥/٣/٣١	١٢٦	فضل الشريه	ذكر	جروح - حروق	أب	يريم	٢٠١٥/٣/٣١		
١٢٨	ماجد المسلمي	ذكر	جروح - حروق	أب	يريم	٢٠١٥/٣/٣١	١٢٩	ماجد زوامل	ذكر	جروح - حروق	أب	يريم	٢٠١٥/٣/٣١		
١٣١	محسن العمري	ذكر	جروح - حروق	أب	يريم	٢٠١٥/٣/٣١	١٣٢	محمد سالم علي صالح	ذكر	جروح - حروق	أب	يريم	٢٠١٥/٣/٣١		
١٣٤	محمد سيف اللهيبي	ذكر	جروح - حروق	أب	يريم	٢٠١٥/٣/٣١	١٣٥	محمد سيف اللهيبي	ذكر	جروح - حروق	أب	يريم	٢٠١٥/٣/٣١		
١٣٧	محمد شمسان العنزي	ذكر	جروح - حروق	أب	يريم	٢٠١٥/٣/٣١	١٣٨	محمد صالح محمد اللهيبي	ذكر	جروح - حروق	أب	يريم	٢٠١٥/٣/٣١		
١٤٠	محمد صالح محمد اللهيبي	ذكر	جروح - حروق	أب	يريم	٢٠١٥/٣/٣١	١٤١	محمد فادي محمد	ذكر	جروح - حروق	أب	يريم	٢٠١٥/٣/٣١		
١٤٣	محمد صالح محمد اللهيبي	ذكر	جروح - حروق	أب	يريم	٢٠١٥/٣/٣١	١٤٤	مصالح الشامي	ذكر	جروح - حروق	أب	يريم	٢٠١٥/٣/٣١		
١٤٦	مصالح محمد المختار	ذكر	جروح - حروق	أب	يريم	٢٠١٥/٣/٣١	١٤٧	متنصور عبيد العراسي	ذكر	جروح - حروق	أب	يريم	٢٠١٥/٣/٣١		
١٤٩	منير عبيد العراسي	ذكر	جروح - حروق	أب	يريم	٢٠١٥/٣/٣١	١٥٠	منير عبيد العراسي	ذكر	جروح - حروق	أب	يريم	٢٠١٥/٣/٣١		
١٥٢	نبيل أحمد البحري	ذكر	جروح - حروق	أب	يريم	٢٠١٥/٣/٣١	١٥٣	نبيل أحمد صالح النجار	ذكر	جروح - حروق	أب	يريم	٢٠١٥/٣/٣١		
١٥٥	وليد العياشي	ذكر	جروح - حروق	أب	يريم	٢٠١٥/٣/٣١	١٥٦	وليد محمد بكرامة	ذكر	جروح - حروق	أب	يريم	٢٠١٥/٣/٣١		
١٥٨	وليد محمد عبدالله الصباحي	ذكر	جروح - حروق	أب	يريم	٢٠١٥/٣/٣١	١٥٩	وهيب منهدش	ذكر	جروح - حروق	أب	يريم	٢٠١٥/٣/٣١		
١٦١	ياسر محمد هبة	ذكر	جروح - حروق	أب	يريم	٢٠١٥/٣/٣١	١٦٢	ياسر محمد هبة	ذكر	جروح - حروق	أب	يريم	٢٠١٥/٣/٣١		

Figure A208 List of injured from the Legal Center for Rights and Development report

Allegedly responsible

The tweet by Saudi state-run news outlet Almnatiq offered support that Saudi Arabia [confirmed](#) that the Saudi led coalition aircraft hit two fuel stations in Yarim. The strikes were documented by [videos](#) posted by [Abdul-Rahman Qaid Al-Hajari](#) on YouTube. As satellite images show at the site that open source analysis identified earlier, a gas tank was bombed near a military point, which corresponds to the news by [Saudi Almnatiq newspaper](#) that the coalition hit a military point in Yarim. This offers confirmation of the coalition's responsibility for the three strikes.



Figure A209 Screenshot from Abdul-Rahman Qaid Al-Hajari YouTube video of station 1



Figure A210 Screenshot from Abdul-Rahman Qaid Al-Hajari YouTube video of station 2

This tweet below states that coalition forces have attacked a Houthi militia checkpoint in the Yarim district, south of Dhamar city, killing 18 Houthi militants. It came at 7:28 AM, two hours before Almnatiq's tweet about the coalition's bombing of two fuel stations in Yarim.



Figure A211 Screenshot of a tweet by Saudi Almnatiq newspaper



Figure A212 Satellite images of where a gas tank was bombed

Here in Figure A212 are two satellite images from Google Earth of the area where the gas tank was bombed near a Houthi-Saleh military point. They are compared in the second image here with screenshots from [Youthstand47's video](#) of the site after the attack.

Conclusion

Analysis of the available open-source data for this incident shows that at dawn on 31 March 2015, Saudi-led coalition aircraft allegedly bombed with direct hits two fuel stations and a gas tank, in Yarim district, Ibb governorate, in central Yemen, with three air strikes, allegedly killing 32 civilians, including children and women, and injuring 81 civilians, including women and children.

Water Case study

INVESTIGATION, SANAA: INF_00397

Attack Type	Air Strike
Location	Beit Saadan, Ozlat Al-Thulth, Arhab district, north of Sanaa
Date	10 September 2016
Potential munition	US-made Paveway II bombs
Time	The first attack: between 01:28 and 02:55 am. The second attack between 08:40 and 09:00 am
Victims	22 civilians killed, including three children; 20-42 civilians injured
Allegedly Responsible:	Saudi-led coalition
Physical Damage	Water rig damaged to the point of being inoperable. Equipment and vehicles were damaged, and a number of citizens' motorcycles were destroyed, in addition to the room next to the water rig

Introduction

On 10 September 2016, a water rig in Arhab district, north of Sanaa, was hit allegedly by two air strikes, in what is known as a double tap. The second strike hit civilians and paramedics gathered at the site after the first strike, causing dozens of civilian casualties and property losses.

About the area

Beit Saadan area is [located](#) in Ozlat Al-Thulth, in Arhab district countryside, approximately 23 km north of Sanaa International Airport. The area is under the control of the Houthis. It is bordered to the east by Nihm district in which the Houthis and the Yemeni Government forces were fighting. The Yemeni government forces were receiving air and logistics supported from the Saudi led coalition.

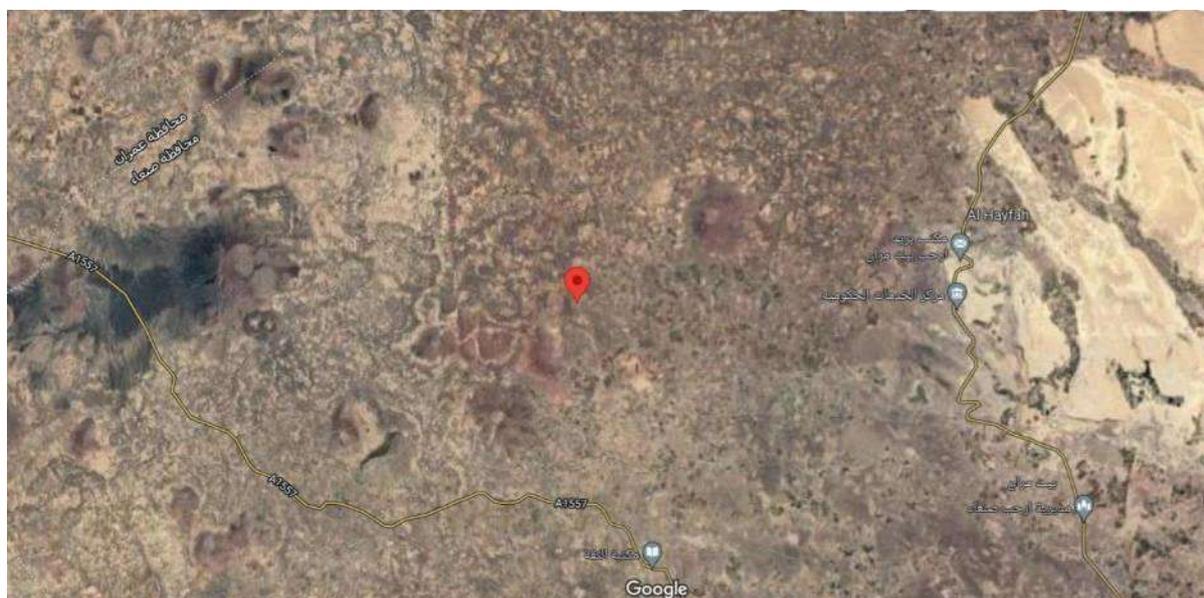


Figure A300 Photo of a satellite image of the water rig location, from Google Maps

The Incident

On 10 September 2016, the Saudi led coalition aircraft allegedly bombed a water rig in Beit Saadan area of Arhab district, north of Sanaa. The series of attacks, which began before dawn, continued until midday. According to several sources, including [Human Rights Watch](#), it consisted of two series of air raids, and as such, is categorised as a double tap. [Photos](#) of the attack circulated by users on social media on the same day, showed the citizens' bodies, including children', as well as scattered vehicles and motorcycles.



Figure A301 Screenshot of tweet by Al-Masirah TV about civilian casualties

The tweet above claims that in Sana'a governorate there are 13 dead and more than 12 wounded, the initial outcome of 15 raids launched by the [Saudi] aggression on a water rig in Beit Saadan in Arhab.



Figure A302 Screenshot of a tweet by Al-Masirah TV about paramedic casualties

This tweet states that the [Saudi] aggression warplanes again attack the water digger in the Beit Saadan area in Arhab, Sanaa governorate, and there are casualties among the paramedics.

On the same day, Yemen Today TV published a YouTube [video report](#) about the incident. The video showed destroyed vehicles of citizens, and the victims' bodies after being bombed by the second attack when they gathered around the water rig. Euronews Arabic, which is funded by the EU, also published [a YouTube video](#) showing the site of the attack with the destroyed water rig as well as wounded civilians, including a boy in the hospital being interviewed. The Houthi-run Al Masirah TV published a YouTube video report. This report was deleted and re-published on [Crimes of Decisive Storm on the people of Yemen](#) Facebook page.

Date and time of the attack

Reports by Human Rights Watch and social media users on the one hand and the coalition's Joint Incident Assessment Team (JIAT) on the other differed in how many attacks the coalition carried out, with the JIAT emphasizing that its attack at 8:40 AM was in retaliation for a Houthi attack. It did not mention a coalition airstrike preceding this one, in contrast to reporting by Human Rights Watch as well as social media users.

Testimonies in Human Rights Watch's [report](#) indicated that the first attack on the water rig took place at 2:55 am on 10 September 2016, while the second attack on the gathering of citizens and paramedics took place between 08:00 and 09:00 am.

Saudi newspaper, [Okaz reported](#) the Joint Incident Assessment Team (JIAT) response in a press conference on 12 September 2017:

The Team found that at 2:38 am on Saturday 10 September 2016, the armed Houthi militia and the forces of ousted Saleh fired a ballistic missile from Arhab towards Saudi territory. Pointing out that on the same day at 8:40 am, one of the air formations spotted a ballistic missile launcher, gatherings of individuals and two trucks in the same vicinity (Arhab), and accordingly the military target was dealt with as it constitutes an imminent and direct threat to Saudi lands. Pointing out that it later turned out that what was targeted was a well-digger. Confusion occurred during visual monitoring due to the great similarity between the rig- which contains a similar crane and is close in shape- and ballistic missile launchers.



Figure A303 Screenshot from Human Rights Watch's YouTube video

A quote from Human Rights Watch report:

Salim al-Sadani, a local farmer, said that when he learned that his uncle Mahdi al-Sadani had died in the airstrike, he went to the site, arriving at about 8 a.m. : “About 300 people, including the dead’s relatives, [were there] to remove the bodies. ... I saw two warplanes arriving from the south. Between 8 and 9 a.m., I saw the missile coming down to ground as I was [here] next to my uncle’s body.”

According to several tweets and the [HRW report](#), the possible time range for the first attack was between 01:28 and 2:50 am, while the second attack occurred between 08:40 and 09:00 am. [HRW’s reporting](#) found that villagers came to remove bodies around 9:00 am, and that the bombing raids resumed again quickly and lasted until 12 noon. Issa Al-Shaflut’s tweet (below) claimed the bombing began at 01:28 am, attacking a camp and several sites. [The tweets reporting](#) that the water rig itself was bombed, however, came after 6 am.



Figure A304 Screenshot of the first report of the bombing in Arhab by Issa Al-Shaflut on Twitter

This tweet, posted at 1:28 AM, claimed that coalition aircraft were carrying out raids on Al-Sama camp, in Arhab.

Geolocation of the incident

The visual content related to the incident, documented by various sources, showed mountains surrounding the impacted water rig from different directions with small buildings nearby. By matching the terrain in Google Earth images from ground level, analysis of open source content was able to locate the water rig at coordinates:

[15.683028, 44.163431](#), north of Arhab district in Beit Saadan of Ozlat Al-Thulth in Sanaa governorate.

The following, in Figure A305, includes screenshots of social media and news posts and images from Google Earth of the areas surrounding the water rig, from which Yemeni Archive was able to locate the water rig at coordinates [15.683028, 44.163431](#). This corroborates the coordinates given above.

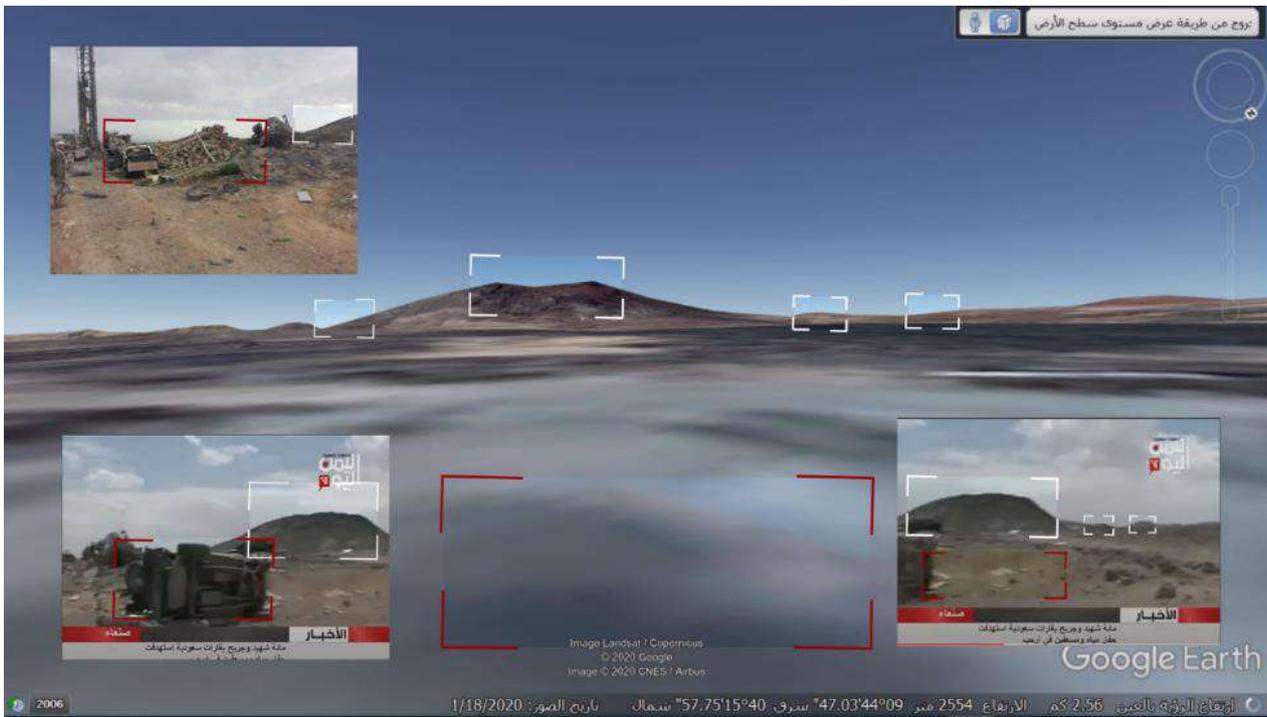


Figure A305 Screenshots from Yemen Today TV report on YouTube, an image posted by Sheikh/Mohammed Al-Habbari's Twitter account of the water rig location, and a ground level satellite image from Google Earth (southwest)

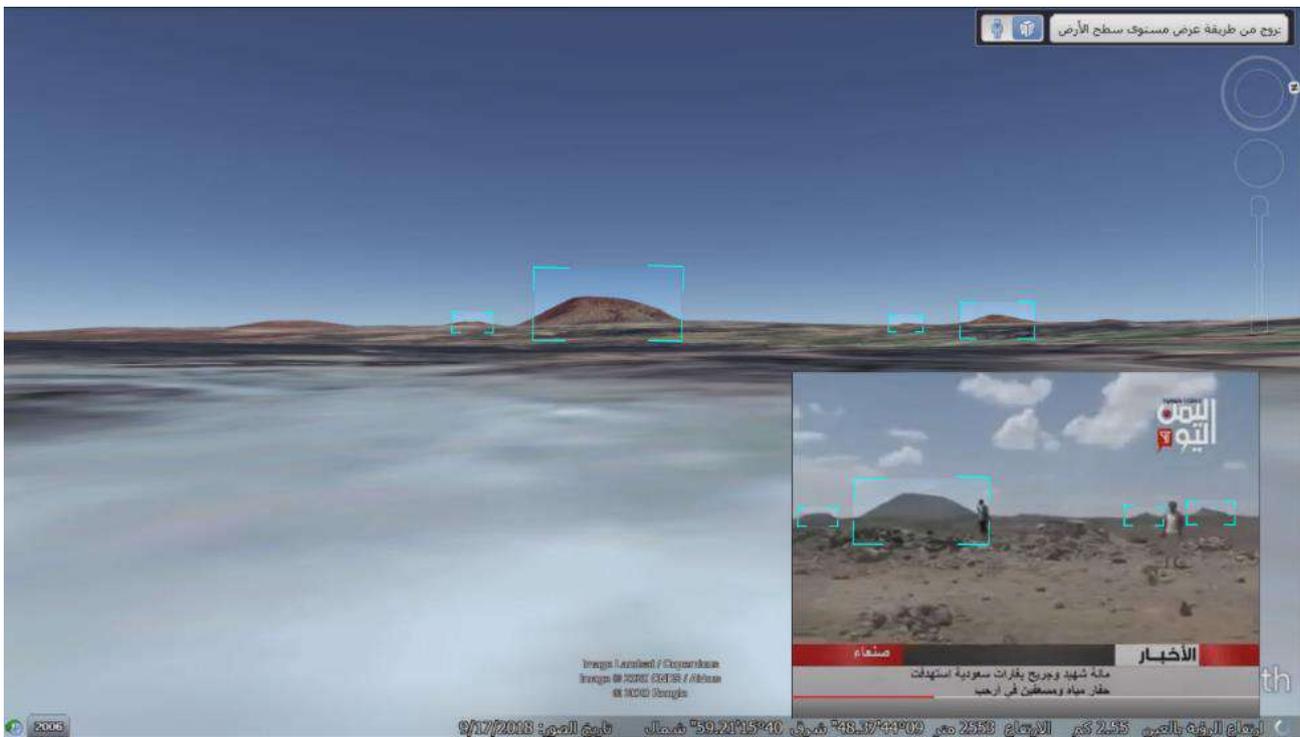


Figure A306 This is a screenshot from Yemen Today TV video of the heights west of the water rig location, and a sea level satellite image from Google Earth.



Figure A307 The top image is a screenshot Human Rights Watch video. On the bottom left is an image from Al-Mawqea Post website citing the New York Times, and to the right is an image from Storm To Give Back Twitter account of the heights northwest of the water rig

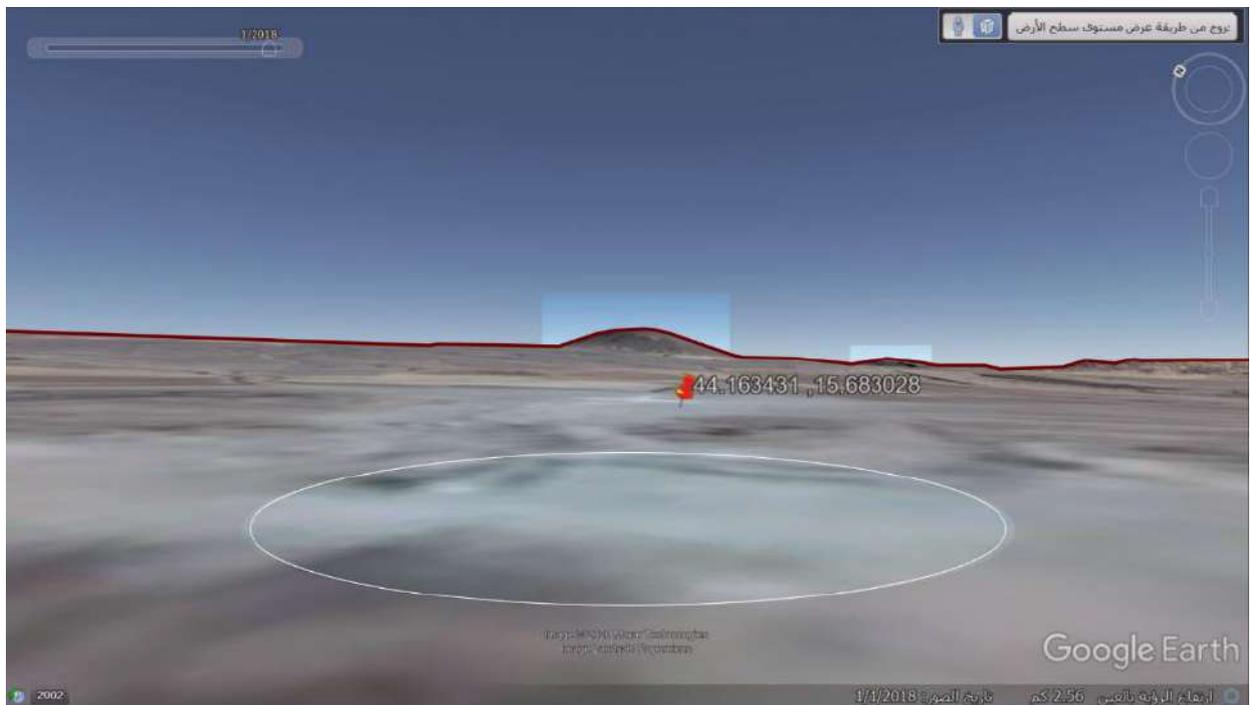


Figure A308 Sea level satellite image from Google Earth of the heights northwest of the water rig



Figure A309 Satellite image from Google Earth of highlands near the water rig



Figure A310 Screenshot from Human Rights Watch YouTube video showing a stone building near the water rig location matching satellite imagery

- A comparison of archival Google Earth images of the water rig location and the impact of the air strikes after the attack
- <https://cdn.knightlab.com/libs/juxtapose/latest/embed/index.html?uid=1e7e1dec-c10b-11ea-bf88-a15b6c7adf9a>
- `<iframe frameborder="0" class="juxtapose" width="100%" height="933" src="https://cdn.knightlab.com/libs/juxtapose/latest/embed/index.html?uid=1e7e1dec-c10b-11ea-bf88-a15b6c7adf9a"></iframe>`

Physical damage

The visual content appears to differ in the level of destruction, which supports Human Rights Watch's findings that there was a second series of attacks during the morning. The visual content seems to show that the second attack was more destructive than the previous one, as it took place while civilians and paramedics gathered at the location. Screenshots from the videos from Al Masirah, Yemen Today TV, and Euronews Arabic together show what appears to be a completely destroyed water rig, a burnt transport truck and the remains of a large tank vehicle that seemed to be for fuel, destroyed and burned passenger car, and many body parts and corpses scattered on the ground. [HRW's report](#) added that the bombing occurred on the last day of planned drilling, after the villagers had struck water. They had pooled together their personal funds to pay to drill the well to supply drinking water to their village. Open-source documentation of this incident also indicates that the raids damaged equipment, several motorcycles and vehicles at the water rig location. The raids also totally destroyed the room, likely the land guard room, next to the water rig (see images from videos below).

Several photos posted on Facebook claim to show the effects of only the first attack, as they revealed that the room next to the water rig was not yet destroyed. The photos posted by [Abdel-Khaleq Sharhan](#) and [Majdi Ahmed Al-Shabibi](#) on Facebook, (below the screenshots from the news videos) from different angles, showed that the room was not totally destroyed, next to the water rig and the vehicles. This means that the photos were taken before the second attack. However, these photos were not taken immediately after the first attack, as that is reported by Human Rights Watch to have occurred during the middle of the night, at 2:55 am. Human Rights Watch also reported that the second attack took place between 8:00am and 9:00 am.



Figure A311 Image posted on Twitter by Sheikh Muhammad Al-Habbari

This image shows the destroyed room at the site of the water rig, thought to be the land guard room



Figure A312 Screenshots from the videos posted, respectively, by Euronews Arabic, Al Masirah TV, and Yemen Today TV

These screenshots offer comparison of the effects of the destruction that resulted from the airstrikes on the water rig, revealed in the videos from Yemen Today TV, Euronews Arabic, and Al Masirah TV. They show consistency from a variety of sources.



Figure A313 Additional screenshots from the videos posted, respectively, by Yemen Today TV, Euronews Arabic, and Al Masirah TV



Figure A314 Photos posted by Abdel-Khaleq Sharhan and Majdi Ahmed Al-Shabibi on Facebook, from different angles, which showed that the room was not totally destroyed, next to the water rig and the vehicles, after the first attack



Figure A315 Screenshot from Yemen Today YouTube video, and an image posted on Twitter by Sheikh Muhammad Al-Habbari showing the destruction after the second attack

Potential munition

The visual content below, as Human Rights Watch's video, shows one type of munition used in the double tap attack. [A video](#) by Human Rights Watch on YouTube showed that remnants of munition from the water rig location belong to the US Paveway II bomb, made by Raytheon Inc.

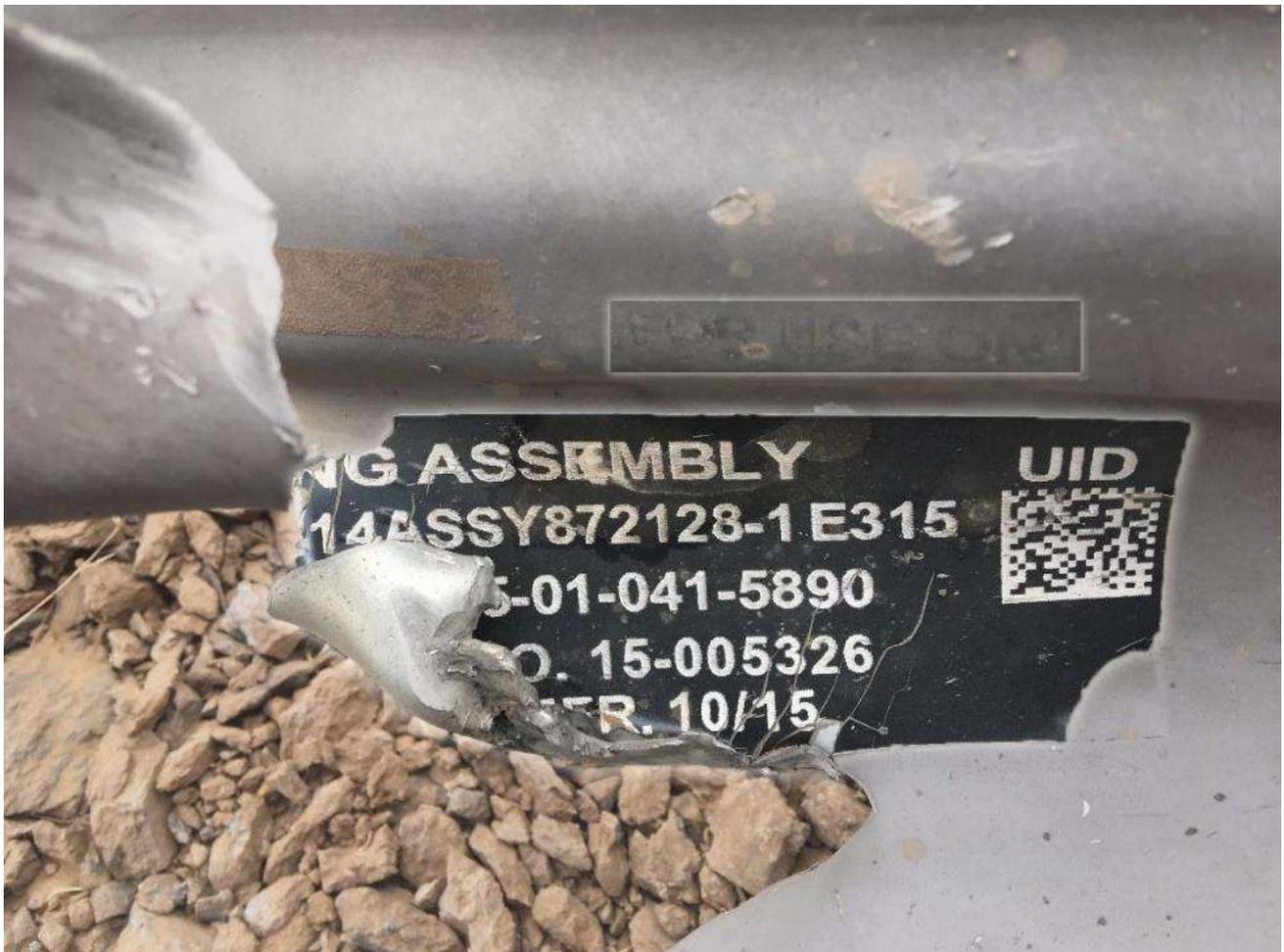


Figure A316 Photo of the remnants of the Paveway II bomb used in the attack, found by Human Rights Watch

Victims

There are different accounts about the number of the victims of the attack in [international](#) and [local](#) reports. Human Rights Watch [reported](#), quoting the Office of the United Nations High Commissioner for Human Rights, that at least 31 civilians were killed and 42 others were injured. In independent reporting, Human Rights Watch confirmed the names and ages of 21 people who were killed in the attack, including three children aged 12-15 years.

Locally, Al-Thawra Net website [published](#) the names of 22 people who died in the attack on the water rig. Given the similar numbers of those who were killed and documented by name in the Human Rights Watch report and Al-Thawra Net website, these statistics can be relied upon as being more accurate, while the number of the injured ranges between 20 and 45 people, and has not been confirmed, according to multiple sources.

A paragraph from a [Human Rights Watch report](#):

“...coalition aircraft struck the site of a water drilling rig near Beit Saadan village in the Arhab district, 30 kilometers north of Sanaa. The drill rig was in an unpopulated area reachable only by dirt road, about two kilometers from the nearest village. Multiple strikes over the course of the morning killed at least 31 civilians and wounded 42 more.”

Paragraph from a Human Rights Watch report:

“The first strike hit near a workers’ shelter occupied by nearly a dozen workers and managers, killing six and wounding five others. At about 9 a.m., after several dozen villagers came to remove the bodies of those killed and examine the site, three planes returned and proceeded to bomb the vicinity at least 12 more times, about 15 minutes apart, witnesses said. The strikes lasted until about noon, killing at least 15 civilians, and wounding dozens more. Human Rights Watch independently confirmed the names and ages of 21 people who died in the attack, including three boys ages 12, 14, and 15.”

The names of those killed, from Al-Thawra Net [website](#):

Rabea Hamid Al-Athari

Mustafa Amin Ahmed Rashid Al-Athri

Mohammed Al Saadani

Mahdi Al Saadani

Abdul Ghani Musli Al-Dhahyani

Saleh Mohammed Abdel-Waseh Sawa

Mohammed Saleh Nasser Al-Salami

Fouad Sherian Majrash

Ahmed Mohamed Qaid Al-Salami

Ibrahim Yahya Majrash Al-Salami

Abdul Salam Muhammad Jassar

Abdullah Saleh Ahmed Jassar

Nassib Saleh Ahmed Jassar

Ahmed Moqbel Nasr

Mahdi Muhammad Ali

Mohamed Ahmed Ali Abdullah

Riad Muhammad Ali Qaid

Abed Saleh Ali Al Abdali

Nabil Saleh Jafash

Said Ayoub Hussein Saeed

Saleh Mohsen Al-Murahabi

Abdullah Melfi Al-Salami

Allegedly responsible

The spokesman for the Joint Incident Assessment Team said in a [press conference](#) on 12 September 2017, that the Saudi led coalition had hit the water rig, but explained:

“The Team found that at 2:38 am on Saturday 10 September 2016, the armed Houthi militia and the forces of ousted Saleh fired a ballistic missile from Arhab towards Saudi territory. Pointing out that on the same day at 8:40 am, one of the air formations spotted a ballistic missile launcher, gatherings of individuals and two trucks in the same vicinity (Arhab), and accordingly the military target was dealt with as it constitutes an imminent and direct threat to Saudi lands. Pointing out that it later turned out that what was targeted was a well-digger. Confusion occurred during visual monitoring due to the great similarity between the rig- and ballistic missile launchers, as they contain a similar crane and are close in shape.”

Conclusion

Analysis of open-source documentation demonstrates that on 10 September 2016, Saudi-led coalition aircraft allegedly bombed a water rig twice. The water location was in Beit Saadan area of Ozlat Al-Thulth in Arhab district, 23 km north of Sanaa International Airport.

Aircraft allegedly bombed the water rig for the first time between 02:38 and 02:55 am. The bombing resumed six hours later with raids attacking a gathering of citizens and paramedics who were at the site to help the victims. The aircraft used US-made Paveway II munition. 22 civilians, including children, were killed, and 20-42 civilians were injured. Several trucks, vehicles and motorcycles were destroyed.

Electricity Case Study

Incident	Shelling the rural power station in Taiz
Attack Type	Missile shelling
Physical Damage	Electrical transformer burned out
Location	Osaferah, Al-Qahirah district, north of Taiz city
Date	29 September 2015
Time	Between 08:45 - 09:05 am
Potential munition	122 mm BM-21 Grad
Victims	No casualties reported
Probable Responsibility	Houthi-Saleh forces

Introduction

According to open source information, on the morning of 29 September 2015, alleged artillery and missile shelling hit several areas in Taiz city. The attack hit the rural power plant in Osaferah area of Al-Qahirah, north of the city, which resulted in burning one of the power transformers and damaging the station's nearby facilities.

This attack on the station was not the first. The station was attacked several times [see incidents INF_0069601, INF_0069602, INF_0069603, INF_0069604, INF_0069605, INF_0069606] since the beginning of the war, and was completely out of service. The station, along with the Mocha station, were the only source of electricity for the governorate and its countryside. As it went out of service, Taiz city lacked government electricity completely. This service was replaced by [commercial \(private\) stations](#), which impose exorbitant prices for electricity services, amounting to approximately (one dollar per kilowatt), in addition to the subscription fees, which are much higher than the financial abilities of people there.

About the area

The rural power plant is located in Osaferah area of Al-Qahirah district, north of Taiz, the capital of the governorate, close to the lines of engagement between the Resistance Forces and the government army on the one hand, and the Houthi-Saleh on the northern fronts of Taiz, and 700 meters from Jabal Jarrah, one of the strategic sites in the city. It has a military importance to both sides, and was subject to violent confrontations during 2015 to control it.

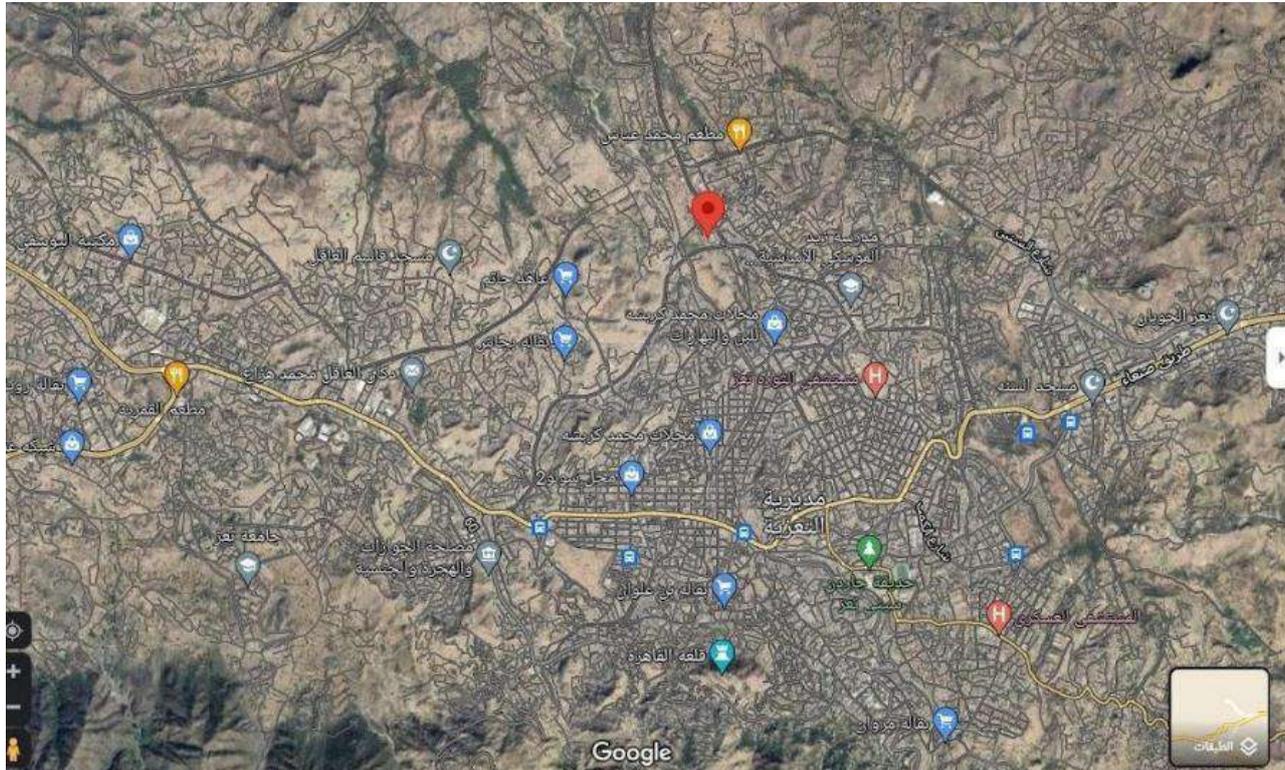


Figure A400 Satellite image from Google Maps, of the location of the rural power station in Taiz city

The incident

On the morning of 29 September 2015, social media platforms circulated news that the rural power station in Osaferah area of Taiz city had been subjected to ground bombardment, as a result of which fire broke out in the station. This event coincided with military confrontations between the Resistance Forces and the government army on one side and the Houthi-Saleh forces in different areas of the city.



Figure A401 Screenshot of Taiz City Facebook page post

This Facebook post claims that there is a fire in Osaferah power station after it was bombed by the Houthi militias and Saleh's forces.

Geographical location

[Taiz News Network T.N.N](#) and [Al-Jazeera TV](#) documented the impact of the shelling in the site of the projectile's fall at the rural power station in Osaiferah area. Through analysing available open sources, attack site was geolocated to coordinates [13.596395, 44.012081](#) near the fuel tanks inside the station.



Figure A402 Screenshots from Al Jazeera YouTube video and a satellite image from Google Earth of the landmarks shown by Al Jazeera report from inside the station

The station is located approximately 600 meters away from the lines of engagement. The nearest location appears in [Al-Jazeera TV's](#) report, where the reporter points to buildings on the strategic Jabal Jarra overlooking the city, while there are no military aspects at the station.

The date and time of the Attack

After 9 am local time, the first report of the incident was published by [Taiz News Network T.N.N](#) on Facebook at 09:05 according to the timestamp analysis tool. The likely time range of the attack is between 08 :45 - 09:05 am, local time, 29 September 2015.

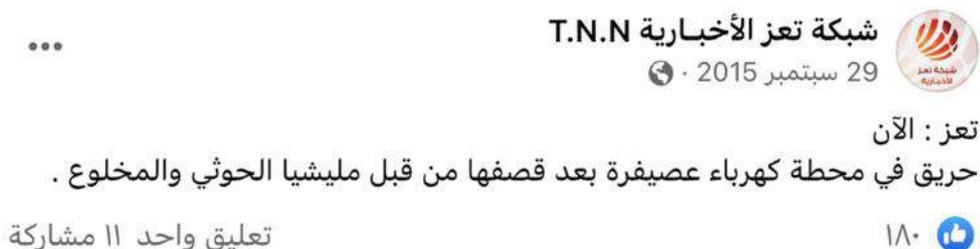


Figure A403 Screenshot of the first report of the incident by Taiz News Network T.N.N .

This tweet by T.N.N. states that there is a fire in Osaiferah power station after it was bombed by the Houthi militias and Saleh's forces

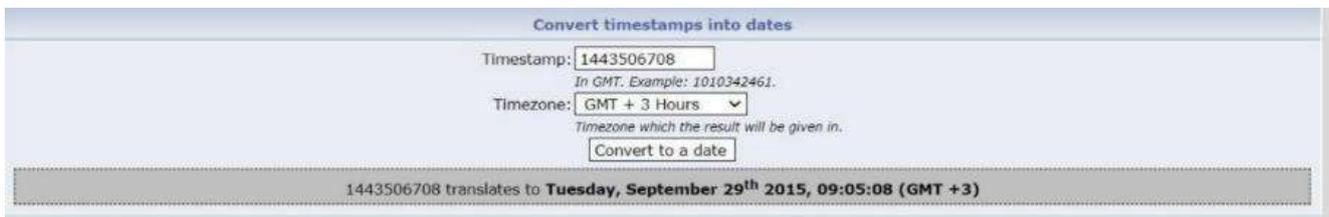


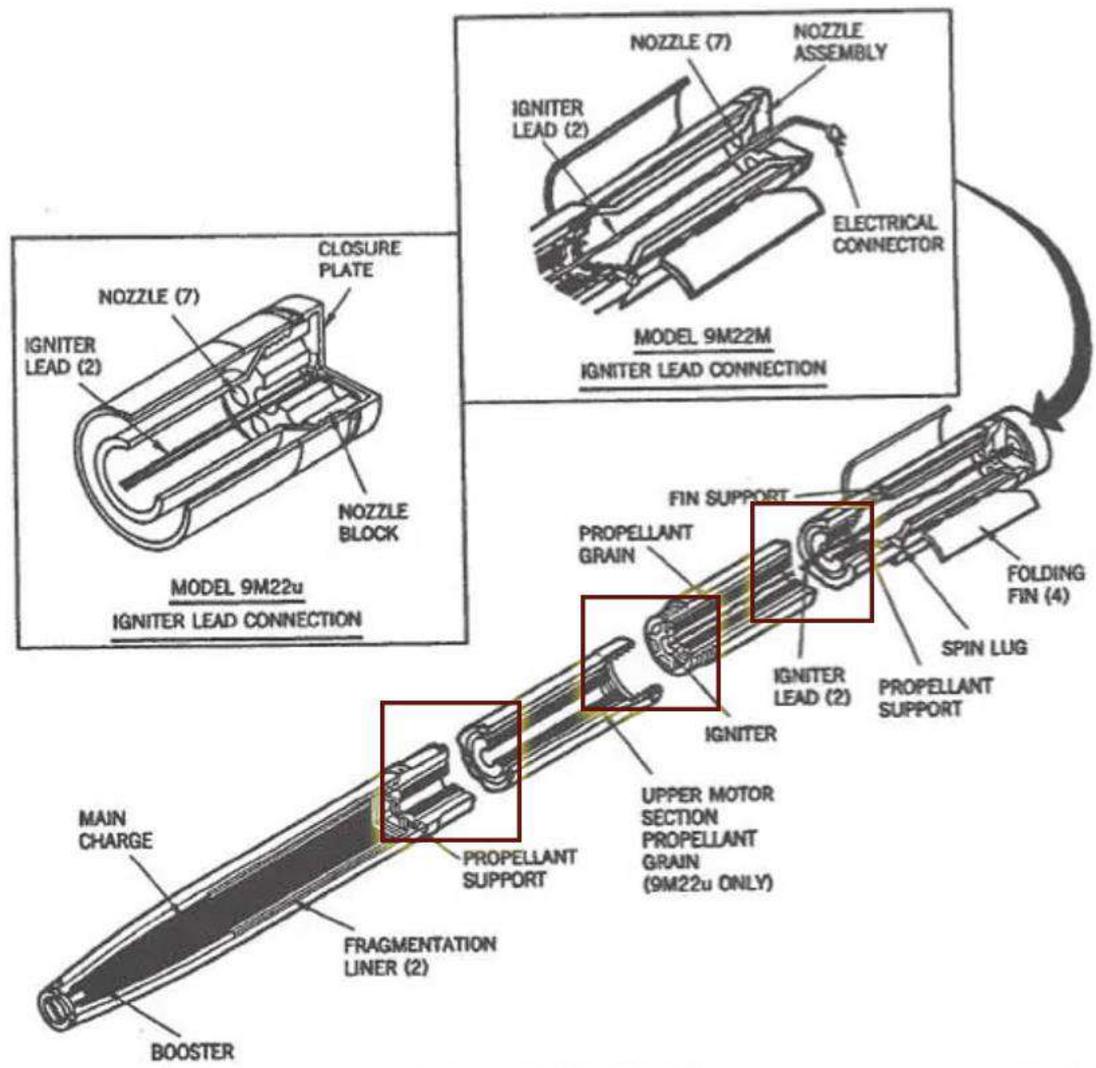
Figure A404 Screenshot of 4webhelp timestamp analysis tool of the first report of the incident in Taiz News Network T.N.N Facebook post

Potential munition

In [video footage](#) of the site after the attack, Al Jazeera News claimed that the weapon used was a Katyusha rocket (Grad bm-21). Taiz News Network T.N.N Facebook [published](#) a photo (see first photo below) and a [video](#) of munition remnants from the attack site. There are 6 pieces with internal and external spiral rings connecting the missile parts. The second photo below shows a drawing of a 122 mm Grad bm-21, depicting the separate pieces of the missile. By comparing the drawing to the image of the weapons remnants, similarities in the separate parts connecting the missile together can be observed. Based on this, Yemeni Archive's analysis of the munitions used in this attack seem to offer support to [Al Jazeera's reporting](#), although further analysis would be needed to make a definitive conclusion.



Figure A405 Photo of munition remnants from Taiz News Network T.N.N Facebook post. This photo shows 6 pieces with internal and external spiral rings connecting the missile parts



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Figure 3

1) GENERAL ARRANGEMENT OF THE ROCKETS

Figure A406 Illustrative photo of the parts for a 122mm Grad bm-21 rocket from the World in War website.

Physical Damage

Open source documentation of this incident shows that the attack resulted in burning and damaging one of the station's electrical transformers, as well as shattering windows in buildings and containers near the site of the missile strike.



Figure A407 Screenshot from Taiz News Network T.N.N Facebook video, showing the burned transformer



Figure A408 Screenshot from Taiz News Network T.N.N video on Facebook, of windows and containers impacted by the attack

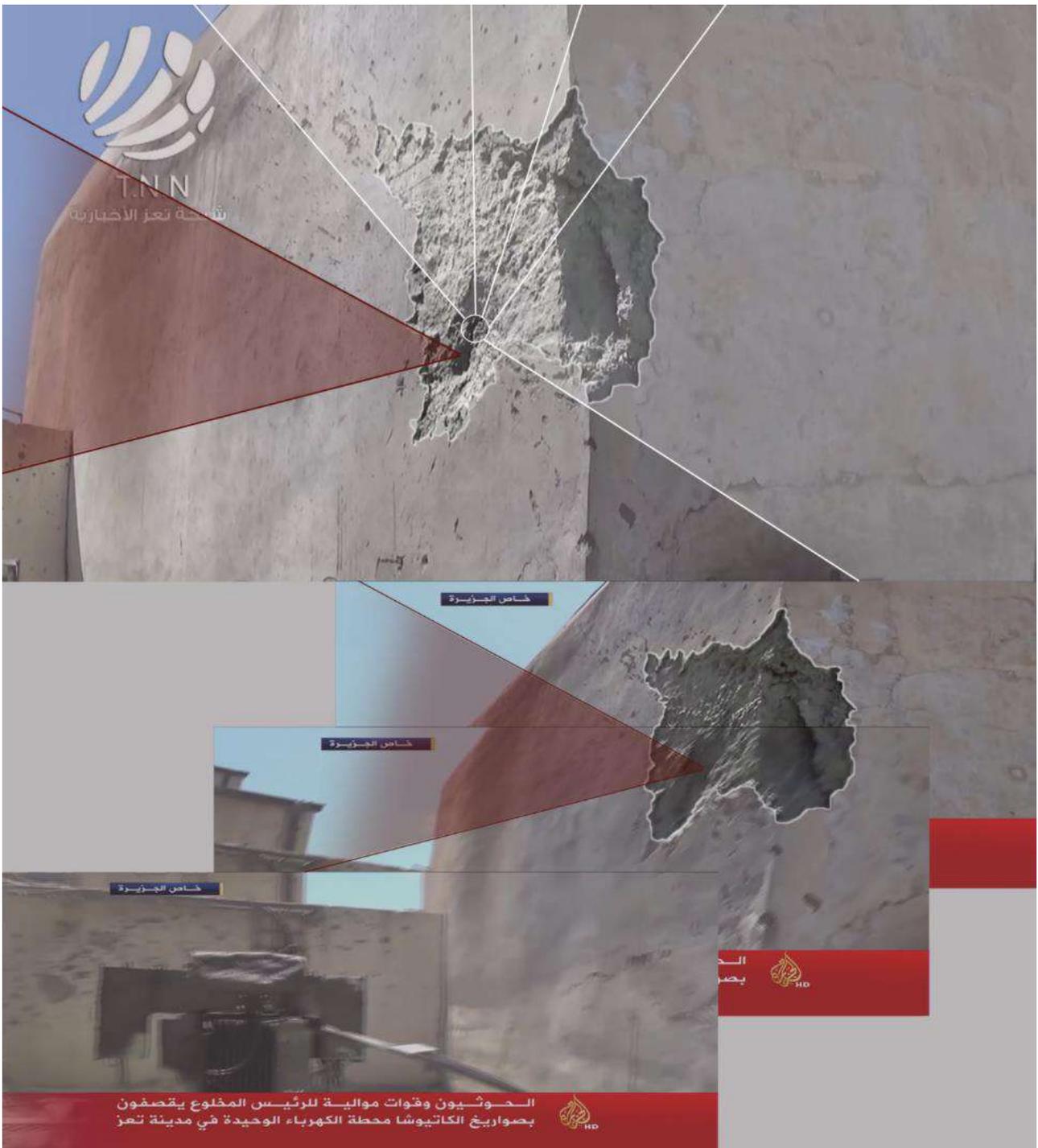


Figure A409 Screenshot from Taiz News Network T.N.N video on Facebook, next to panoramic screenshots from Al-Jazeera video on YouTube showing the possible directions of the missile trajectory based on the impact.



Figure A410 Screenshot from Taiz News Network T.N.N Facebook video



Figure A411 Panoramic screenshots from Al-Jazeera video on YouTube showing the location of the wall in relation to the electrical transformer, in order to determine the direction opposite to the wall

Analysis of open-source documentation appears to support claims made by Al Jazeera's on the Grad missiles being used. Open-source analysis expanded the possibilities of the missile trajectory in a wider range from the east and north-east directions to ensure not to fall into the error of optical deception because the documentation of the wall was from a side angle. By extending the lines to a distance of 20 km - the range of the Grad missiles - open-source analysis revealed that the farthest point controlled by the Resistance within the area of possible trajectory is located at a distance of 20 km, one kilometer from the power station, while the rest of the area is within the control of the Houthi-Saleh forces. Because this analysis fits with the range of the Grad bm-21 missiles, it offers potential evidence supporting Al Jazeera's claims that the weapon used was a Katyusha rocket (Grad bm-21).



Figure A412 Satellite image from Google Earth, showing a possible missile trajectory

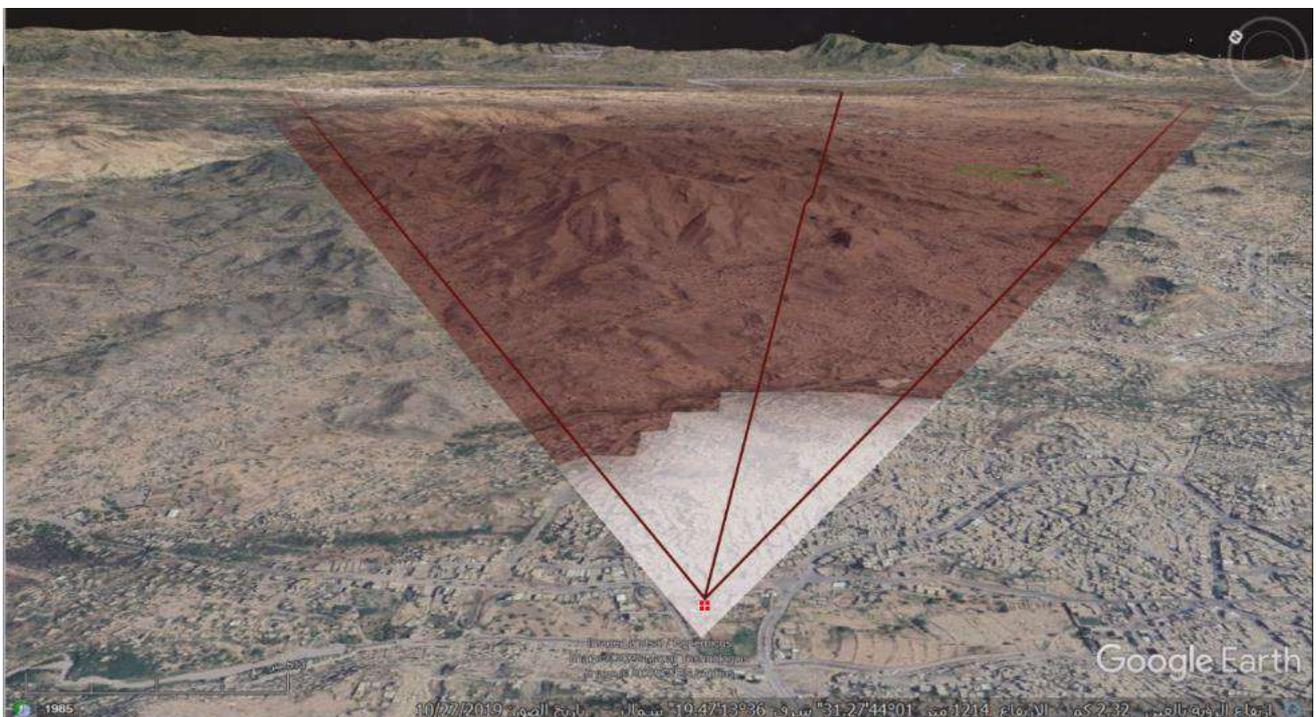


Figure A413 Satellite image from Google Earth, showing the military control during the shelling period within the possible launch area of the missile.

Brown color: Under the control of the Houthi-Saleh forces

Analysis of open source documentation concerning this incident shows characteristics consistent with Houthi-Saleh force attacks. From the areas they control, the Yemeni Army and Resistance Forces can not launch a missile that falls with an impact angle of 25 degrees or less, as we saw in this incident. In addition, there were steel structures and buildings present [in the area controlled by the Yemeni Army the Resistance Forces] higher than the impact site, and this would have prevented the missile from reaching the impact point in the event of a direct hit by the Yemeni Army and Resistance Forces.

However, if a missile was launched from the area controlled by the Houthi-Saleh forces, it can fall in multiple angles, including the angle Yemeni Archive estimated at approximately 25 degrees, which makes it possible that the Houthi-Saleh forces were responsible for the attack.

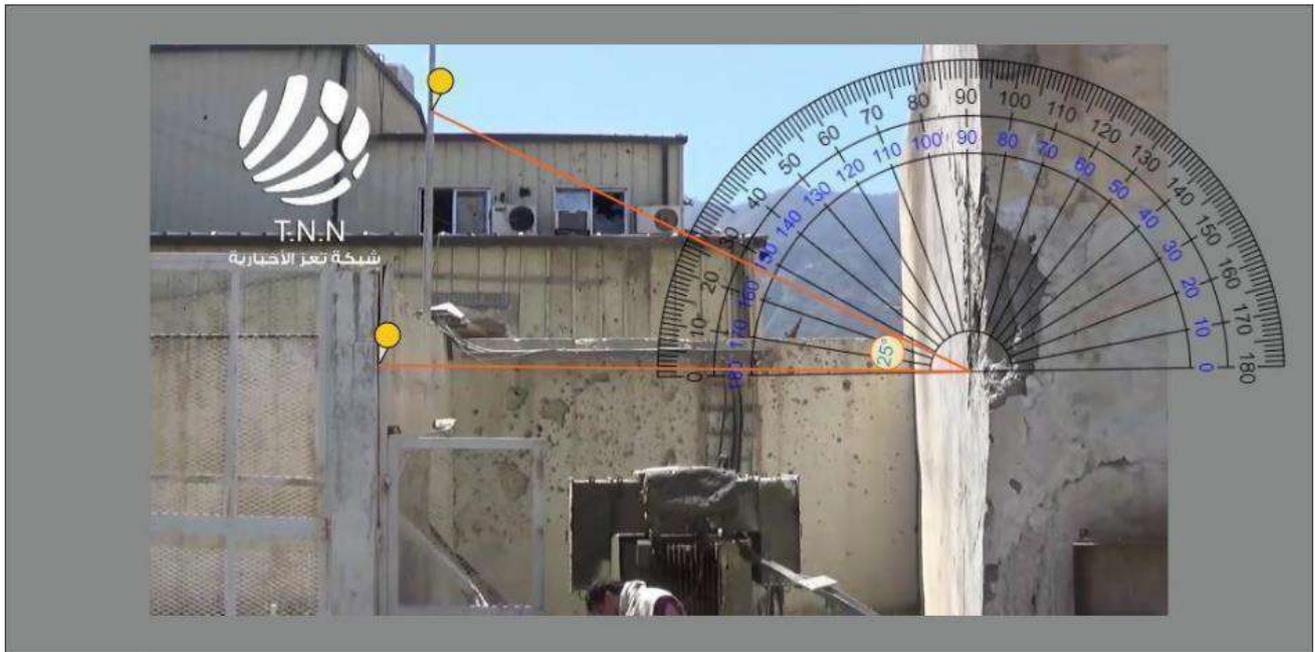


Figure A414 Measurement of the potential impact angle from a screenshot from a video by Taiz News Network T.N.N on Facebook, via Online Protractor tool

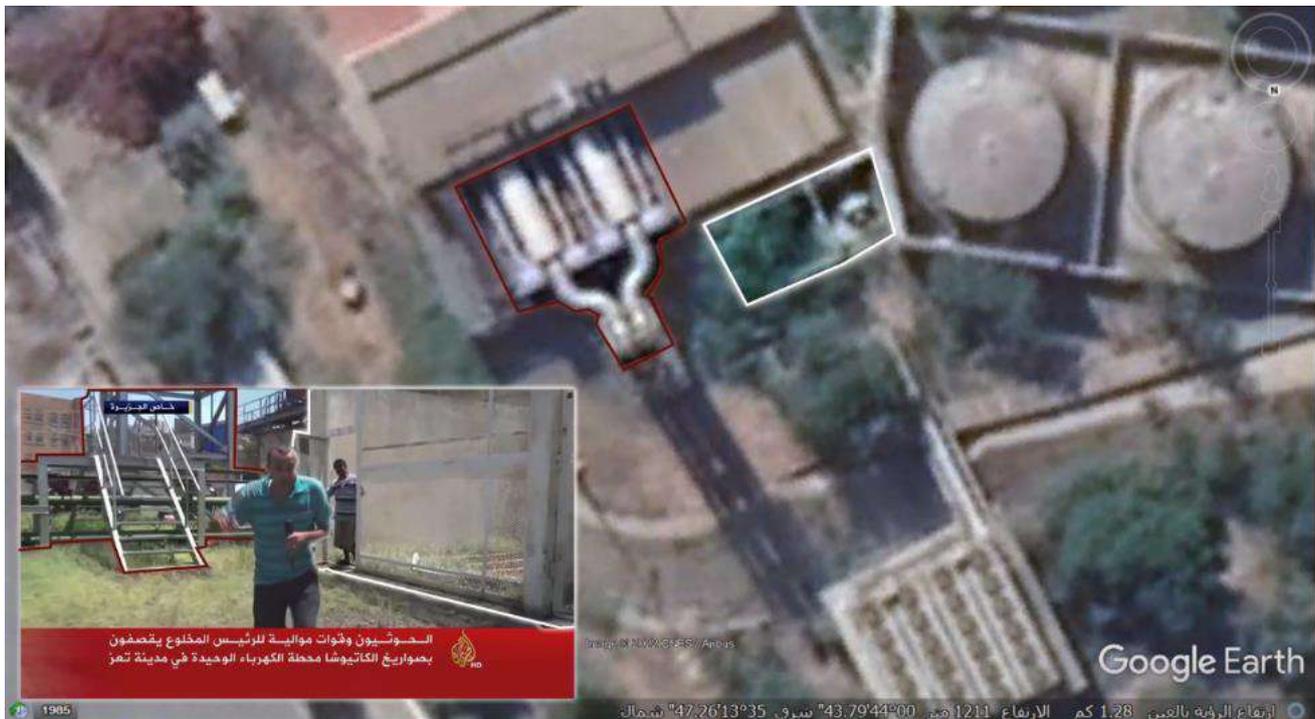


Figure A415 Satellite image from Google Earth and a screenshot from Al Jazeera YouTube video showing steel structures higher than the transformer room

Conclusion

Analysis of available open-source information demonstrates that on the morning of 29 September 2015, the Houthi-Saleh forces allegedly shelled the rural power station in Osaiferah area, north of Taiz city, likely with a 122mm bm-21 grad rocket, and that the attack appeared to burn one of the station's power transformers.

APPENDIX II - LEGAL DEVELOPMENTS

As noted in this report's section on Relevant International Law, most direct parties to the conflict in Yemen are not signatories to major IHRL treaties such as the ICCPR. Since the start of the Saudi and UAE led intervention in Yemen, there have been a number of UN resolutions addressing and condemning the use of food as a weapon of war, and targeting of civilian infrastructure in war, including those pertaining to the Yemeni conflict specifically. They include the following:

On 10 April 2015, the internationally recognized government of Yemen (IRGY) imposed a blockade on commercial and humanitarian imports and authorized the Saudi and UAE led coalition to implement enforcement measures

14 April 2015, UNSC adopted Resolution 2216 imposing an arms embargo against the Houthi rebels, which in turn bolstered and legitimized the IRGY's coalition-enforced arms embargo.

In July 2015, European Parliament condemned naval blockade for dire humanitarian effects resulting in thousands of Yemeni deaths

UN Resolution 2342 (2017) expressed serious concern over humanitarian effects of SLC naval blockade, but stopped short of condemning the naval measures. The SLC naval blockade is arguably not illegal under international law on blockades, because of UNSC 2216, which specifies it is not a true, total blockade, but specifically aimed at stopping arms.

UN Resolution 2417 (2018) recognized the connection between food and conflict, and condemned the use of food as a weapon in war

Security Council Res. 2573 (2021) Protection of critical civilian infrastructure including water and electricity infrastructure, food markets, and others.

In April 2021, UNSC adopted Res. 2573, which referenced a number of international conflicts and civil wars, where civilians have been targeted. It mentions the role of arms transfers and economic sanctions in contributing to the heavy toll on civilian lives and livelihoods. Yemen is a major case it highlights, as pillaging of livestock and airstrikes on fishing boats has led to high risk of mass famine.

Although the legality of the SLC's blockade on Yemen is not clear, it may be illegal under customary international law, codified in the San Remo Manual, if sufficient evidence provides that the SLC has had the intention of starving the Yemeni population. However, this may be difficult to prove given the dearth of information on the conflict (Fink 2017).

Rules on Responsibility for Non-State Actors

There is a debate as to whether non-state actors (NSA), such as the Houthis, can be held responsible under IHRL and IHL. On this subject, there are several UN resolutions which state “armed non-state actors exercising either government-like functions or de facto control over territory and population must respect and protect the human rights of individuals and groups.” Those resolutions include: [list]. Paragraph 29 of A/HRC/45/CRP.7 concludes that the Houthis are in fact the de facto authorities in the North-West of Yemen, thus can be regarded as being bound by international human rights norms. This is echoed by the [International Committee of the Red Cross](#) which recognized the critical role of non-state actors under the human rights principles aimed at protecting citizens. The ICRC has further stated that [“when non-state parties to armed conflicts control territory over an extended period of time, IHL continues to apply and provides protection to civilians.”](#)

The following summarizes the ratification status of international treaties, protocols, agreements, and other documents that are relevant to covered objects’ prospective Human Rights Violations (HRVs):

Relevant Legal Documents	Link
UN General Assembly Resolution 2675 - which was unanimously adopted and applies to all armed conflicts.	UN General Assembly Resolution 2675
Customary IHL - Rule 150. A State responsible for violations of international humanitarian law is required to make full reparation for the loss or injury caused.	https://ihl-databases.icrc.org/en/customary-ihl/v1/rule150
Customary IHL - Rule 53. The use of starvation of the civilian population as a method of warfare is prohibited.	https://ihl-databases.icrc.org/en/customary-ihl/v1/rule53
United Nations Human Rights Council (2021, February 25). Joint Statement by independent United Nations human rights experts on human rights responsibilities of non-State actors.	https://www.ohchr.org/en/press-releases/2021/02/joint-statement-independent-united-nations-human-rights-experts-human-rights?LangID=E&NewsID=26797
Human Rights Council (2020, September 29). Situation of Human Rights in Yemen, including violations and abuses since September 2014.	https://www.ohchr.org/sites/default/files/Documents/HRBodies/HRCouncil/GEE-Yemen/A-HRC-45-CRP.7-en.pdf
ICRC (2015, October 31). International Humanitarian Law and the Challenges of Contemporary Armed Conflict.	https://www.icrc.org/sites/default/files/document/file_list/challenges-report_ihl-and-non-state-armed-groups.pdf
International humanitarian law restricts and prohibits the use of particular types of weapons and delivery modes. Rule 17 of customary IHL states that all parties to the conflict must “take all feasible precautions in the choice of means and methods of warfare” in order to limit the loss of civilian life and damage to civilian objects.	https://ihl-databases.icrc.org/en/customary-ihl/v1/rule17

Relevant Legal Documents	Link
<p>Article 3.8 of Amended Protocol II to the Convention on Certain Conventional Weapons (CCW) defines indiscriminate weapons as weapons that are: "(a) not directed against military objective, (b) means of delivery cannot be directed at specific military objective, and (c) expected to cause incidental loss of civilian life which is excessive in relation to anticipated military advantage.</p>	<p>https://ihl-databases.icrc.org/en/ihl-treaties/ccw-amended-protocol-ii-1996/article-3?activeTab=undefined#:~:text=8.%20The%20indiscriminate,military%20advantage%20anticipated.</p>
<p>Article 1, paragraph 2 of the ICCPR provides that people may not be deprived of their means of subsistence.</p>	<p>https://www.ohchr.org/en/instruments-mechanisms/instruments/international-covenant-civil-and-political-rights#:~:text=2.%20All%20peoples,means%20of%20subsistence.</p>
<p>Common Article 3-Geneva Convention (IV) relative to the Protection of Civilian Persons in Time of War (1949).</p> <ul style="list-style-type: none"> • Yemen Arab Republic: 16/07/1970 (Accession) • Saudi Arabia: 18/05/1963 (Accession) 	<p>https://ihl-databases.icrc.org/en/ihl-treaties/gciv-1949</p>
<p>Convention on Certain Conventional Weapons (1980).</p> <ul style="list-style-type: none"> • Yemen Arab Republic: 16/07/1970 (Not a party) • Saudi Arabia: 07/12/2007 (Accession) 	<p>https://www.icrc.org/en/doc/assets/files/other/icrc_002_0811.pdf</p>
<p>International Covenant on Civil and Political Rights (1966)-ICCPR.</p> <ul style="list-style-type: none"> • Democratic Yemen: 9/02/1987 (Accession) • Saudi Arabia: 07/12/2007 (Not a party) 	<p>https://www.ohchr.org/en/instruments-mechanisms/instruments/international-covenant-civil-and-political-rights</p>
<p>International Covenant on Economic, Social and Cultural Rights (1966) - ICESCR.</p> <ul style="list-style-type: none"> • Democratic Yemen: 9/02/1987 (Accession) • Saudi Arabia: 07/12/2007 (Not a party) 	<p>https://www.ohchr.org/en/instruments-mechanisms/instruments/international-covenant-economic-social-and-cultural-rights</p>
<p>Optional Protocol to the Convention on the Rights of the Child on the involvement of children in armed conflict (2000).</p> <ul style="list-style-type: none"> • Yemen: 2/03/2007 (Accession) • Saudi Arabia: 10/06/2011 (Accession) 	<p>https://www.ohchr.org/en/instruments-mechanisms/instruments/optional-protocol-convention-rights-child-involvement-children</p>

APPENDIX III - METHODOLOGY

This Appendix describes the methodology utilised by Yemeni Archive to carry out this work. More information about the Yemeni Archive's methodology can be accessed [on its website](#).

Sources and types of information used

Yemeni Archive thoroughly researched each of the 611 incidents. This required extracting open-source data observations based on dates and geographic location, as well as using content discovery tools to search on social media platforms, such as Facebook advanced search, Twitter advanced search and Google advanced search.

Non-visual open-source content derived from social media can be more difficult to verify using only open-source tools and methodologies. Consequently, the Yemeni Archive team pulled from a wider variety of online sources when seeking to verify or potentially disprove --- in whole or in part --- the data collected here on attacks on economic infrastructure.

At the initial open-source information collection stage of work, the research team used the Whopostedwhat tool to gather more accurate information about the nature and time of the attack by searching for the first published information about the attack and then analysing the timestamp of Facebook posts using the 4webhelp tool. In order to verify the attacks, the Yemeni Archive team searched archived Google Earth Pro satellite images, analysed the visual documentation associated with the attack and verified its compatibility with the satellite images. These images were also compared with the visual content of each attack and identified by visible and prominent places in photos and in linked videos. Yemeni Archive also relied on YouTube and Google to search for videos posted in the days following the incident in order to make the search more accurate.

When reviewing and verifying the collected open-source information, Yemeni Archive gave greater weight to visual content directly documenting the attack incident or its aftermath that could be verified for location, date, time, and weather content and whose source could be evaluated for reliability and credibility. All open-source materials derived from social media were evaluated for their relevance and potential reliability against a number of factors, including:

- Time of posting relative to the verified attack time;
- Location of the source relative to the verified attack location;
- Seeing if weather in visual footage matches what the weather reports were that day/time
- The source's dialogue or accent relative to those heard in the attack area;
- Historical online behaviors of the source (e.g., whether their tone implies strong biases or whether they appear to have contributed in some way to the spread of mis/disinformation);
- Consistency of technology apparently used by the source (e.g., as discernible in footage quality); and
- Whether the source is known to Yemeni Archive (i.e., whether they are included in Yemeni Archive's established database of credible sources for online content).

Standard of information

Where judgement was required in the tagging process for this project, Yemeni Archive only assigned tags that met a 'reasonable grounds to suspect' standard of information. In other words, each individual tag was assigned only if the researcher was convinced by the available information that there are reasonable grounds to suspect the tag is applicable or accurate. The Yemeni Archive team have chosen to point to and aim for this standard of information with the end goal of being as accurate as possible while also erring on the side of inclusion when assigning tags. For almost all subsequent uses, the facts established in the dataset will require additional investigation and

corroboration. Since Yemeni Archive does not have the resources or mandate to research and evaluate each incident to the highest possible evidentiary standard, use of the 'reasonable grounds to suspect' standard for the information available to the team enables Yemeni Archive to assign tags to incidents both in instances where the team is very confident in the tag based on available open source information as well in instances where the team reasonably suspects that subsequent investigation and analysis will confirm the tag.

The methodology descriptions and examples provided in the tag definitions illustrate how this discretion was exercised and this standard of information met, in practice. Researchers also maintained open lines of communication or otherwise flagged and revisited after consultation the more challenging discretionary decisions encountered. Further, each tag for each incident was reviewed multiple times, at multiple stages of the workflow, by multiple Yemeni Archive researchers. This helped to ensure that all tags were assigned as consistently as possible across the entire database.

Phrased differently, tagging decisions were an application of the standard of information to an open-source verification process. This may mean, for example, that the Yemeni Archive team has seen unverifiable claims in the source materials about certain alleged perpetrators, delivery methods, munitions, or other types of information. However, simply because Yemeni Archive has not affirmatively tagged these claims does not mean that they are necessarily false. The team simply could not verify them to the chosen standard. For this reason, the default tag identified in Yemeni Archive's methodology is often 'unknown,' and the final database includes numerous 'unknowns.'

Confidence annotations

For each incident considered for the database, Yemeni Archive assigned overall confidence scores of 0, 1, 2, or 3. These scores are separate from the 'alleged perpetrator' confidence scores, as they assess sources and content around what happened more generally. They therefore oftentimes but do not necessarily always overlap with the score given for alleged perpetrator confidence. Incidents with an overall confidence annotation of 0 were excluded from the database, because for such incidents there was deemed to be no reliable or consistent evidence confirming their existence. As explained below, however, a number of incidents with an alleged perpetrator score of 0 do exist in the database, as these were incidents in which an alleged perpetrator had to be tagged as unknown. For such incidents of 'unknown alleged perpetrator' included in the database, there was some visual evidence and/or sources considered reliable, from which the team could determine sufficient likelihood of a specific time, location, and/or impact such as reported civilian casualties. For example, in incident [INF_0069607], unknown attackers bombed a hospital's electricity generator in Aden. The team had visual evidence from multiple sources showing the location and impact from the attack's explosions, including reports of civilian casualties, allowing the team to score this incident with a confidence of 2, but not enough to give it a 3. Because there were no explicit claims on who the perpetrator was, and no visual evidence of weapons remnants or other content to indicate a particular perpetrator, the alleged perpetrator score was a 0. In the table below (Figure A500), the distribution of total incident confidence scores is shown for each alleged perpetrator. As the table shows, 83% (432 out of 522) incidents allegedly carried out by the Saudi led coalition and pro-coalition forces had confidence scores of either 2 or 3, meaning there was a fair to high amount of certainty of the incidents occurring as described. An even higher proportion, 97% (63) of alleged Houthi incidents had a score of either 2 or 3.

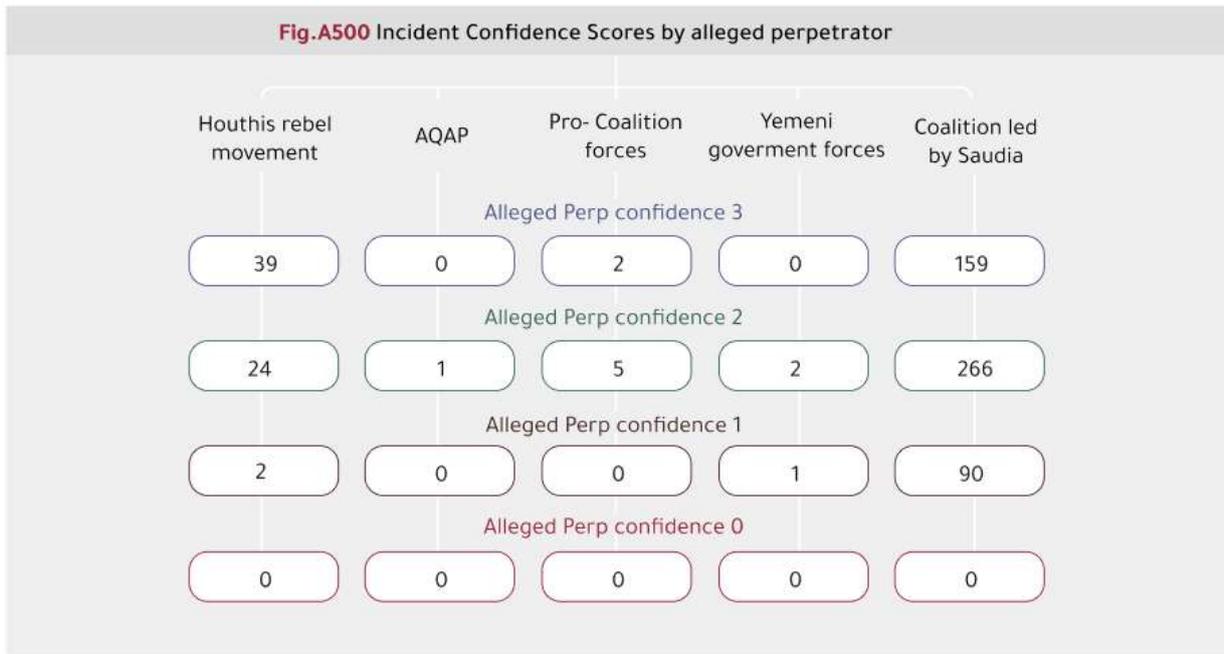


Figure A500 Incident Confidence Scores by alleged perpetrator

Confidence rating

Confidence rating

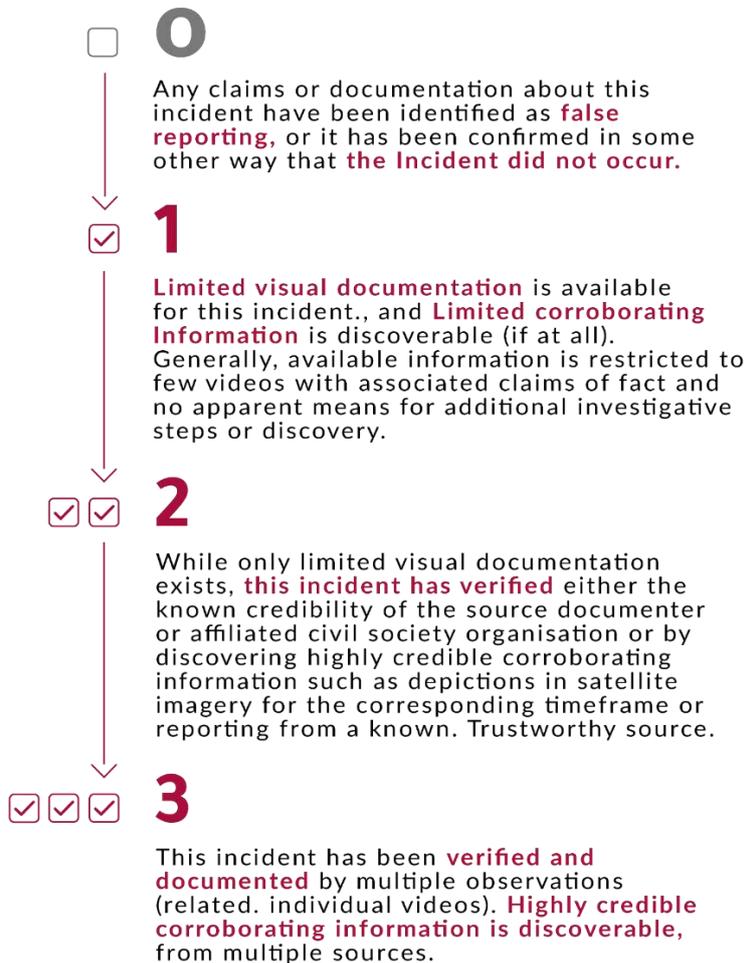


Figure A501 Yemeni Archive’s process for determining total incident confidence scores is broken down by the rankings of 0 through 3.

Alleged perpetrator – Confidence Approach

Perpetrator attribution has been assigned to each incident for which a credible, reliable, and corroborated perpetrator allegation has been identified among the potentially responsible groups: the Houthi rebel movement, the Saudi-led coalition, Pro-coalition forces, Yemeni government forces, Al-Qaeda in the Arabian Peninsula (AQAP). All perpetrator claims were considered in combination with other information about the attack incident, particularly which group reportedly controlled the attack area (area of control), proximity to any frontlines, and weapons used or delivery method (for example, airstrikes were much more probably attributable to the SLC). The default for the alleged perpetrator tag was “unknown”: if available information did not pass the chosen standard of information threshold for tagging, our researchers tagged “unknown.”

0 - Perpetrator is unknown, and there is no available information to support allegations against any one perpetrator. Available attribution information is conflicting and therefore not clearly indicative of a specific party's responsibility. There is often more conflicting evidence that would lead to a designation of 0 here in cases of militias, including the Houthis as well as coalition-affiliated militias. This is because their method of weapon delivery tends to be more varied and less easily identifiable than Saudi coalition airstrikes. Furthermore, the high number of militias on the ground with shifting loyalties and unclear motives for attacks can make it difficult to be sure of the specific perpetrator. For example, in incident MAR_0223, unknown forces potentially affiliated with the UAE-backed Abu al-Abbas Brigades planted explosives in a crowded market in Taiz. In several cases in which the alleged perpetrator is 0, there were clashes between the Houthis and SLC and its affiliated forces, which made it difficult to confirm any one specific perp.

0 - Unknown perpetrator

1 - Very limited attribution information is available, but what is available is consistent with publicly available indicia of a specific party's responsibility (SLC, Houthis, Yemeni government, pro-coalition forces, AQAP, or ISIS). Relevant observations contain no verifiable visuals implicating a specific perpetrator, and there is no physical damage visible from satellite imagery to confirm exact location. For example, in the incident MAR_0310, AQAP, in coordination with Saudi-backed militias, reportedly fired mortar shells on a market in Taiz. The exact nature of the relationship between the Saudi-backed militias and AQAP was unclear, and, although sources were consistent, none offered a great amount of detail on the perpetrators or their potential motives.

2 - All available attribution information is consistent with publicly available indicia of a specific perpetrator's responsibility. There are some verifiable visuals implicating a specific perpetrator. However, there is no statement by an official party source, such as the JIAT, nor is there visuals of weapons remnants implicating a specific perpetrator's weapons.

3 - The Yemeni Archive has a very high degree of confidence that a specific party is responsible. Large number of sources confirming attribution; statement made by external authority associated with that party (e.g. JIAT, SLC...). All available attribution information is consistent with publicly available indicia of a specific party's responsibility, and relevant observations include verifiable visuals indicative of that particular party's responsibility (e.g., the airframe or munition(s) used in the airstrike).

One of the initial factors that goes into helping Yemeni Archive to determine the perpetrator behind an attack is who controls the area. Often, but not always, the perpetrator is fighting the group in control of the territory where an attack is located. The vast majority of SLC attacks were on Houthi controlled areas, although several SLC attacks were on territory controlled by pro-coalition forces, many of whom are backed by the UAE, which is nominally an

ally and lead coalition partner to Saudi Arabia and the IRGY, but whose interests frequently compete with and rival those of the IRGY and Saudi Arabia. Most Houthi attacks were in territory controlled by either pro-coalition forces or the internationally recognized government of Yemen, though some were in Houthi-controlled territory.

Given that the Houthis control territory home to about 70% of Yemen’s population, it is not surprising that over half of the area of attacks are in Houthi-controlled territory.

As Figure A502 below shows, for 77% (50) of the incidents in which the Houthis were an alleged perpetrator, a score of at least 2 was given, meaning that there was a fair to high level of confidence of Houthis being the alleged perpetrator for the majority of incidents tagged as Houthi for alleged perpetrator. For a similar proportion, 78% (402) of incidents in which the Saudi led coalition was a perpetrator, there was a score of at least a 2 given for confidence that that perpetrator was the Saudi led coalition. For the 7 incidents in which other pro-coalition forces were allegedly involved, most (71%, or 5 incidents) only had an alleged perpetrator confidence score of 1. As Figure A501 above shows, however, most of these pro-coalition forces incidents had incident scores of at least 2. This discrepancy may be due to the fact that there are so many different pro-coalition forces on the ground, and verifying with a high level of confidence a specific perpetrator is often more difficult than with the Houthis or with Saudi airstrikes. Nonetheless, despite greater uncertainty over alleged perpetrator confidence, there has been enough content to show these incidents exist in terms of location, time and type of attack.



Figure A502 Confidence score for attribution of alleged perpetrator

Area of control

Area of control research involved an evaluation of the geographic area surrounding the attack impact site on which faction of the conflict was effectively in control at the time of the incident in question. To determine this tag, Yemeni Archive searched historical data on frontlines from [Liveuamap](#) and corroborated this information with additional research. The tag options are: Yemeni government forces, Houthis rebel movement, Al-Qaeda in the Arabian Peninsula (AQAP), Pro-coalition forces, ISIS, Tribal militias, Disputed areas, and Unknown. For disputed areas the controlling group is contested or in flux, meaning multiple groups have a stake in control over the area and recognised or effective control changes both regularly and unpredictably.

Physical Damage visible in satellite imagery

This is determined by visual (satellite) sources. If damage to allegedly impacted or otherwise affected site is visible in the satellite imagery, this is TRUE; if not, FALSE

Exact location

This is often, but not always, determined by damage visible in the satellite imagery. It can also be determined through corroborating evidence and other visual sources, such as photographs taken at the site that show the site of impact and its surroundings. If the team was able to verify the exact coordinates of the site impacted, this is TRUE; if Yemeni Archive does not have information on exact coordinates, it is UNKNOWN; if Yemeni Archive has coordinates that are an estimate or a nearby location but not the exact location directly impacted, then it is FALSE

Impact Visible in Observation Data

If Yemeni Archive has visual evidence showing the effect of the attack, then this is YES

Location analysis

This tag describes the name of the governorate where the attack occurred. As with the more specific exact location, this is determined by a combination of sources, and this tag does not generally require visual verification, given it is a very general location category.

District

This tag also does not usually require visual verification. This is a somewhat more specific category than “location analysis”, as it describes the district, which sometimes is the same as the city, where the attack occurred.

Area

This does not always require visual verification, but often includes visual sources. Of the general location categories, this is the most specific, as it describes the area within a district that the attack occurred. There is not always a name for a specific area beyond what the district is called, in which case this category would be left blank, or refers back to the name of the district or governorate, such as in the case of Saada City, the data would be tagged “the City” in reference to the governorate and district name of Saada. Sometimes this tag is left blank if it is simply unknown because the exact location is not known, but this is not always or necessarily the case, as there are not always names for specific areas.

Weapons remnants

If Yemeni Archive has visual evidence from photographs or videos of weapons remnants found at the site of the attack, then this is labelled YES.

Delivery method/weapons used/munitions:

This is typically determined by a combination of visual and research sources. If the attack originated from the air, it was tagged as an airstrike, (e.g. this could include cluster, guided bomb, flash bomb, etc.). If the attack originated on the ground but was fired at a site above before hitting the ground again, this was tagged as ground to ground (e.g. this could include mortar, artillery, small arms). For cases of placed explosive and small arms, this was simply labeled ground attack, as it was not fired above ground. The team included multiple methods of delivery in cases of there being multiple types of weapons delivery cited in sources for a particular incident. In cases where multiple delivery methods were tagged, there were claims of various weapons types being used simultaneously, or, in some cases, variation in what the accounts described. For example, in incident INF_00919, the Houthis allegedly attacked a solar-powered water project in Hudaydah governorate, with [several sources](#) claiming that [the Houthis](#) had fired

[medium weapons](#) and [used a BMP vehicle](#). The team labelled this as a ground attack with small arms as the munitions. Photo and video evidence also included an eyewitness on the farm showing remnants from what he [claimed to be from an RPG](#). So, in addition, the team labelled this also as a ground to ground with rocket-propelled grenade as the munition.

In such video footage from open sources the team looked for indicators of specific munitions or weapons systems remnants. The team would then match these to known types of weaponry used by parties to the conflict. If a munition was observed within visual content preserved on Yemeni Archive's infrastructure, additional desk research was conducted whereby other investigations completed by Yemeni Archive on types of weapons systems and munitions used, as well by other organisations or international accountability bodies (e.g. HRW, United Nations), were reviewed.

Direct Hit

Yemeni Archive determines whether there was a direct hit from having several verified sources claim that the impact site was hit directly by the alleged perpetrator, as opposed to being incidentally hit as a result from general fighting or a different intended object of impact. For example, if a vehicle inside a station is hit and the station was hit, this is not a direct hit. Or if Houthis and SLC were fighting in a market, not a direct hit. While not absolutely necessary, visual evidence in which the incident being analysed shows indicators the site may have been targeted, is given greater weight. In addition, if Yemeni Archive found that an official source, such as the JIAT, or a Houthi spokesperson, admitted to directly hitting the location in the incident, then this is considered evidence verifying a direct hit. While direct hit alone cannot determine intentionality behind the attack (i.e. whether the site directly impacted was meant to be, or, for example, was mistaken for something else), it nonetheless is a very important indicator of whether or not the site was the specific site of the attack, as opposed to being affected in a secondary blast. It is a necessary, but not sufficient, condition for determining whether a site was intentionally targeted.

Double tap

This is typically determined by a combination of visual and research sources. An incident is marked TRUE for Double tap if there was corroborating evidence to show that the same location for the site of the incident was hit more than once within a 12-hour period. If there was only one strike or hit in the 12-hour period, it is marked FALSE. Double taps are generally treated as single incidents in the database, with a single incident code number.

Repeat attack

This is typically determined by a combination of visual and research sources. An incident is marked TRUE for a repeat attack if there was corroborating evidence to show that the same location for the site of the incident was hit more than once, after more than 12 hours had passed since the initial attack. For example, a repeat attack could be an airstrike hitting a gas station twice over the course of two different days, or twice over the course of two years. All incidents involved in the repeat attack are marked true, including the incident on the initial date of the first attack in a series of repeat attacks. If there was no repeated hit on a site, or if the repeated hit fell within a 12-hour time frame since the initial hit, then this is marked FALSE for repeat attack.

Fixed Object/Non-fixed object

This is determined from visual analysis, as well as possible further corroboration from additional research/sources. An incident was tagged as TRUE for 'Fixed object' if the object impacted was stationary and did not have the potential to be in motion at the time of impact. This would include a gas station, an oil facility, or a water facility. Objects considered non-fixed in any way were marked FALSE for this, and TRUE for 'non-fixed object'. Examples of non-fixed objects include oil, water, or food trucks. In cases where the truck was parked and thought to have been

parked throughout the duration of the incident, the label “Non-fixed object” was still marked TRUE given the potential for the object to be in motion and inability to say with 100% certainty that the object was stationary. For example, in incident INF_00443, it was uncertain whether or not the trucks were moving. The SLC allegedly hit five transport trucks (four with fuel, one with food) as well as a gas station. Some sources stated the trucks were parked near the gas station, whereas others mentioned them being on the main road. Because YA’s sources showed evidence of the trucks as well as the gas station being impacted, this incident was labelled TRUE for both ‘fixed’ and ‘non-fixed’ categories, as it contained impacted objects known to be stationary (the gas station) and those with the potential to have been in motion (the trucks).

Although this binary labelling was generally useful for differentiating between potentially moving objects and those known definitively to be stationary, there were some notable exceptions in which the ‘fixed/ non-fixed’ tags could be counterintuitive or in conflict with what the sources described. For example, in INF_0069631, the SLC allegedly hit a water truck that was parked at Wahb dam, waiting to be filled to irrigate crops. Although the sources described the truck as stationary at the time of the attack, YA nonetheless marked this incident as TRUE for ‘Non-fixed object’ because the impacted object was a (water) truck, which always had the potential to move and there is no way of knowing when the last time it had moved before being destroyed.

Additionally, in the incident INF_00397 (see also water case study in Water section) the SLC hit a water rig, which the JIAT admitted to the coalition having mistaken it for a missile launcher, given the similarity in the shape of the crane. Because the water rig had a crane that might have been moving at the time of the attack, YA tagged it as a ‘Non-fixed object’. There were 12 other incidents involving attacks on water drillers [INF_00907, INF_00688, INF_00414, INF_00463, INF_00466, INF_00541, INF_00559, INF_00595, INF_00613, INF_00628, INF_00634, INF_00655] which the team labelled as Non-fixed for this reason. YA does its best to be as deliberate and literal in its descriptions as possible, so as to err on the side of giving whatever party is the alleged perpetrator the benefit of the doubt in whether it was targeting an object, and also whether an alleged target was hit with intentionality, as opposed to, as in this case, hit accidentally, as the JIAT claimed. At the same time, this label of ‘Non-fixed’ in this particular incident also offers potential further evidence for the impacted object having been a potential target, given that this was a double tap.

Conflicting narrative

This is a mostly research-based tag, and not one derived from visual analysis. It is marked TRUE if there was conflict or inconsistency in what the sources YA reviewed regarding the overall trajectory of events that occurred, including who the alleged perpetrator was, what was impacted, whether something was directly hit or hit as a result of an attack on something else, or what types of weapons and delivery method were used (airstrike or ground-to-ground). This does not include disagreement over specifics that do not affect the general scenario of what happened, such as number of casualties, but it *does* include disagreement over whether civilians were impacted at all, or whether it was solely a military site being impacted.

APPENDIX IV - LIMITATIONS

Open-source information presents challenges and limitations to its use. The proliferation of the Internet and smartphones has significantly increased the amount of open-source content available in comparison to the pre-digital period. Data is more plentiful, but also (arguably) more difficult to verify. The veracity and reliability of open-source content must be evaluated on a case-by-case basis. As a result, open-source information is often paired with evidence gathered from other methods, such as interviews with affected parties. For example, a video might be presented alongside a witnesses' testimony of an incident to corroborate their account.

This section details several limitations regarding the types of incidents captured, source bias, to what extent captured incidents reflect the overall picture of human rights violations in Yemen, and the accuracy of casualty counts.

Types of incidents captured.

The most robust open-source documentation of violations committed during the Yemeni conflict includes incidents that occur in public, such as airstrikes and mortar attacks on residential neighborhoods. By contrast, violations that typically occur in private and impact individuals—such as gender-based violence and mistreatment of detainees—tend to have less, if any, open-source documentation available.

This dynamic seems to stem from the ease of filming public versus private violations in conflict situations. Any bystander can film and upload footage from the aftermath of an airstrike. By contrast, accessing violations that occur in detention facilities or other restricted locations requires one of three unlikely situations: 1) the presence of a guard or facility employee who films for their own personal gratification and either posts their video, or their video is leaked, as happened with the leaked [footage](#) of Russian mercenaries torturing a Syrian army conscript to death, 2) the presence of a guard or facility employee with a strong conviction that what they are witnessing needs to be exposed, and a willingness to take on great personal risk to do so and 3) hackers gaining access to security camera [footage](#) and posting it on the Internet, as occurred with footage of prisoner abuse at Tehran's Evin prison.

Given these limitations, incidents captured by this scoping report tend heavily towards public incidents such as airstrikes and mortar attacks.

Source bias.

Most open-source documentation of violations in Yemen is produced and/or uploaded by media outlets and personalities affiliated with one party to the conflict: the Houthi Ansar Allah movement, the SLC, the STC, Islah movement, etc. (There are some exceptions such as Belqees TV, whose editorial line is independent despite the Islah connections of the outlet).

This does not mean that images and videos of violations posted by these sources have been manipulated. However, the prevalence of photographers and uploaders associated with conflict parties could present challenges to the use of open-source documentation in advocacy efforts or legal proceedings, as implicated parties could claim inherent bias, namely that documentation was manipulated by the photographer or uploader.

Yemeni Archive's methodology seeks to mitigate this limitation by matching video versions over time (repeated postings to check for changes). However, this does not preclude the possibility that videos were altered before they were uploaded to the Internet.

Potential lack of representativeness.

It is impossible to know to what extent the incidents presented in this report are a complete reflection of the overall scope of human rights violations in Yemen. An unknown number of violations have occurred and have not been recorded or reported. Yemeni Archive's time-intensive analysis precludes comprehensive data capture.

This limitation does not reflect upon the accuracy of the data presented here, but it should make the reader cautious about generalizing the trends explored in this report across the entire Yemen conflict.

Accuracy of casualty counts.

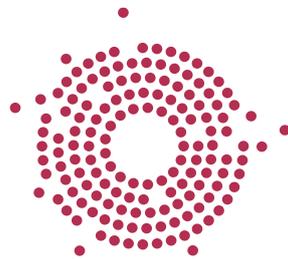
Many open-source records are produced in the immediate aftermath of an attack. Therefore, casualty counts as presented by news websites, reporters, and citizen journalists should not be taken at face value. In many cases, human remains have yet to be extracted from attack sites, and bystanders might not have accurate information given the chaotic aftermath of the attacks. More accurate casualty counts require an in-depth analysis of each incident. In the case of discrepancies across sources, it may be necessary to contact medical personnel who treated the wounded, family members of victims, local government officials, etc.

About the data:

This database contains documentation of 611 attacks on economic infrastructure in Yemen since the first documented incident in 2015. This data comes from 948 sources. Open sources posted online come from individual citizen journalists, local and international media groups, as well as NGOs and civil society organisations. It is important to note that many of these sources are partisan. Given the highly polarized political climate in Yemen, this is inevitable; their claims should be evaluated with caution.

In total, Yemeni Archive identified 6175 relevant videos, posts, and publications from news sources documenting attacks on economic infrastructure and markets, the majority of which were published on social media pages.

The sheer amount of content being created, and the near constant removals of materials from public channels, means that Yemeni Archive is in a race against time to preserve important documentation of crimes committed. Content preserved and verified by the Yemeni Archive might offer the only evidence to corroborate other evidence of attacks on economic infrastructure in Yemen and to implicate potential perpetrators.



YEMENI ARCHIVE