Forensic Architecture

Goldsmiths, University of London
8 Lewisham Way
London SE14 6NW
United Kingdom

forensic-architecture.org

Airstrike in Barbour, Beirut

26 November 2024

Digital Incident Reconstruction
Expert Report

22 January 2026

A Contents

B About Forensic Architecture

1 Forensic Architecture (FA) is a research agency, based at Goldsmiths, University of London. The team includes architects, academics, journalists, and other specialised professionals and experts.

2 We have provided spatial research and evidence for numerous human rights investigations and prosecutions under international law, including at the UN General Assembly in New York in October 2013, and the Human Rights Council in Geneva in 2014 (on drone warfare via the UNSRCT).

B.1 Selected submissions to legal processes and parliamentary inquiries

3 Our report on the Use of White Phosphorus in urban environments was presented in 2011 in the Israeli High Court, and at the UN Human Rights Council (HRC) in 2012.

4 We presented findings to the French Tribunal de Grand Instance in 2012 (1317601476; 2300/13/69). In 2019, the same work was cited in a communication to UN HRC in SDG vs. Italy.

5 We presented findings to the UN General Assembly alongside the UN Special Rapporteur on Counter-Terrorism and Human Rights (Ben Emmerson KC) in October 2013 and the UN HRC in 2014 (FA's reports: 1 / 2 / 3 / 4).

6 We submitted findings to the Inter-American Court of Human Rights in 2013 on the case of the genocide perpetrated against the Ixil Maya. In March 2024, Professor Weizman was cross-examined in the criminal trial of Lucas Garcia in the First Criminal Sentencing Court for High Risk Processes Group A, brought by the Human Rights Office of the Archbishop of Guatemala (ODHAG).

7 We presented in the Israeli High Court in the case of The Committee of the Village of Battir vs. the Ministry of Defence (HCJ 7612/12).

8 Our findings on the 2014 bombing of Rafah by Israel were submitted to the International Criminal Court (ICC) and the UN Independent Commission of Inquiry in 2015.

9 Our investigation of the murder of Pavlos Fyssas was played in the Court of Appeal of Athens in 2018, as part of the trial of 69 members of the Golden Dawn political organisation (2425, 2644/22-10-20).

10 Our 2018 findings on the killing of Tahir Elçi were cited by UN rapporteurs as instrumental in the re-opening of the state's investigation and were cited in the prosecutors' indictment in 2020.

11 Our investigation into the presence of Russian military units in eastern Ukraine in 2014 was submitted to the European Court of Human Rights (ECtHR) by the European Human Rights Advocacy Centre (EHRAC) in 2019.

12 Our investigation into the pushbacks of Turkish nationals Ayse Erdogan and Kuzey in the Evros/Meriç in May 2019 was submitted to the ECtHR by the Greek Council for Refugees (A.R.E. v. Greece, 15783/21, and Akcay and Others v. Greece, 60702/21).

13 Our investigation into the enforced disappearance of a Syrian man in the Evros/Meriç in November 2016 was submitted to the United Nations Human Rights Committee in 2020 by the Global Legal Action Network (GLAN).

14 Our investigation into the killing of Muhammad al-Arab at the Greek-Turkish border of Evros/Meriç was submitted by lawyers from Turkey's Edirne Bar Association to the ECtHR.

15 Our investigation into the killing of Muhammad Gulzar at the Greek-Turkish border of Evros/Meriç was submitted to the ECtHR. Gulzar's family also initiated legal proceedings in Greece (Muhammad v. Greece, App No 34331/22), during which FA staff testified pre-trial as expert witnesses. These investigations led to an emergency hearing of the LIBE Committee of the European Parliament in July 2020 during which our reports were extensively discussed.

16 Our investigation into the pushbacks of Parvin A. was submitted to the United Nations Human Rights Committee in February 2022 by the European Centre for Constitutional and Human Rights (ECCHR).

17 Our investigation into intentional fire-setting in Papuan rainforests was submitted to a court in Hamburg in February 2021 (324 O 561/19).

18 Our investigation into the 2011 police killing of Mark Duggan in London, commissioned by lawyers for the Duggan family, was submitted to pre-trial negotiation in the case of Pamela Duggan & Others v The Commissioner of Police for the Metropolis, Claims No. HQ12X02226 and HQ12X02909.

19 Following our investigations into the right-wing terror attack in Hanau, Germany, in February 2020, FA was invited to present as expert witnesses at the investigative inquiry UNA 20/2 of the Hessen state parliament.

20 FA's research was commissioned by the Colombian Truth Commission towards its final report, published in 2023. Following the submission to the Colombian Truth Commission, Forensic Architecture was commissioned as an independent expert by the Comite de Solidaridad con Presos Politicos to analyse the materials of the criminal case 111001600013201913891 into the death of Dilan Cruz.

21 Our investigation into the killing of LGBTQ+ activist Zak Kostopoulos was submitted to court in Athens in 2021, and FA's lead investigator for the case, Christina Varvia,

testified as an expert witness in January 2022 and in January 2024, at the first and second degree trials respectively.

22 Our investigation into drift-backs of asylum seekers in the Aegean Sea has been submitted to the European Court of Human Rights as supporting evidence for two cases filed by victims against Greece (e.g G.R.J. v Greece (app.no. 15067/21) and A.A.J. and H.J. v Greece (app.no.24982/21)). The investigation's findings were reviewed and deemed credible by FRONTEX, the European Border and Coast Guard Agency, at the request of MEP Erik Marquardt.

23 Our director, Professor Eyal Weizman, appeared as an expert witness in R v. Gwynne & Bin Hishamundin at Loughborough Magistrates Court in 2023.

24 Our investigation into the September 2020 fire in Moria refugee camp was submitted to the Mixed Jury Appeal court of the North Eastern Aegean in Greece in the appeals against decisions 46-55/2021 (ABM A-2020/2076) in March 2024.

25 FA's expert report and reconstruction of a train collision was submitted to Circuit Court of Cook County, Illinois, USA (Case No: 2002 L 005325) in September 2024.

26 FA's expert report and reconstruction of the police killing of Sean Fitzgerald by the West Midlands Police in Coventry, UK was submitted the Coventry and Warwickshire Coroners Court in February 2025. FA's lead investigator on the case, Kishan San, testified as an expert witness at the Coroners Court in May 2025.

C Project Team

C.1 Dr Samaneh Moafi, BA, MA, PhD

27 Dr Samaneh Moafi is Assistant Director of Research at Forensic Architecture. Before joining FA in 2015, she completed her BA and MA in Architecture at the University of Technology, Sydney, and a PhD in Architecture at the Architectural Association in London. At FA, Samaneh Moafi provides conceptual and methodological oversight across projects, specialising in spatial investigations and crime scene reconstruction.

28 For this project, Samaneh Moafi coordinated and produced the spatial research, and wrote this report.

C.2 Kishan San Il Tze Bhopal, BA(Hons), AA Dipl

29 Kishan San is a Senior Researcher and Architectural Investigator at Forensic Architecture. Before joining FA in 2019, he completed a BA in Architecture at the University of Westminster, with First Class Honours, and a Diploma in Architecture at the Architectural Association, with commendation. At FA, Kishan San specialises in spatial investigation and incident reconstruction.

30 For this project, Kishan San produced the site model of the Cherri building.

C.3 Ray Adams Row Farr, BA(Hons)

31 Ray Adams Row Farr is an Editor at Forensic Architecture. Before joining FA in 2025, she completed a BA in Sociology at the University of Cambridge, with First Class Hons. At FA, Ray Adams Row Farr specialises in coordinating, writing and editing reports for a legal context.

32 For this project, Ray Adams Row Farr reviewed the in-process work ensuring that it adheres to the principles of research integrity, and supported the writing and editing of this report.

D Request

33 In this matter, we have been instructed by the International Federation for Human Rights (FIDH), the legal representatives acting on behalf of Ali Cherri, in connection with the investigation into the attack on his home in Beirut, Lebanon, on the evening of 26 November 2024.

34 On the evening of 26 November 2024, hours before a ceasefire agreement between Lebanon and Israel was due to take effect, an Israeli airstrike impacted the flat owned by Ali Cherri on the ninth floor of a twelve-story building on Majdalani Street, in the Barbour neighbourhood of Beirut, Lebanon. The building was designed and built by the Cherri family.

35 The area had not previously been under attack, and there was no prior evacuation warning. The strike killed both of Ali Cherri's parents, together with their domestic worker, who were in his ninth-floor flat at the time. In the aftermath, it became clear that substantial damage was brought to floors seven to ten, with limited damage to the other floors.

36 FA were requested to investigate the scale of destruction, identify the type of weapon used, and analyse the nature of the strike(s) on and damage to the Cherri flat.

E Material and Software Used

37 All the material we received from Ali Cherri was considered for potential relevance in producing the site model and conducting analysis of the damage and remnants.

E.1 Material received from Ali Cherri

38 A plan from Ali Cherri, showing the layout of the Cherri flat.

39 Photographs and a video taken by Ali Cherri before the incident, showing the relationship of the Cherri building with its surroundings.

40 Photographs and videos taken by Ali Cherri's siblings on 26 November 2024 and 5 December 2024, showing the surrounding environment in the immediate aftermath of the incident.

41 Photographs and videos taken by a neighbouring resident on 26 November 2024, showing the immediate aftermath of a fire on the north side of the building.

E.2 Material received from Amnesty International

42 Transcript of witness testimonies from neighbouring residents.

E.2.1 Photography used for Photogrammetry

43 Drone photographs of floors eight, nine and ten.

E.3 Software used to produce the reconstruction

44 Agisoft Metashape — Photogrammetry software used for the reconstruction of the digital model.

45 Blender[1] — 3D modelling software for the assembly of the photogrammetry model, the site model, and the graphical 3D analysis.

F Glossary

F.1.1 Munition

46 A munition typically describes any bomb, missile, shell, or device configured for combat use. It is a term covering both weapons and the materials they use.

F.1.2 Airstrike

47 An airstrike, or 'strike', is an attack made by an aircraft using a munition.

F.1.3 Munition remnant

48 A munition remnant, or 'remnant', refers to any part or leftover piece of a munition after it has been used, exploded, failed to explode, or abandoned.

[1] More information on Blender is available online here: https://www.blender.org/. Blender can be downloaded here: https://www.blender.org/download/previous-versions/.

F.1.4 Tail actuation system

49 The tail actuation system is located at the rear of a munition, furthest from the explosive. It is often found partly or largely intact following a munition's use.

F.1.5 Warhead

50 The warhead is the portion of the munition which carries its payload and, in this case, includes the nosecone at the front of the munition.

F.1.6 Payload

51 The explosive component of a missile.

F.1.7 Deformation

2 Deformation is the change in the shape of an object due to an applied force. In this case, deformation refers to the change in the shape of structural columns due to force from the impact of a munition.

F.1.8 Site modelling

2 Site modelling, or 3D modelling, is the process of creating a three-dimensional digital representation of objects or surfaces, such as an urban environment.

F.1.9 Massing model

54 A massing model is a representation used in architectural analysis to illustrate the fundamental forms, proportions, and spatial relationships of an urban area. It hides façade details and focuses instead on building volumes, heights, and their arrangement within a site, allowing assessment of issues such as strike trajectories, density, and urban character.

F.1.10 Image matching

55 Image matching is one of Forensic Architecture's core techniques and has been used in almost every investigation since 2012. It is the process of reconstructing the position of a photograph and creating a simulated camera that matches the 3D model. A single recreated image and camera is referred to as an 'image match'.

56 Image matching works by placing a semi-transparent 2D image or video frame in front of a virtual camera within a 3D digital environment. The camera's position, angle, and focal length from the original shot are either entered manually or calculated inside the 3D scene.

57 This allows the 3D environment to be reconstructed to match the 2D image, creating digital models that represent the real-world objects in the photo. When viewed through the simulated camera, the 3D scene aligns precisely with the original image.

F.1.11 Photogrammetry

58 Photogrammetry is the process of using photographs of an object or space to create a spatially accurate representation which can be used in 3D software.

F.1.12 Reflected ceiling plan (RCP)

59 A reflected ceiling plan is an architectural drawing that shows the features and layout of a ceiling as if it were mirrored onto the floor. It provides a view of the ceiling 'from above'.

G Methodology

60 The objective of this work was to digitally reconstruct the aftermath of the airstrike on the Cherri flat on 26 November 2024, in order to investigate the nature of the incident, including the type and number of weapon(s) used, how much damage occurred, and any patterns observed in the damage.

61 To investigate this, FA conducted open-source investigation, site modelling, photogrammetry, and damage analysis.

G.1 Open-Source Investigation

62 Open-source investigation (OSI) is the process of finding, analysing and/or corroborating data using publicly available sources, such as social media posts, news reports, and online forums.

63 In this investigation, OSI was used to identify what kind of munition was used in the strike on the building. We did this by cross-referencing remnants located in the imagery we received with images of identified munitions.

64 A munition is considered identified, or 'confirmed', when images of munitions from multiple sources are found to match the munition in the image(s) in question.

65 In this investigation, we relied on the dataset of the Open Source Munitions Portal to identify the munition.[2] The Open Source Munitions Portal is a free online tool designed to help researchers understand and identify explosive weapons used in conflicts. It contains a searchable archive of verified open-source images of munitions and

[2] Open Source Munitions Portal, 'Open Source Munitions Portal', accessed 6 January 2026, https://osmp.ngo/.

remnants. It is commonly used in open-source investigations as a tool for analysing and verifying munitions. Each individual munition has a visual guide, containing details on how to identify it, including the key components and how they appear.

G.2 Photogrammetry

66 For the purposes of this investigation, photogrammetry was used to model the damage to Ali Cherri's flat on floor nine.

67 Forensic Architecture commissioned Flyingcam Lebanon to document the Cherri flat on the ninth floor using drone photography, for the purposes developing a photogrammetry model.

68 The pilot visited the site on the third week of July 2025 and captured 174 photographs. The images were then turned into a 3D model using the software Agisoft Metashape (Figure 1).

69 While the focus of the documentation was the Cherri flat, some of the photographs show parts of the destruction to the floors above and below — floors eight and ten. These additional floors are included in the 3D model; however, they are only partially mapped. Hatching has been used to indicate areas in which data is missing from the model.

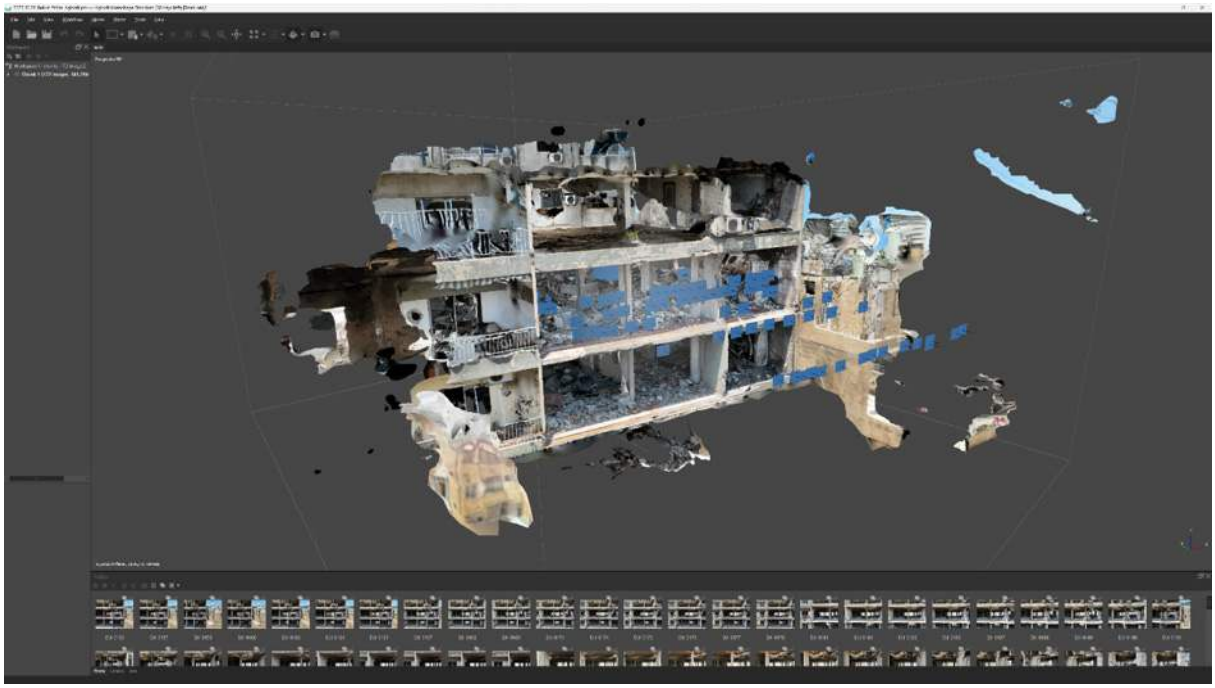

Figure 1: Image of the photogrammetry model of floors eight, nine, and ten, within Agisoft Metashape.

G.3 Site Modelling

70 The site model of this incident comprises the landscape, streetscape, and buildings in proximity to the airstrike, with particular attention given to the mapping of the Cherri building (Figure 1). The model was created using satellite images and photographs of the site, data from Open Street Maps (OSM), and on-site measurements.

Figure 2: The site model and photogrammetry layer for the south façade of the Cherri building.

71 Image matching was also used to determine the proportions and scale of architectural objects (Figure 2). The site model was created in 3D computer-aided design (CAD) software using architectural modelling tools (Figure 3).

72 This model serves as the skeleton for bringing multiple datasets together, including:

- The photogrammetry model of the damage to the Cherri flat, as well as parts of floors eight and ten.
- Photographs and videos from the night of the strike.
- Photographs and videos of the neighbouring building where a remnant was found in the aftermath of the incident.

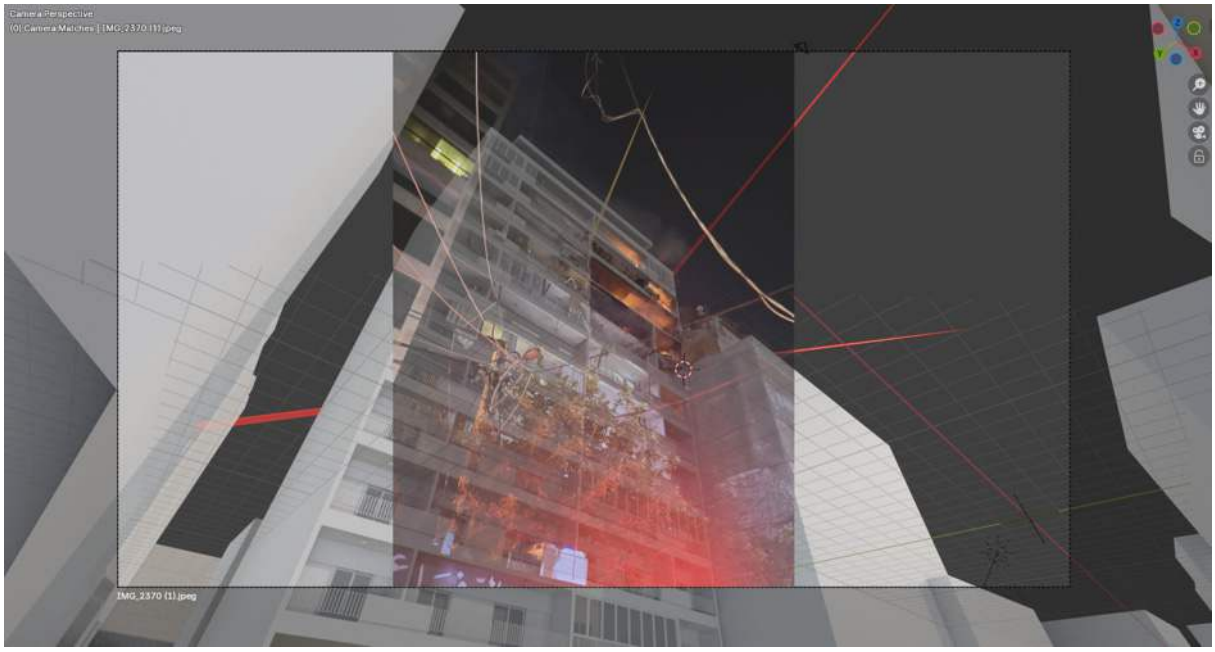

Figure 3: South façade of the Cherri building, showing the site model with an image match of a photograph from the night of the incident.

G.4 Damage Analysis

73 To analyse the damage, we annotated the photogrammetry model which shows damage to floors eight, nine, and ten.

74 We used one of three different of annotation based on the damage identified: annotations of perforations (red), surface damage (orange), and distortion (yellow):

- A perforation was marked when a hole was visible through an otherwise continuous surface, such as a floor, wall, or ceiling (Figure 4).
- Surface damage was marked when damage was visible to an otherwise continuous surface, such as a floor, wall, or ceiling, but no perforation was identified (Figure 4).
- A distortion was marked where a bend or breakage was identified in an otherwise vertical structural element, such as a column (Figure 5).

Figure 4: Before (left) and after (right) annotation of perforations (red), and surface damage (orange).

Figure 5: Before (left) and after (right) annotation of perforations (red), surface damage (orange), and distortion (yellow).

75 We then verified each annotation using images and videos taken by the Cherri family in the week following the incident (Figure 6). The footage was systematically cross-referenced with the photogrammetry model in order to verify existing annotations, and add any missing annotations.

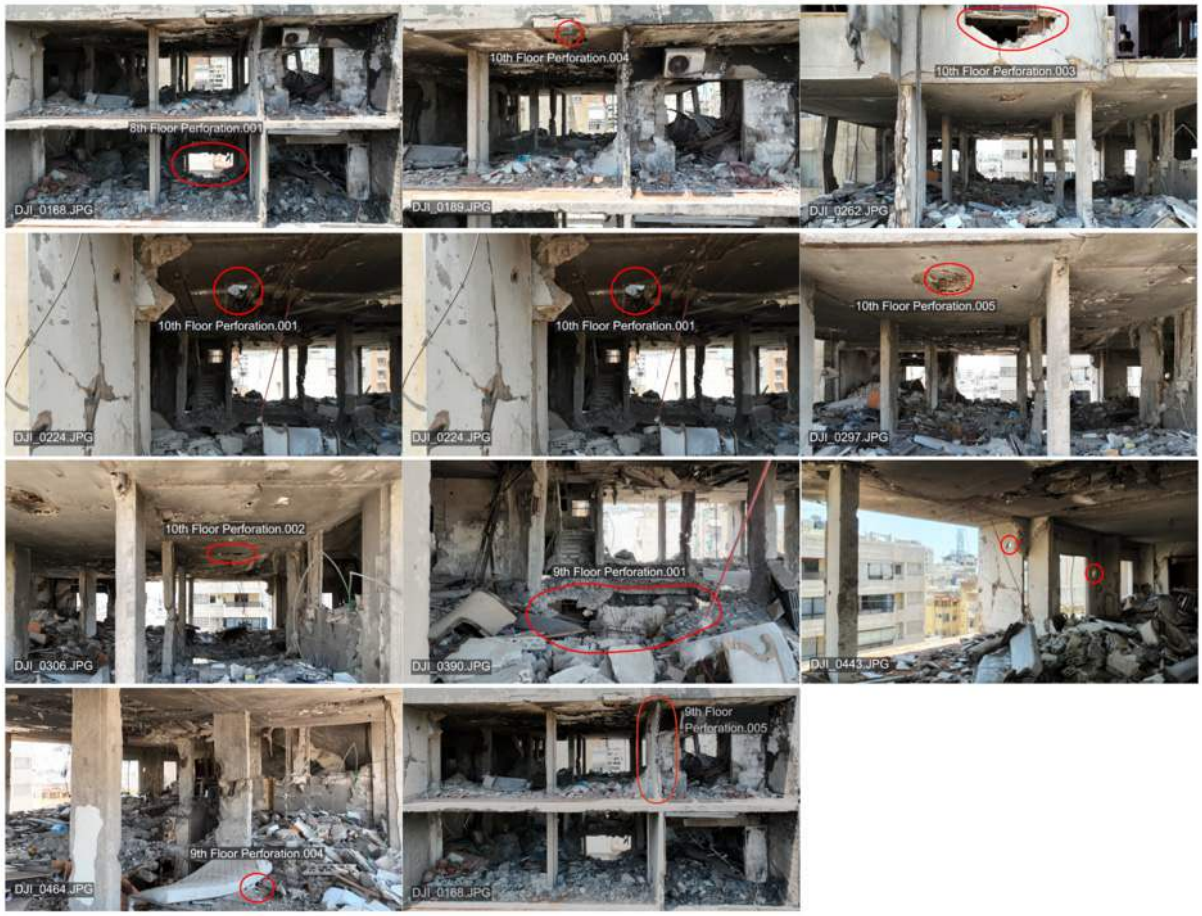

Figure 6: Verification of perforations (in red) using photographs and videos provided.

H Analysis

76 Witness statements and the imagery provided indicate that two buildings were impacted in the airstrike on Majdalani Street on the evening of 26 November 2024: the Cherri building, and a neighbouring building to the northwest (Figure 7).

77 The Cherri building is a twelve-story block of flats designed and built by the Cherri family. Each floor contains two flats separated by a staircase and a lift. Ali Cherri's flat, the focus of the investigation, was the eastern flat on floor nine.

78 A second twelve-story building located to the rear of the Cherri building was also impacted by the strike (Figure 7). In this building, a missile penetrated a sixth-floor window and came to rest against an interior wall without detonating (Figure 8).

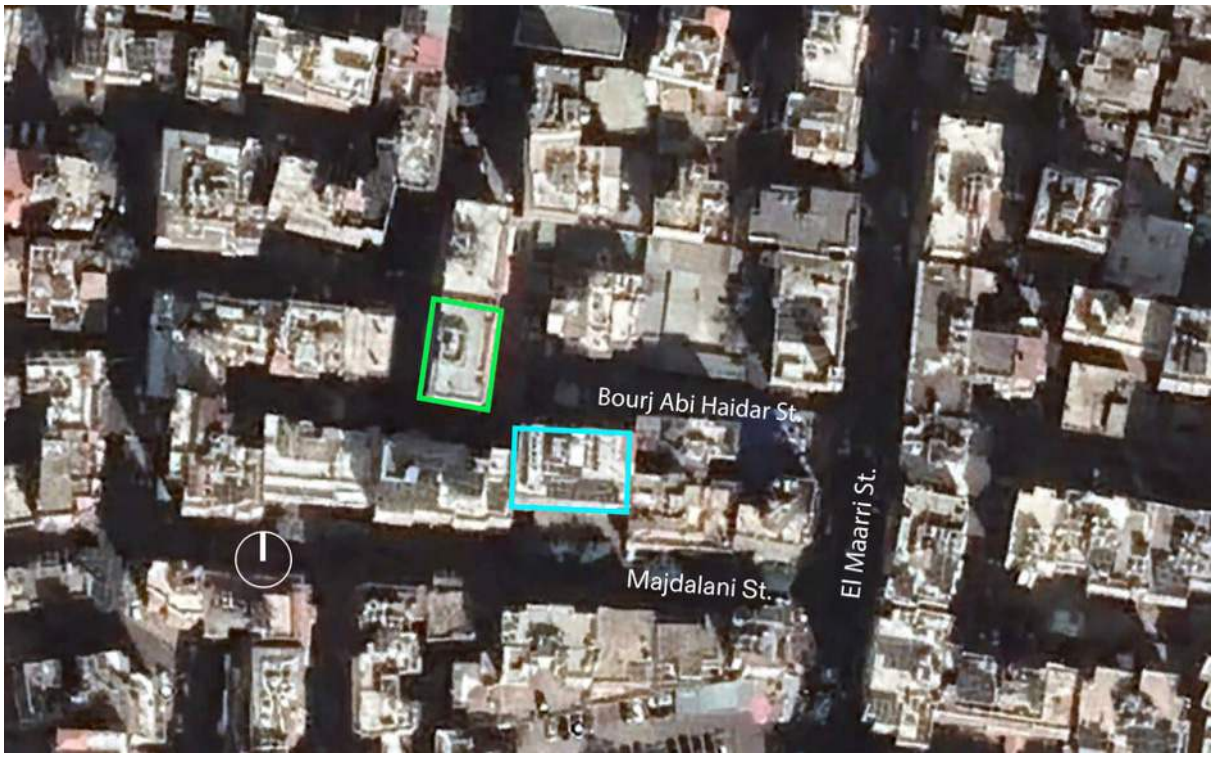

Figure 7: Annotated satellite image of Barbour, Beirut, showing the Ali Cherri building (blue) and the neighbouring building (green) which were impacted in the incident. Source: Google Earth, March 2023.

Figure 8: North façade of the Cherri building, showing the site model, photogrammetry model and the sixth-floor window of the neighbouring building (right) where a remnant was found.

79 FA analysed the 3D model as well as videos and photographs provided in order to investigate the following research questions:

- What munition(s) were used in the strike(s)?
- How many strike(s) impacted the Cherri flat?
- What is the nature and extent of damage to the Cherri flat? How does this compare to the rest of the building and neighbouring buildings?

H.1 Damage Analysis

H.1.1 The Cherri Building

80 The eastern flats of the north (rear) and south (front) of the Cherri building suffered damage. The western flats were undamaged.

81 On the night of the incident, videos and a photograph of the southern façade show a fire burning across floors seven, eight, nine, and ten (Figure 9). A photograph from the immediate aftermath shows severe burn marks on the eastern flats.

82 From the material we received, the damage appears localised to the Cherri building and the remnant found in the neighbouring building (p.25).

83 On the Cherri building, the façade of floors seven, eight, nine, and ten were completely destroyed (Figure 11). From the material we received, no other façades on the front of

the Cherri building were destroyed, and the most severe damage was to floors seven to ten. The photogrammetry model, which maps parts of the eastern flats on floors eight, nine, and ten, corroborates the damage sustained to these floors (Figure 10).

84 The roof appears undamaged.

Figure 9: Documentation from 26 November 2024 (left) and 27 November 2024 (right) showing fire and burn marks on the south side of the Cherri building.

Figure 10: Photogrammetry model showing damage sustained to the south façade of the Cherri building.

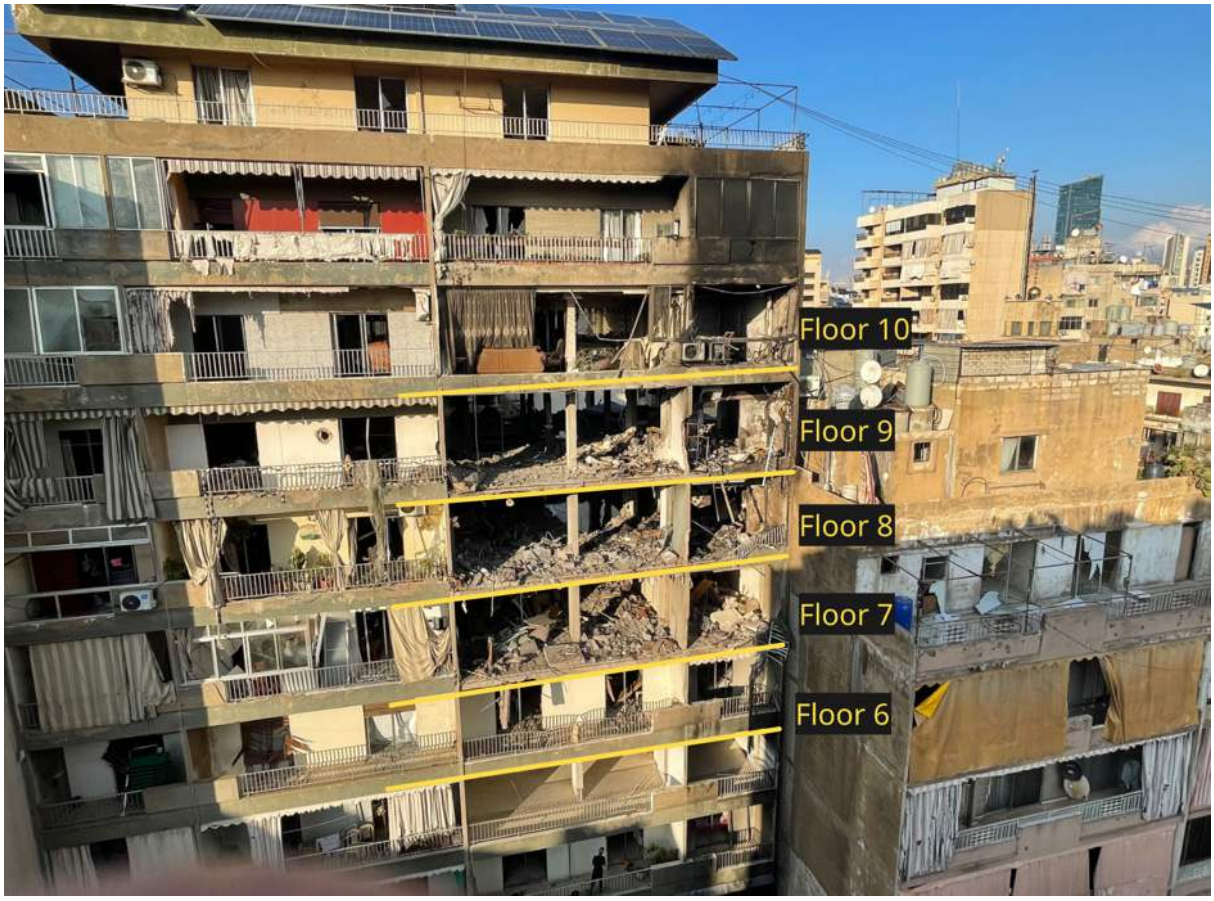

Figure 11: Photograph from 5 December 2024 showing damage to the south façade of the Cherri building.

85 On the north façade, there is severe damage to floors seven, eight, and nine (Figure 12). Of the affected floors, the façade of floor nine appears most impacted: the exterior

walls are completely destroyed, and there is consistent significant damage to the rooms behind the exterior walls.

86 On the north façade of floor six, aside from a perforation on one of the balconies, no other portion of the exterior walls is visibly damaged or destroyed.

87 On the north façade of floor ten, one third of the flat's exterior walls are completely destroyed, and a perforation hole below the central window frame is visible. The rest of the flat's exterior walls are undamaged. This pattern of damage is corroborated by the photogrammetry model of the rear façade of floors eight, nine, and ten (Figure 13).

Figure 12: Photographs from 26 November (left) and 5 December (right) show damage sustained to the north façade of the Cherri building.

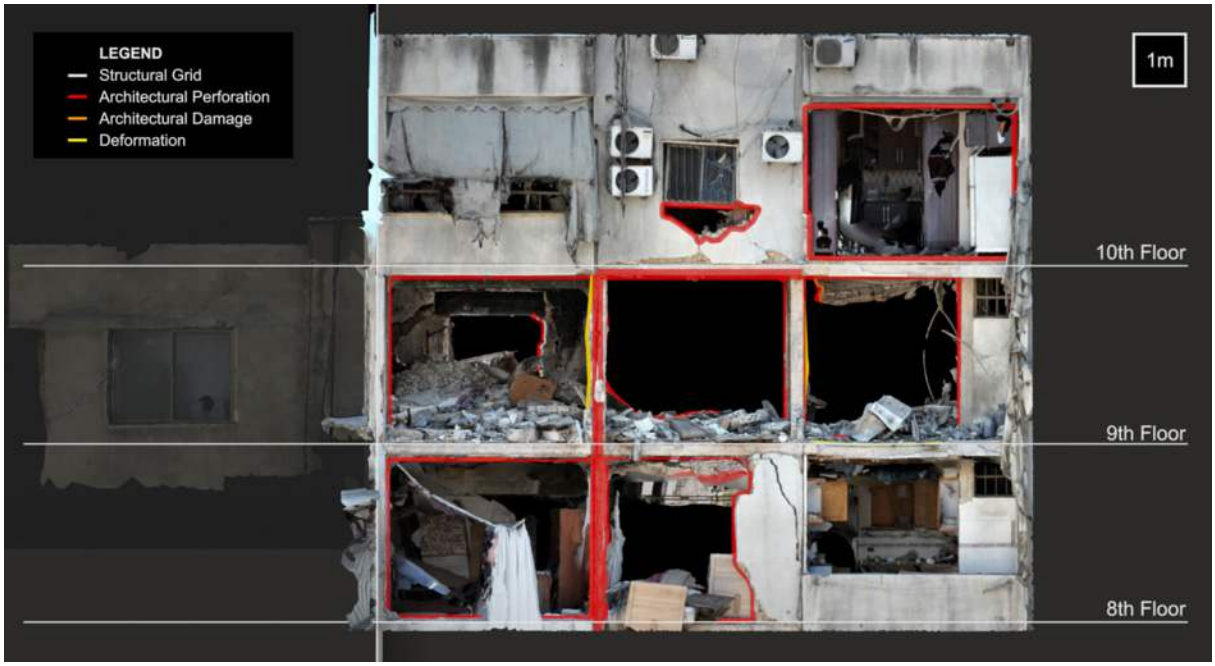

Figure 13: North elevation of the photogrammetry model showing damage sustained to the north façade of the Cherri building.

H.1.2 Floor Nine: the Cherri Flat

88 The Cherri flat on the ninth floor of the Cherri building is nine metres wide and twelve metres deep. It is arranged into a grid of nine rooms, which include three bedrooms, a kitchen, a living room and dining area, and a TV room.

89 Ali Cherri's parents were inside the ninth-floor flat at the time of the strike. According to witness accounts:

- The body of Ali's father was discovered in Bedroom 1 (Figure 14).
- The body of Ali's mother was found in the TV room area of floor seven (Figure 14).

90 As discussed above (see H.1.1), both the front and rear façades of the flat were destroyed.

91 Deformation to structural columns was most notably observed around Bedroom 2, at the northeast corner of the flat (Figure 15).

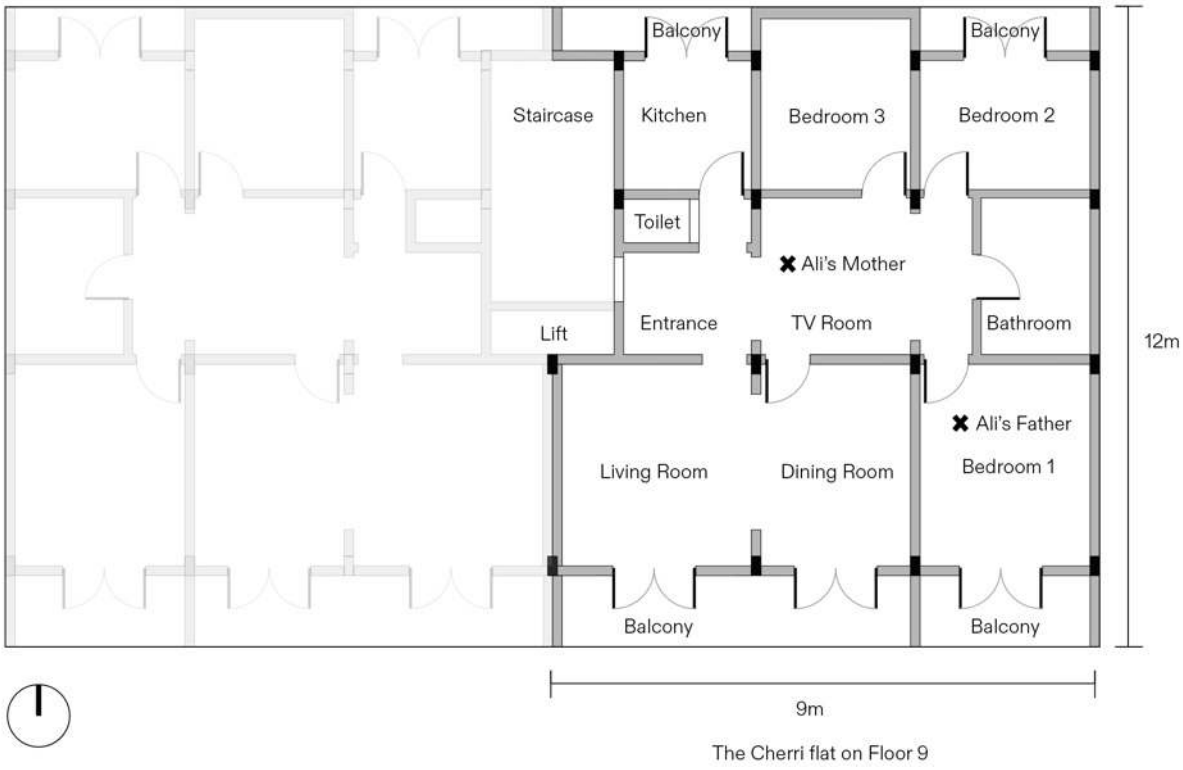

Figure 14: Plan of the Cherri flat with annotations of where his parents were at the time of the strike.

Figure 15: View into Bedroom 2 of the Cherri flat from the north, with deformation marked.

92 There are four main perforations to the floor of the Cherri flat (Figure 16):

- The largest perforation measures approximately 5.5m x 3.5m and extends from the entrance to the Cherri flat into the building's communal hallway.

- On the north side of the TV room, there is a perforation measuring approximately 2.8m x 1.4m.
- On the south side of Bedroom 3, there is a perforation measuring approximately 0.5m x 0.4m.
- On the southeast side of the dining room, there is a perforation measuring approximately 0.7m x 0.7m.

93 A mattress partly obscures the perimeter of the perforations on the south side of Bedroom 3 and the north side of the TV room. It is possible these two perforations are connected as part of one larger perforation.

94 There are four main perforations to the ceilings of the Cherri flat (Figure 17):

- In the entrance, there is a perforation measuring approximately 1.8m x 0.9m.
- On the north side of Bedroom 3, there is a perforation measuring approximately 0.5m x 0.4m.
- On the south side of the balcony, there is a perforation measuring approximately 0.4m x 0.3m.

95 On the dividing wall of the south balconies, there is perforation measuring approximately 3.0m x 0.6m.

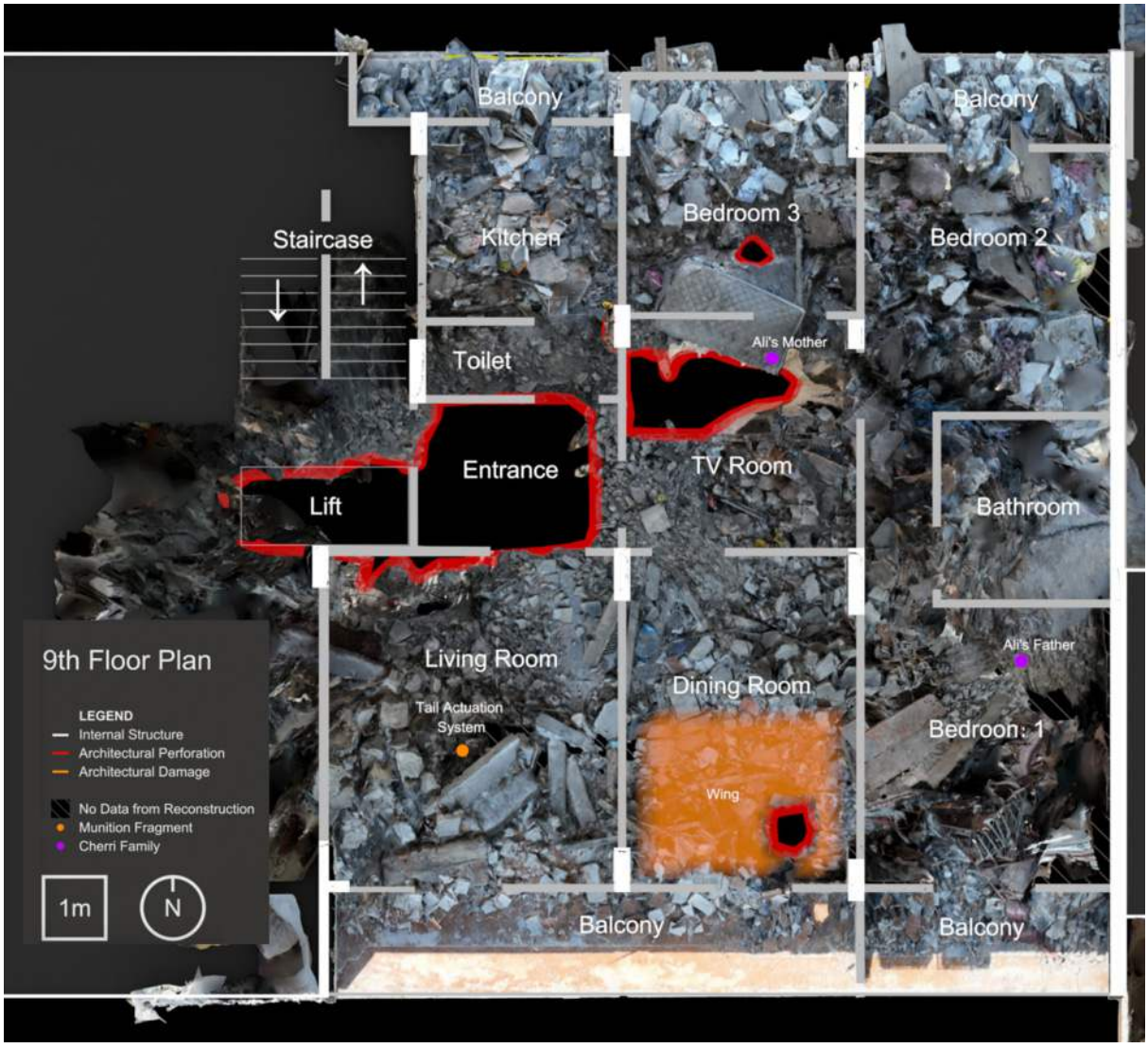

Figure 16: Floor plan, the Cherri flat.

96 There is additional surface damage to the walls and ceilings of the flat (Figure 17):

- On the south balconies, there is damage to the dividing walls, and to the ceiling on the eastern side, surrounding a perforation.
- On the living room ceiling, there is damage to the west side surrounding a perforation.
- In Bedroom 3, there is damage to the ceiling surrounding a perforation on the north side, deformation and damage to the column on the northeast corner, and damage and deformation to the column on the southwest corner (Figure 15).
- On the kitchen ceiling, there is damage to the northeast corner.
- In the hallway between Bedrooms 1 and 2, there's damage to the ceiling.
- In the TV room, there's damage to the column in the northeast corner.
- In Bedroom 2, there's deformation and damage to the column on the east side.

Figure 17: Reflected ceiling plan, the Cherri flat.

97 Damage to the ceilings and floors in the Cherri flat is related in four main areas (Figure 16, Figure 17):

- In the entrance, the perforation in the floor corresponds with surface damage to the ceiling.
- In the TV room, the perforation in the floor corresponds with surface damage to the ceiling.
- In Bedroom 3, the perforation in the floor corresponds with surface damage to the ceiling.
- In the southeast corner of the dining room, a perforation in the floor corresponds with a perforation in, and surface damage to, the east side of the ceiling of the adjacent balcony.

H.2 Remnant Analysis

98 From video and photograph documentation of the aftermath of the incident, we located two distinct munition remnants. We identified them both as components from two GBU-39 munitions.

H.2.1 Remnant 1: unexploded warhead in the neighbouring building

99 A photograph taken by a neighbour shortly after the attack shows an unexploded munition in a neighbouring building north-west of the Cherri building (Figure 18). In the photograph, the remnant is leaning against the wall, and its base is tangled in what appears to be a curtain. Light debris, including dust and broken glass, is visible across the room, on the floor, and on a bed in the background.

100 Witnesses describe the munition entering through the window on the evening of 26 November 2024, getting tangled in the curtain, and coming to rest in the position it is pictured in.

101 We were able to estimate the dimensions of the remnant by comparing its proportions with those of standard-size domestic furnishings in the photograph, namely the plastic chair and single bed (Figure 18). We estimate the remnant measures approximately 1.8m in length and 15cm in diameter.

Figure 18: Left: dimensions of domestic furnishings within the frame. Right: Munitions remnant found in the neighbouring building.

102 Nick Waters, a former army officer and open-source investigative expert with a focus on conflict, reviewed the image and identified it as the warhead of a GBU-39.

103 We verified this identification by comparing the remnant to verified photographs of the GBU-39 on the Open Source Munitions Portal (Figure 19). The shape, size and visual characteristics are consistent with the warhead of a GBU-39.

104 The GBU-39 is precision-guided glide bomb developed by the US and used extensively by the US and its allies — in particular Israel — in conflicts including Afghanistan, Ukraine, Lebanon, and Gaza.[3] The US military describe the munition as engineered for precise targeting: 'once the weapon is released, it relies on GPS/INS to self-navigate to the desired impact point.'[4]

105 The GBU-39 typically approaches the target along an oblique, downward trajectory rather than a purely vertical path. The damage patterns observed on the Cherri are consistent with this behaviour: we did not identify damage to the roof and upper floors which would possibly indicate a vertical trajectory.

106 It causes direct damage upon impact with a surface, as well as exerting upward and downward force, often producing damage above and below the impact point. Its nosecone is designed to pass through 0.9m of steel-reinforced concrete before detonation.[5] The damage patterns observed on the Cherri are consistent with this behaviour: there is a relationship between surface damage and perforations in multiple areas of the flat.

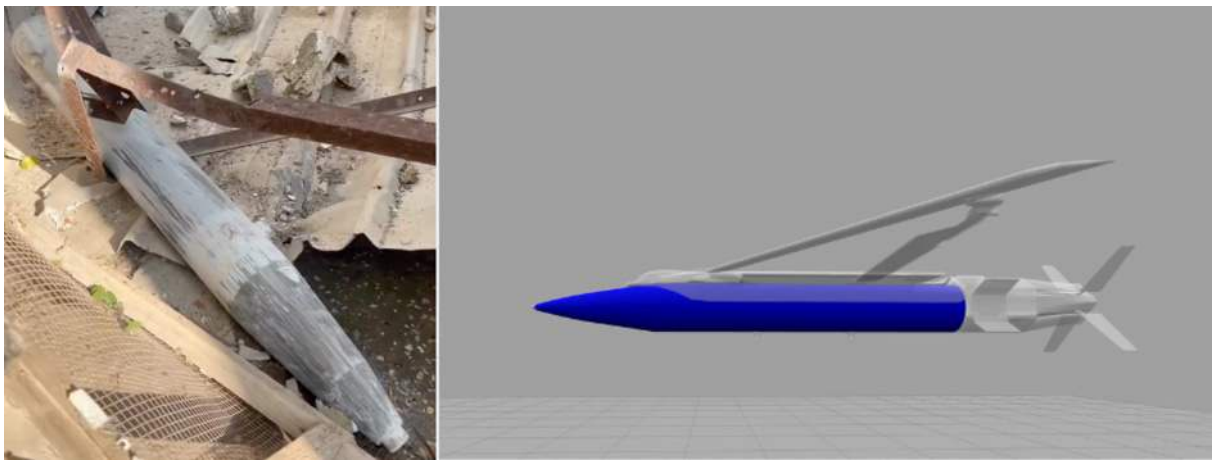

Figure 19: Left: The warhead of a GBU-39 found in Gaza on 1 December 2023. Right: Warhead of a GBU 39 marked in blue. Source: The Open Source Munitions Portal.

[3] Open Source Munitions Portal, 'The GBU-39 Air-Delivered Bomb: A Visual Guide,' 2 December 2024, accessed 6 January 2026, https://osmp.ngo/collection/small-diameter-bomb-gbu-39-visual-guide/.

[4] U.S. Air Force, 'GBU-39B Small Diameter Bomb Weapon System,' fact sheet, last modified 31 December 2020, accessed 6 January 2026, https://www.af.mil/About-Us/Fact-Sheets/Display/Article/104573/gbu-39b-small-diameter-bomb-weapon-system/.

[5] Open Source Munitions Portal, 'GBU-39 Air-Delivered Bomb,' https://osmp.ngo/collection/small-diameter-bomb-gbu-39-visual-guide/.

107 The warhead is the component of the munition that carries the payload, and in this case includes a nosecone at the front.[6]

108 We consulted an experienced human rights investigator, who specialises in weapons analysis and who has worked extensively on Gaza and Lebanon since 7 October 2023. They provided the following analysis of the warhead in the image in Figure 18:

109 *'The scratches, marks, deformation of the nuts and bolts, and missing wings and nose cone indicate this unexploded warhead has passed through hard surfaces, such as wall(s) or floor(s). It is highly unlikely this level of deformation would be sustained by a munition passing through a window alone.'*

H.2.2 Remnant 2: tail actuation system in the Cherri flat

110 The second remnant was documented one week after the incident, on 5 December 2024, in a video filmed inside the former living room of the Cherri flat (Figure 20).

111 We identified the remnant by comparing it to verified photographs of the GBU-39 in the Open Source Munitions Portal archive (

112 Figure 21). The shape, size and material characteristics of the remnant are consistent with those outlined for the tail actuation system of a GBU-39. The tail actuation system is often found partly or largely intact after a munition has impacted.

113 Expert Nick Waters also reviewed the image and concluded 'that [it] appears consistent with the tail actuation section of GBU-39.'

114 The independent human rights investigator consulted for weapons analysis assessed that it is highly likely the two remnants identified are from two separate munitions:

115 'Tail actuation units very often survive impact. The fact that the tail actuation unit of the munition was found on the ninth floor of the Cherri building would suggest that it was attached to a GBU-39 that struck the Cherri building. It is highly unlikely that it detached from the munition that was found in the building on the opposite side of the street.'

[6] Ibid.

Figure 20: Annotated close-up of the tail actuation system identified in the Cherri flat.

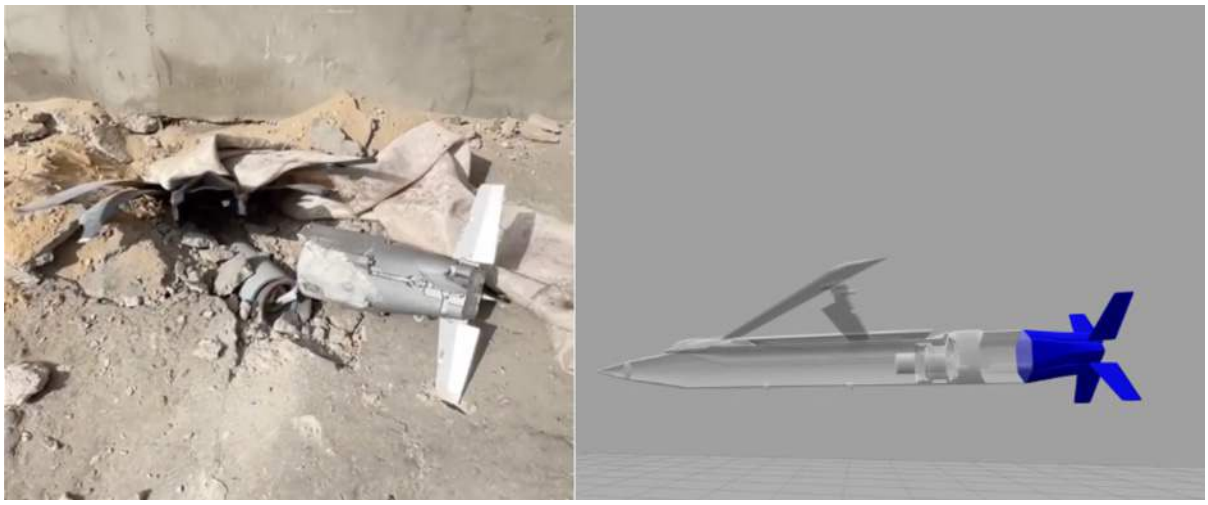

Figure 21: Left: Tail actuation system of a GBU-39, 21 May 2024, Gaza. Right: Tail actuation system of a GBU-39 annotated in blue. Source: Open Source Munitions Portal.

I Summary of Findings

116 The damage to the Cherri building was localised to the eastern flats on four floors: floors seven, eight, nine, and ten.

117 Both facades of the Cherri flat sustained extensive damage, and severe destruction including perforations to the floors and ceiling were observed in the central spaces — the TV room, and the entrance

118 Two munition remnants related to this incident were recovered, both identified as components of GBU-39 munition(s).

119 It is almost certain that these remnants were from different GBU-39 munitions, meaning at least two GBU-39 munitions were used in this attack.

J Declaration

120 I, Samaneh Moafi, declare that:

121 I understand that my duty in providing written reports and giving evidence is to help the Court, and that this duty overrides any obligation to the party by whom I am engaged or the person who has paid or is liable to pay me. I confirm that I have complied and will continue to comply with my duty.

122 I confirm that I have not entered into any arrangement where the amount or payment of my fees is in any way dependent on the outcome of the case.

123 I know of no conflict of interest of any kind, other than any which I have disclosed in my report.

124 I do not consider that any interest which I have disclosed affects my suitability as an expert witness on any issues on which I have given evidence.

125 I will advise the party by whom I am instructed if, between the date of my report and the trial, there is any change in circumstances which affect my answers to points 3 and 4 above.

126 I have shown the sources of all information I have used.

127 I have exercised reasonable care and skill in order to be accurate and complete in preparing this report.

128 I have endeavoured to include in my report those matters, of which I have knowledge or of which I have been made aware, that might adversely affect the validity of my opinion. I have clearly stated any qualifications to my opinion.

129 I have not, without forming an independent view, included or excluded anything which has been suggested to me by others, including my instructing lawyers.

130 I will notify those instructing me immediately and confirm in writing if, for any reason, my existing report requires any correction or qualification.

131 I understand that:

132 my report will form the evidence to be given under oath or affirmation;

133 questions may be put to me in writing for the purposes of clarifying my report and that my answers shall be treated as part of my report and covered by my statement of truth;

134 the court may at any stage direct a discussion to take place between experts for the purpose of identifying and discussing the expert issues in the proceedings, where possible reaching an agreed opinion on those issues and identifying what action, if any, may be taken to resolve any of the outstanding issues between the parties;

135 the court may direct that following a discussion between the experts that a statement should be prepared showing those issues which are agreed, and those issues which are not agreed, together with a summary of the reasons for disagreeing;

136 I may be required to attend court to be cross-examined on my report by a cross-examiner assisted by an expert;

137 I am likely to be the subject of public adverse criticism by the judge if the Court concludes that I have not taken reasonable care in trying to meet the standards set out above.

138 I am aware of the practice direction on pre-action conduct. I have acted in accordance with the Code of Practice for Experts.

K Statement of Truth

139 I confirm that I have made clear which facts and matters referred to in this report are within my own knowledge and which are not. Those that are within my own knowledge I confirm to be true. The opinions I have expressed represent my true and complete professional opinions on the matters to which they refer. I understand that proceedings for contempt of court may be brought against anyone who makes, or causes to be made, a false statement in a document verified by a statement of truth without an honest belief in its truth.

140 Samaneh Moafi
Assistant Director of Research, Forensic Architecture
Dated: 22 January 2026

L Addendum: Alignment Analysis

142 Comparing the floor plans and reflected ceiling plans from the photogrammetry model, we identified at least three alignments in the damage to the Cherri building:

- An alignment between perforations in the façade of floor ten and the ceiling of Bedroom 3 on floor nine.
- An alignment between perforations in the TV room on floors eight and nine.
- An alignment between deformation to structural columns on floor nine, and the location of the unexploded warhead in the neighbouring building.

143 The observed alignments may have been caused by passage of missile(s) themselves, by upward force from a detonation, or from secondary projectiles — objects within the building propelled by the explosion. Further evidence is required to determine the cause of the alignments.

144 It is possible one could draw further alignments between the damage to the Cherri flat and surrounding floors.

L.1 Observation 1: There is an alignment between perforations to the tenth-floor façade, and Bedroom 3 of the ninth floor

145 The model shows an alignment between perforations to the rear façade of floor ten and the ceiling of Bedroom 3 on floor nine (Figure 22).

146 Both perforations have an approximate width of 0.7 metres. Therefore, it is possible that a munition has entered through the exterior rear wall of floor ten, passed through the floor, and entered the ceiling of Bedroom 3 on floor nine (Figure 23).

Figure 22: Alignment between perforations (red) to the façade of floor ten, and the ceiling of Bedroom 3 on floor nine.

Figure 23: North-east façade view of the alignment between perforations on floors ten and nine, as indicated by the red line.

L.2 Observation 2: There is an alignment between perforations in the TV room of floors eight and nine

147 Comparing the floor plans of floors eight and nine there is an alignment between perforations in the floor of both TV rooms (Figure 24, Figure 25). The perforation to floor eight is three times larger in size, making it a possible point of detonation (Figure 26). In this scenario, a missile could have detonated in the TV room of floor eight, destroying the floors above and below through upward and downward force. Alternatively, it could have passed through floor nine before detonating on floor eight.

148 Based on the size of the perforations, there is a possibility that a munition detonated in the entrance of floor nine, and/or the TV room of floor eight.

Figure 24: Alignment between perforations to the floor of the TV room and entrance on floor nine (left), and floor eight (right).

Figure 25: Alignment between perforations in the TV room on floor eight and nine.

Figure 26: Comparison of perforations in the TV room and entrance of floor eight (green) and floor nine (red).

L.3 Observation 3: An alignment between deformation to structural columns on floor nine, and the location of the unexploded warhead in the neighbouring building

149 As discussed in H.2.1, the weapons expert assessed it to be highly unlikely the warhead found in the neighbouring building sustained the level of damage visible in the photograph solely by passing through a window: the munition must have passed through hard surfaces, such as wall(s) or floor(s).

150 Witness testimonies describe the munition passing through the window of the sixth floor. Given the weapon expert's analysis and the absence of visible damage to other surrounding buildings, if the testimony is accurate, the munition likely passed through the Cherri building before landing undetonated in the neighbouring building.

Figure 27: Close up of Bedroom 3 in the northeastern corner of the Cherri flat, with deformations to structural columns marked in yellow.

151 A trajectory for this possible scenario can be approximately mapped. In the northeastern corner of the Cherri flat, in Bedroom 2, we see deformation to structural columns but no visible damage or perforations on the ceiling or floor. This suggests the room was not affected by a detonation. It could also suggest the passage of a projectile, which exerts substantial force. The munition could have passed through this area before landing undetonated on the sixth floor of the neighbouring building (Figure 28).

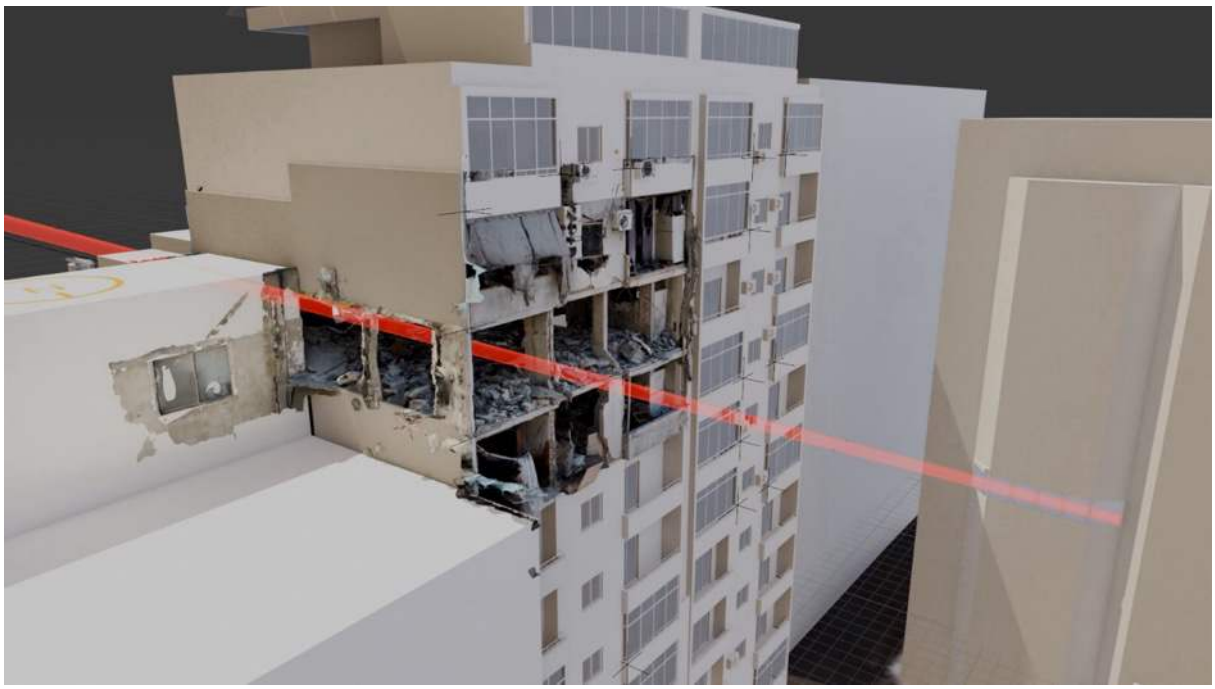

Figure 28: Rear view of the Cherri flat, showing possible trajectory for the GBU-39 warhead.