



Community Perceptions of Rubble-Filled Gabion Walls in Post-Conflict Reconstruction (Syria, Palestine): An Exploratory Social Study

Ahmad Haimour¹, Defry Agatha Ardianta^{1*}, Vincentius Totok Noerwasito¹

¹ Department of Architecture, Faculty of Civil Planning and Geo Engineering, Institut Teknologi Sepuluh Nopember (ITS), Surabaya, Indonesia

*Corresponding author email: agathadefry@its.ac.id

Article Info

Article history:

Received May 10, 2026
Approved August 30, 2026

Keywords:

Rubble Gabion Walls, Post-Conflict Reconstruction, War-Damaged Concrete, Social Perception

ABSTRACT

In recent years, the massive urban destruction of Syrian and Palestinian cities created huge amounts of concrete rubble, which requires sustainable post-war reconstruction paradigms. Although reusing or recycling this concrete waste could be economically and ecologically sustainable, the psychosocial consequences associated with refitting war ruins are not fully examined. The community perceived acceptance of rubble-filled gabion walls for reconstruction provides a basis for future research in this area. Drawing on a quantitative survey (N=115) of populations, the study assesses the emotional, symbolic, and practical implications for reusing conflict remnants. Statistical results from nonparametric inferential tests indicate an architectural paradox and psychological divide among the population. While communities recognize the economic advantage of sustainable reconstruction, there is a widespread psychological resistance to visibly exposed war rubble-gabion walls. The findings reveal a statistically significant association between considering rubble as a trauma trigger and an absolute desire to hide it behind conventional, opaque layers. In addition, major differences were found between architecture and engineering professionals who prefer the exposure of material memory of conflict and lay people who are highly opposed to this architectural aesthetic in private living spaces. As a result, this study recommends a trauma-informed approach by suggesting leveraging the circular economy for concealed structural efficiency but carefully adapting sensory sites to hide rubble within the context of homes and saving exposed applications for curated memorial spaces, which help to facilitate the psychological recovery for domicile-affected communities.

Copyright © 2026, The Author(s).

This is an open access article under the CC-BY-SA license



How to cite: Haimour, A., Ardianta, D. A., & Noerwasito, V. T. (2026). Community Perceptions of Rubble-Filled Gabion Walls in Post-Conflict Reconstruction (Syria, Palestine): An Exploratory Social Study. *Jurnal Ilmiah Global Education*, 7(3), 3231–3253. <https://doi.org/10.55681/jige.v7i3.6339>

INTRODUCTION

The weaponization of the built environment has fundamentally transformed the nature of contemporary warfare, shifting the epicenter of conflict from remote, open battlefields to dense urban centers and residential neighborhoods (ReliefWeb, 2024). In regions such as Syria and Palestine, systematic urban warfare has resulted in the widespread obliteration of civilian infrastructure, historic urban cores, and the fundamental fabric of domestic life (Azzouz, 2023b). This systematic and

deliberate erasure of the home has been conceptualized in contemporary urban and architectural theory as "domicide," a process that inflicts profound psychological trauma alongside immense physical and spatial devastation (Azzouz, 2023a). Beyond the immediate and catastrophic human toll, the destruction of these cities leaves behind staggering volumes of construction and demolition debris, creating a secondary crisis that severely impedes post-conflict recovery.

To quantify the magnitude of this architectural and environmental catastrophe, recent spatial data analysis indicates that in the Gaza Strip alone, an estimated 36.8 million metric tons of debris from destroyed and damaged buildings were generated in a mere 14-month period between October 2023 and December 2024 (Abdelnour & Roy, 2025). When factoring in destroyed road networks and broader municipal infrastructure, this figure escalates to over 50.7 million metric tons (Abdelnour & Roy, 2025). Similarly, the historic core of Aleppo, Syria, witnessed the complete destruction of approximately 30 percent of its buildings, yielding an estimated 14.9 million tons of rubble across the wider city (Kousa & Pottgiesser, 2019). The management, clearance, and processing of this debris present an overwhelming logistical, economic, and environmental crisis. Traditional methods of clearing and transporting such massive quantities of rubble to centralized disposal sites are highly carbon-intensive and practically unfeasible in resource-constrained or blockaded regions. Analytical logistical models indicate that merely transporting the 36.8 million metric tons of Gaza's debris would require over 2.1 million dump truck loads, necessitating 29.5 million kilometers of travel—equivalent to roughly 736.5 times the circumference of the Earth and generating approximately 65,642 tons of carbon dioxide equivalent (CO₂e) emissions (Abdelnour & Roy, 2025). Furthermore, processing this material with the limited, low-capacity crushers currently available in these specific regions could take more than 37 years to complete.

Consequently, integrating circular economy principles into post-disaster reconstruction is no longer merely an abstract environmental ideal; it is an absolute logistical necessity (Byers et al., 2025). Urban mining—the paradigm of treating the ruins of the destroyed city as a distributed "material bank" rather than a homogeneous waste stream—offers a critical pathway toward sustainable, localized recovery (Ruggiero et al., 2025). Previous research has definitively demonstrated the technical viability of reusing war-generated rubble. Extensive studies in materials science and civil engineering, notably the research conducted with Hanein and Provis, have proven that recycled concrete aggregate (RCA) derived from the rubble of war-destroyed buildings in Syria can successfully replace up to 50 percent of virgin raw materials in new concrete mixtures without significantly compromising structural performance or durability (The University of Sheffield, 2023; Rashwani et al., 2023).

Alongside the highly processed application of RCA, the deployment of rubble-filled gabion walls has emerged in architectural discourse as an alternative low-cost, low-tech, and highly resilient construction method for post-disaster contexts (Reynolds, 2021). Gabions modular wire mesh baskets filled with raw stone or crushed concrete fragments have a long, proven history in civil engineering for erosion control and in military engineering for rapid fortification (Gabion Supply, n.d.). In recent decades, avant-garde architectural practices have elevated the gabion wall from a purely utilitarian retaining structure to a highly aestheticized building envelope, celebrated for its massive thermal inertia, permeability, and textural integration with the surrounding landscape (Natura, 2021).

However, a critical void exists in the current academic literature regarding the socio-cultural, emotional, and psychological acceptance of these specific material technologies in post-war contexts. While structural engineers and sustainability advocates may champion the ecological and economic logic of recycling ruins, the end-users of these rebuilt structures are communities that have been deeply traumatized by the violent loss of their homes (Marie & SaadAdeen, 2021). Living within walls constructed directly from the pulverized debris of one's own destroyed neighborhood introduces highly complex emotional and phenomenological dynamics. Previous humanitarian reconstruction

interventions have frequently failed to account for the phenomenology of material memory, leading to reconstruction efforts that, while technically and structurally sound, are psychologically alienating to the displaced populations they intend to serve (Kousa et al., 2025).

The current study is specifically designed to address this research gap, which is isolated herein, the unknown perception of rubble reuse among traumatized populations. It is imperative to explicitly state that this study does not constitute a definitive evaluation of the real-world operational feasibility, life-cycle sustainability, or ultimate societal adoption of gabion walls. Instead, it is strictly framed as an exploratory perceptual study designed to uncover the cognitive and emotional tendencies of individuals when confronted with the hypothetical integration of war ruins into their built environment spaces. The evaluation of rubble reuse in post-conflict reconstruction cannot be isolated to structural metrics and carbon accounting; it must be firmly grounded in a robust theoretical framework that encompasses the sociology of urban destruction, the psychology of complex trauma, and the evolving architectural discourse surrounding ruins, memory, and material culture.

The deliberate destruction of the built environment is a strategic, calculated mechanism of modern warfare intended to dispossess civilian populations, erase historical narratives, and inflict collective psychological trauma (Azzouz, 2024). The concept of "domicide" the systematic and deliberate killing of the home articulates the profound severity of this act. As theorized extensively in the context of the Syrian conflict, particularly in the besieged city of Homs, the obliteration of residential architecture represents far more than the loss of physical shelter. It constitutes the violent dismantling of an entire way of living, the severing of intergenerational community networks, and the erasure of spatial identity (Azzouz, 2023a, 2023b). The psychological impact of domicide is both acute and enduring. Empirical studies examining the mental health consequences of home demolitions in Palestine highlight that the stress of losing a family residence results in severe, long-term psychiatric morbidities, including deep depression, chronic anxiety, post-traumatic stress disorder (PTSD), and a pervasive sense of learned helplessness. For survivors, the trauma is continuously reinforced by the visual landscape of destruction; they are forced into a state of continuous and intense exposure to environmental stressors, surrounded daily by the physical remnants of their trauma (Marie & SaadAdeen, 2021). Therefore, the rubble generated by domicide is not politically, historically, or emotionally neutral. It is a highly charged, violently produced material that embodies the exact moment of displacement, terror, and the loss of the domestic sanctuary (Azzouz, 2023a).

The architectural response to destroyed cities is historically characterized by a deep tension between the urge to seamlessly restore the past and the necessity to acknowledge the violent rupture of war. Aldo Rossi, in his seminal 1966 treatise *The Architecture of the City* (Nilufar, 2006; Rossi, 2007), established that the city functions as a vast repository of collective memory, where the physical "urban artifact" serves as a grounding resource for societal identity and continuity. When this continuous urban fabric is shattered by aerial bombardment or artillery, the continuity of collective memory is violently disrupted, creating a spatial and temporal void (Osypchuk, 2025). In stark contrast to restorative nostalgia, visionary architect Lebbeus Woods, in his work *Radical Reconstruction*, (Woods, 1997) argued that war permanently and irreversibly alters the socio-spatial reality of a city. Woods posited that attempting to seamlessly restore a city to its pre-war state is a dangerous illusion that ignores the transformative violence the community has endured. Instead, he theorized that reconstruction should actively integrate the "scars" and "scabs" of destruction, forging a radically new spatial order that directly confronts the reality of the trauma rather than masking it beneath facsimile historical facades. This intellectual tradition has contributed to a contemporary architectural fascination with the aesthetics of ruins, decay, and "material memory" (Gentle, 2025). In contemporary installation art and avant-garde architectural practice, ruins are frequently viewed as active sources of inspiration that speak to the passage of time, raw materiality, and spatial transformation (Ravasi et al.,

2019). Architects and preservationists frequently utilize salvaged, exposed rubble as a form of material memory to symbolize loss, resistance, and to deepen historical awareness. However, this aestheticization of ruins is highly contested when applied to everyday residential architecture in active or recently stabilized conflict zones.

To navigate the profound psychological complexities of post-war reconstruction, the principles of Trauma-Informed Design (TID) provide a critical, evidence-based operational framework (Grabowska, 2021). TID emerged from the principles of trauma-informed care in healthcare and social work, translating deeply researched psychological needs into physical spatial configurations (Justus & Raghani, 2025). The core tenets of TID recognize the physiological, neurological, and emotional impacts of trauma, aiming to design environments that meticulously avoid re-traumatization while actively promoting healing, resilience, and user empowerment. Key architectural principles of TID include reducing environmental stressors, providing distinct physical and psychological safety, ensuring occupant autonomy and control, maintaining sensory balance, and fostering a deep connection to nature (Guhl, 2022). In the context of post-war reconstruction, the visual presence of raw, jagged, destroyed concrete can act as a severe, triggering environmental stressor (Ames & Loebach, 2023). Individuals suffering from conflict-induced PTSD require highly predictable, calm, and visually controlled sensory environments to re-establish a fundamental baseline of safety (Justus & Raghani, 2025). Therefore, while macro-level urban theorists may advocate for the stark visibility of rubble as a monumental testament to a city's resilience, TID principles suggest that at the micro, domestic scale, the explicit visibility of war damage directly compromises the psychological security required to reconstruct the concept of "home" (Owen & Crane, 2022).

The application of gabion walls in reconstruction acts as the physical, tectonic nexus of these theoretical debates. The structural lineage of the gabion is deeply rooted in conflict and infrastructure. Originating over 7,000 years ago in ancient Egypt for Nile riverbank stabilization using woven reeds and mud, gabions evolved into cylindrical wicker baskets filled with local earth to protect artillery gunners and infantry from enemy fire during the Middle Ages, the Crimean War, and the American Civil War (Gabion Supply, n.d.). In the late 19th and 20th centuries, the development of durable galvanized steel wire transformed them into a staple of heavy civil engineering, utilized globally for massive retaining walls, rockfall protection, and coastal erosion control (Natura, 2021). More recently, gabion walls have been adopted and elevated as high-end architectural cladding and primary structural envelopes. A defining precedent in this architectural evolution is the Dominus Winery in Napa Valley, California, designed by the Pritzker Prize-winning firm Herzog & de Meuron. The architects utilized local, dark green basalt rocks housed in varied steel mesh cages to create a "stone wickerwork" that functions as a highly textured, semi-transparent building skin. This approach provided exceptional thermal mass for passive climate regulation, allowed filtered natural light to penetrate the interior, and elevated the gabion from mere infrastructure to a globally recognized aesthetic fashion icon (ArchEyes, 2024; Herzog & de Meuron, n.d.). Subsequent architectural projects worldwide have utilized gabion walls for social housing, orphanages, and community centers, aiming to achieve low-cost, highly sustainable, and visually striking tectonic outcomes. The structural benefits are manifold: gabions are highly flexible, resistant to shear forces, dynamically respond to seismic activity without catastrophic cracking, and offer 30 percent void space, providing natural permeability and ventilation that eliminates the need for complex drainage systems (Baldwin, n.d.; Terrock, 2025). However, the aesthetic and psychological success of gabions in peacetime architecture relies heavily on the use of clean, uniform, and natural quarried stone. Substituting natural geological stone with jagged, heterogeneous concrete rubble extracted from bombed residential buildings drastically alters the phenomenological impact of the wall, potentially evoking the structure's original military connotations and the trauma of destruction rather than a modern, serene eco-aesthetic.

Despite the potential aesthetic and psychological challenges, the macro-environmental imperative for rubble reuse in the Levant is absolute. Post-disaster recovery frameworks increasingly advocate for the implementation of a rigorous circular economy, wherein building deconstruction, material salvage, and aggregate recycling minimize landfill waste and drastically reduce the embodied carbon energy associated with extracting, processing, and transporting new virgin materials (Pradhananga & ElZomor, 2023). In Aleppo, Syria, municipal and international frameworks have modeled scenarios where debris is not only used for immediate residential building repair but is integrated into new multi-purpose public spaces, serving as the physical sub-structure for solar panel infrastructure and processed into "memorial aggregate" (Kousa & Pottgiesser, 2019). Treating conflict rubble as a distributed material stock requires moving beyond viewing it as an undifferentiated, waste stream, instead recognizing it as a critical, localized resource capable of driving self-sufficient economic recovery and generating localized job creation in post-domicide-affected communities.

METHOD

The socio-psychological feasibility of using rubble-filled gabion walls in conflict-affected regions was investigated through a quantitative survey that was employed among participants from Syrian and Palestinian origins to assess community perception and acceptance of rubble-filled gabion walls.

1. Survey Design and Data Collection

A structured questionnaire was designed and distributed via Google Forms to the general population of Syria, Palestine, and neighboring countries to reach the refugees and immigrants. Given the challenges of conducting on-site research in conflict-related areas, this online survey allowed for broader coverage and anonymity while ensuring respondents' safety. Taking into account the post-conflict context, local NGOs' staff and the author's contacts volunteered to assist in sharing the survey to reach more people, especially in the affected regions. The survey was designed with both English and Arabic in mind to ensure accessibility. The total number of participants was $N = 115$. The sample was purposive rather than random due to the difficulties and challenges of random sampling in post-conflict situations; however, efforts were made to ensure overall demographic diversity (including gender, age group, and profession). Participation in the research was primarily voluntary, facilitated by the social media channels and community networks, although there was a recognized limitation due to unstable conditions, making this limitation unavoidable. Nonetheless, the beneficial and valuable data that was offered by the survey for interpreting community thoughts provides insights into their perceptions within these regions.

Table 1. Survey Design and Content Validity Structure

<i>Section</i>	<i>Survey Items</i>	<i>Measurement Type</i>	<i>Justification and Theoretical Basis</i>
Demographic Profile	Q1–Q4	Categorical	Captures age, gender, country of residence, and occupation to contextualize responses and support subgroup comparisons.
Exposure and Awareness	Q5–Q7	Binary / Categorical	Measures respondents' direct exposure to war-related loss and awareness of rubble reuse and gabion systems. Prior experience influences perception, risk evaluation, and acceptance formation.

<i>Section</i>	<i>Survey Items</i>	<i>Measurement Type</i>	<i>Justification and Theoretical Basis</i>
Symbolic and Emotional Perception	Q8–Q11	5-point Likert Scale	Grounded in Place Attachment and Collective Memory. Items capture symbolic meaning (Q8), identity preservation (Q9), trauma-related response (Q10), and hopeful reinterpretation (Q11), ensuring balanced representation of both positive and negative emotional dimensions associated with post-conflict material reuse (Halbwachs et al., 1992; Lewicka, 2008)
Perceived Acceptability	Q12–Q16	5-point Likert Scale	Grounded in Technology Acceptance Model (TAM). Items represent perceived safety (Q12), aesthetic evaluation (Q13), behavioral intention (Q14), economic benefit (Q15), and visibility preference (Q16). Together, they capture cognitive and affective evaluation of a theoretical construction method, consistent with perception-based acceptance measurement (Davis & Venkatesh, 1996), while also reflecting architectural performance considerations such as safety, cost, and visual integration.
Respondent arguments and reasoning	Q17	Open-ended Question	Provides qualitative depth by capturing respondents' personal justifications, concerns, and reflections regarding gabion wall construction. This supports triangulation and enriches interpretation of quantitative findings by revealing underlying reasoning patterns not captured through structured scales.

The survey comprised several sections based on the theories and syntheses mentioned in the Table 1:

- **Demographic Information:** (Q1) Age, (Q2) Gender, (Q3) Country of Residence, and (Q4) Occupation.
- **Binary/Categorical Questions** (*equipped with gabion-wall illustrative images*):
 - Q5: “Have you personally experienced property loss due to war?” (Yes/No)
 - Q6: “Have you heard of 'gabion walls' (mesh cages filled with stone or rubble)?” (Yes/No)
 - Q7: “Do you know of any projects in your region that reuse rubble?” (Yes/No/Not sure)
- **Likert Scale (1-5 scale) Questions/Statements** (*global projects photos are attached to demonstrate the potential of gabion-wall systems*): A series of nine statements (Q8–Q16) assessed attitudes and perceptions. For these scales, 1 indicated strong disagreement and 5 indicated strong agreement.
 - Q8: “Rubble from war-destroyed buildings carries emotional or symbolic meaning”
 - Q9: “Using rubble in new buildings helps preserve memory and identity”
 - Q10: “Living in a home made from war rubble would remind me of loss & trauma”
 - Q11: “Reusing rubble in a new way can be empowering and hopeful”
 - Q12: “I would feel safe in a building using rubble gabion walls”
 - Q13: “Gabion wall buildings are acceptable in terms of aesthetic appearance”
 - Q14: “I would recommend this technique for use in my community”
 - Q15: “I believe this method is economically beneficial”
 - Q16: “I would prefer rubble to be hidden inside concrete, not visible in cages”
 - Q17: “Open-ended Question” Asks the respondents about their arguments regarding gabion walls

Contemporary psychometric research increasingly supports the utility of single-item measures when evaluating specific, unambiguous, and unipolar constructs where the respondent's subjective perception is the primary target of measurement. Single-item measures are more appropriate for use in time-restricted conditions, more suitable for vulnerable populations, and more satisfying for survey-takers than multi-item measures, which can be repetitious and lead respondents to find similarly worded questions tedious and infuriating. Given the advantages associated with single-item measures, they can be viable, valid, and reliable alternatives to their multi-item counterparts (Ahmad et al., 2014; Allen et al., 2022). In the context of this exploratory study, single-item measures are utilized to capture the immediate perceptual reactions of individuals to a proposed concept. Acknowledging this reduction of complex constructs to simple items to target a broad segment of society with diverse cultural and educational levels and backgrounds reinforces the careful framing of this study as an exploratory perception study, providing preliminary indicators that warrant subsequent, fine-grained psychometric evaluation.

2. Data Preparation and Cleaning

Prior to analysis, the dataset was reviewed for completeness and consistency. Categorical variables (e.g., Age, Gender, Occupation, Country, and responses to Q5–Q7) were coded numerically to facilitate statistical analysis.

3. Statistical Analysis Plan

Statistical analysis involved both descriptive and inferential techniques to address the research objectives.

- **Descriptive Statistics:**
 - Frequencies and percentages were calculated for all categorical variables: Age, Gender, Country, Occupation, and responses to Q5, Q6, and Q7.
 - For the Likert scale questions (Q8-Q16), measures of central tendency (mean, median, mode), dispersion (standard deviation), and full frequency distributions (percentages for each scale point from 1 to 5) were computed.
- **Inferential Statistics:** Given the ordinal nature of the Likert scale data, non-parametric tests were used, as they do not rely on assumptions of normal distribution or homogeneity of variances that are often violated in such datasets. This choice ensured more robust and appropriate statistical conclusions.
 - **CHIS - Chi-Square Test of Independence (χ^2):** This test was used to explore associations between two categorical variables. Examples include examining the relationship between Occupation and awareness of gabion walls (Q6), or between Country and personal experience of property loss (Q5).
 - **MWU - Mann-Whitney U Test:** This non-parametric test was selected to compare responses on ordinal Likert scale items (Q8-Q16) between two independent groups. For instance, comparing perceptions of safety (Q12) between male and female respondents, or comparing emotional responses to rubble (Q8-Q11) based on whether respondents experienced property loss (Q5: Yes/No).
 - **KWH - Kruskal-Wallis H Test:** This test, an extension of the Mann-Whitney U test for three or more independent groups, was employed for comparing responses on

Likert scale items across different categories of variables like Occupation (e.g., Civil Engineers vs. Architects vs. Residents vs. Students on recommending the technique, Q14) or Age group.

- **SRC - Spearman's Rank-Order Correlation (ρ):** This non-parametric measure was chosen to assess the strength and direction of monotonic relationships between pairs of ordinal variables, primarily among the Likert scale questions (Q8-Q16) themselves. For example, to examine the relationship between perceiving rubble as a trauma reminder (Q10) and the preference for rubble visibility (Q16).
- **Hypothesis Formulation:** Several key hypotheses were formulated to guide the inferential analysis. These hypotheses aim to uncover not just general attitudes but the underlying drivers and nuances of these attitudes.
 - *H1:* Personal experience of war-related property loss (Q5) significantly influences emotional and symbolic perceptions of rubble reuse (Q8: symbolic meaning, Q9: memory/identity, Q10: trauma reminder, Q11: empowerment/hope).
 - *H2:* Professional background (Occupation, categorized e.g., technical vs. non-technical) significantly affects practical assessments (Q12: safety, Q13: appearance, Q15: economic benefit) and willingness to recommend (Q14) *H3:* Prior awareness of gabion walls (Q6) or existing rubble reuse projects (Q7) is positively associated with willingness to recommend the technique (Q14) and perceived safety (Q12).
 - *H3:* Prior awareness of gabion walls (Q6) or existing rubble reuse projects (Q7) is positively associated with willingness to recommend the technique (Q14) and perceived safety (Q12).
 - *H4:* There is a significant relationship between perceiving rubble as a reminder of loss and trauma (Q10) and the preference for rubble to be hidden rather than visible (Q16). Understanding this relationship is vital because if individuals who associate rubble strongly with trauma also prefer it hidden, this has direct implications for design guidelines in post-conflict settings, aiming to avoid re-traumatization while still potentially acknowledging the past.

The statistical software packages JASP and Microsoft Excel were used for these descriptive and inferential analyses. A significance level (α) was set at 0.15 as the threshold for determining statistical significance during the analysis due to research post-conflict context. This threshold acts as an exploratory benchmark, and this will help to point out any potential trends and psychological indicators rather than definitive proofs. This choice is made because using the traditional $p < 0.05$ for selecting variables often fails to identify important variables (Hosmer et al., 2013), and significance testing can perform acceptably with a threshold reaching 0.20 or higher (Mickey & Greenland, 1989). Since this study is exploratory, several limitations must be addressed.

The study relies on a relatively small, purposive sample ($N=115$), meaning the findings reflect the tendencies of this specific respondent group and couldn't be broadly generalized to full community acceptance. Furthermore, the contextual nature presents another limitation, whereas the respondents evaluated the concept of rubble-filled gabion walls based on textual descriptions, illustrative images, and global projects photos utilizing gabion-walls, rather than lived, 3D environments. Then, the data

capture hypothetical cognitive perceptions responses rather than the embodied experience of residing within this type of built environment.

4. Preliminary Analyses & Validation

Prior to the main analysis, the internal consistency of the survey constructs was assessed using Cronbach's α . Initial testing required the removal of items Q10 and Q16 to optimize reliability; these will be analyzed as standalone variables. The Perceived Acceptability scale ($\alpha = 0.739$) demonstrated good reliability. The Emotional/Symbolic scale ($\alpha = 0.628$) achieved a level of consistency which is considered acceptable in exploratory research when values fall between 0.6 and 0.7 (Hair et al., 2021). Following the confirmation of internal consistency, discriminant validity between the Emotional and Practical constructs was established using a Pearson correlation analysis. The test between the two scales showed a moderate positive correlation ($r = 0.489$). However, the correlation coefficient is well below the conservative threshold of 0.85 (Kline, 2011), which strongly supports the discriminant validity. This confirms that while respondent attitudes regarding the emotional symbolism and perceived acceptability of the rubble-filled gabions are related, they remain distinct and separate constructs. To ensure that all individual items accurately reflected these constructs, convergent validity was examined using corrected item-rest correlations. Every item across both constructs demonstrated a correlation coefficient above the established threshold of 0.30 (Field, 2013), confirming that all items adequately measure their respective underlying constructs and warrant inclusion in the composite scales. Noting that Q10 and Q16 are treated as single items for relevant measurement and analyzed as a standalone variables.

Table 2. Summary of Construct Reliability and Validity

<i>Construct + Items Included</i>			<i>Validation Test Performed</i>
Internal Consistency Reliability	Emotional/Symbolic	Q8, Q9, Q11	Cronbach's $\alpha = 0.628$
	Perceived Acceptability	Q12, Q13, Q14, Q15	Cronbach's $\alpha = 0.739$
	<i>Q10 and Q16 were dropped off during reliability testing to optimize construct internal consistency.</i>		
Discriminant Validity	Emotional $\leftrightarrow$ Perceived Acceptability Constructs		Pearson Correlation Coefficient $r = 0.489$
Convergent Validity	Emotional/Symbolic	Q8, Q9, Q11	Item-Rest Correlation > 0.30
	Perceived Acceptability	Q12, Q13, Q14, Q15	Item-Rest Correlation > 0.30

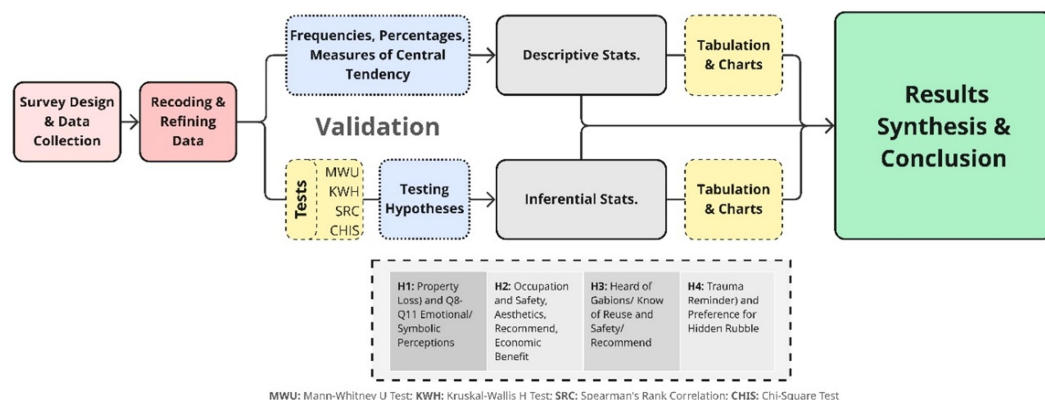


Figure 1. Research Methodology Flowchart

RESULTS AND DISCUSSION

The dataset consisted of 115 responses from Syria and Palestine. It was acknowledged that this sample size is small; consequently, the findings were interpreted with caution regarding their generalizability. This section details the characteristics of the survey respondents, including their demographic profiles and their experiences and awareness related to conflict and construction practices. This contextual information is essential for interpreting the subsequent attitudinal data.

1. **Demographic Characteristics:** Demographic profile of the 115 respondents surveyed for this study is given in Table 3. The sample consists of respondents from Syria (83.5%) and Palestine (16.5%), with men and women forming a balanced demographic mix (54.8% male; 45.2% female). Most of the study participants (82.6%) are men or women aged between 18-50 years, the main age for the core demographic for potential engagement or impacts of post-war reconstruction. Importantly, respondents are nearly equally divided between Architecture, Engineering, and Construction (AEC) professionals (51.3%) and non-professional residents (48.7%). This even occupational distribution gives us a good baseline to measure the technical viewpoint of the industrial experts and perception of the public.

Table 3. Respondent Demographics (N=115)

<i>Demographic Variable</i>	<i>Category</i>	<i>Frequency (N)</i>	<i>Percentage (%)</i>
Age Group	Between 18-30	34	29.6%
	Between 31-50	61	53.0%
	Over 50	17	14.8%
	Under 18	3	2.6%
Gender	Male	63	54.8%
	Female	52	45.2%
Country	Syria	96	83.5%
	Palestine	19	16.5%
Occupation	Architect (Professional)	38	33.0%
	Civil/Structural Engineer (Professional)	15	13.0%
	Resident (Professional AEC Related)	6	5.2%
	Resident (Non-Professional)	56	48.7%
	Total		
	(Professional)	59	51.3%
	(Non-Professional)	56	48.7%

Note: Percentages may not sum to 100% due to rounding.

2. Exposure to Conflict and Prior Awareness

Table 4 details the respondents' contextual background regarding war exposure and awareness of sustainable reconstruction. Over half the sample (54.8%) reported personal property loss due to war. Showing the substantial level of direct trauma exposure within the cohort. While general awareness of "gabion walls" is nearly evenly split (51.3% aware, 48.7% unaware), knowledge of practical, local implementation remains notably low. Only 12.2% of respondents knew of existing regional projects that reuse rubble, whereas the vast majority were either unaware (62.6%) or unsure (25.2%).

Table 4. Respondent Contextual Background
(Q5-Q7 War Exposure & Gabion Walls Awareness, N=115)

<i>Question/Statement</i>	<i>Response Category</i>	<i>Frequency (N)</i>	<i>Percentage (%)</i>
Q5_Have you personally experienced property loss due to war?	Yes	63	54.8%
	No	52	45.2%
Q6_Have you heard of “gabion walls”?	Yes	59	51.3%
	No	56	48.7%
Q7_Do you know of any projects in your region that reuse rubble?	Yes	14	12.2%
	No	72	62.6%
	Not sure	29	25.2%

Note: Percentages may not sum to 100% due to rounding.

3. Emotional and Symbolic Dimensions of Rubble Reuse (Q8-Q11): These features are fundamental, which enable materials to carry psychological and cultural layers of meaning, particularly after a conflict. Ultimately, this reveals complex but mostly positive emotional responses in the data. The most supported sentiment is that reusing rubble is "Empowering/Hopeful" (Q11), which recorded the highest mean score ($M=3.887$) and the highest overall approval with 67.0% of participants either agreeing or strongly agreeing. Table 5 shows that respondents also had a strong agreement that the material has a “Symbolic Meaning” (Q8, $M=3.574$) and with 57.4% in agreement. However, this highlights a dual psychological impact. While considered as empowering, a little over 50% were also agreed that reused rubble is a "Loss/Trauma Reminder" (Q10, $M=3.365$). In addition, attitudes in regard to whether the material helps to "Preserve Memory/Identity" (Q9) were most divided, with the lowest mean ($M=3.226$) and highest standard deviation ($SD=1.475$), suggesting mixed perceptions in the community of embedding past trauma in future dwelling.

Table 5. Descriptive Statistics for Perceptions of Rubble and its Reuse
(Q8-Q11, N=115)

(Scale: 1=Strongly Disagree, 2=Disagree, 3=Neutral, 4=Agree, 5=Strongly Agree)

<i>Question/Statement</i>	<i>Mode</i>	<i>Median</i>	<i>Mean</i>	<i>Std. Dev.</i>	<i>1 (%)</i>	<i>2 (%)</i>	<i>3 (%)</i>	<i>4 (%)</i>	<i>5 (%)</i>
Q8_Symbolic_Meaning	4.898	4.0	3.574	1.421	14.8	7.0	20.9	20.9	36.5
Q9_Preserve_Memory_Identity	4.811	3.0	3.226	1.475	20.9	9.6	22.6	20.0	27.0
Q10_Loss_Trauma_Reminder	4.886	4.0	3.365	1.459	15.7	14.8	19.1	18.3	32.2
Q11_Impowering_Hopeful	4.950	4.0	3.887	1.262	8.7	4.3	20	23.5	43.5

Note: Percentages may not sum to 100% due to rounding.

4. Practical and Functional Perceptions of Rubble Gabion Walls (Q12-Q16)

By shifting focus from the general emotional and symbolic aspects of rubble to the specific practical and functional perceptions of using rubble within gabion wall constructions. It covers attitudes towards safety, aesthetics, willingness to recommend the technique, perceived economic benefits, and preferences regarding the visibility of the rubble. Table 6 presents respondents' practical attitudes toward executing rubble gabion walls. The data indicate strong recognition of the technique's utility, with the highest consensus found in its perception as an economically

beneficial method (Q15, Mean=4.035), where 70.4% of respondents agreed or strongly agreed. Consequently, this shows a general willingness to recommend the technique (Q14, Mean=3.652). However, the practical acceptance is tied to safety and aesthetic reservations. Respondents expressed ambivalence regarding feelings of safety (Q12), yielding the lowest mean score (3.087) and a high neutrality rate of 41.7%. Furthermore, while general aesthetic acceptability (Q13) was moderate (Mean=3.383), a significant majority (65.2%) explicitly preferred that the rubble be hidden from view (Q16, Mean=3.843). This shows that while communities agree with the economic-structural logic of rubble reuse, they prefer to conceal and cover the raw material in their everyday living environments.

Table 6. Descriptive Statistics for Attitudes Towards Rubble Gabion Walls
(Q12-Q16, N=115)

(Scale: 1=Strongly Disagree, 2=Disagree, 3=Neutral, 4=Agree, 5=Strongly Agree)

Question/Statement	Mode	Median	Mean	Std. Dev.	1 (%)	2 (%)	3 (%)	4 (%)	5 (%)
Q12_Safety_Feeling	3.005	3.000	3.087	1.159	11.3	14.8	41.7	18.3	13.9
Q13_Acceptable_Aesthetically	4.000	3.000	3.383	1.073	7.8	8.7	33.9	36.5	13.0
Q14_Technique_Recommendation	3.040	4.000	3.652	1.163	6.1	7.8	30.4	26.1	29.6
Q15_Economically_Beneficial_Method	4.980	4.000	4.035	1.100	2.6	7.8	19.1	24.3	46.1
Q16_Hidden_Rubble_Preference	4.949	4.000	3.843	1.268	7.0	9.6	18.3	22.6	42.6

Note: Percentages are rounded and may not sum to 100%.

5. Likert Scale Responses Summary

The diverging stacked bar chart as shown in Figure 2 illustrates the participants' differences in their perception of rubble gabion walls along nine dimensions. The chart highlights that the greatest positive consensus focuses on the approach being "Economically Beneficial" in parallel with "Empowering & Hopeful", besides a strong majority preference to keep the rubble hidden from view is well-placed. Conversely, the strongest negative skews and divergence in opinion occur in "Safety Feeling," "Trauma Reminder," and "Preserve Memory & Identity," and visually reflect the divergent opinions within the community over structural safety and the emotional weight of exposed war rubble.

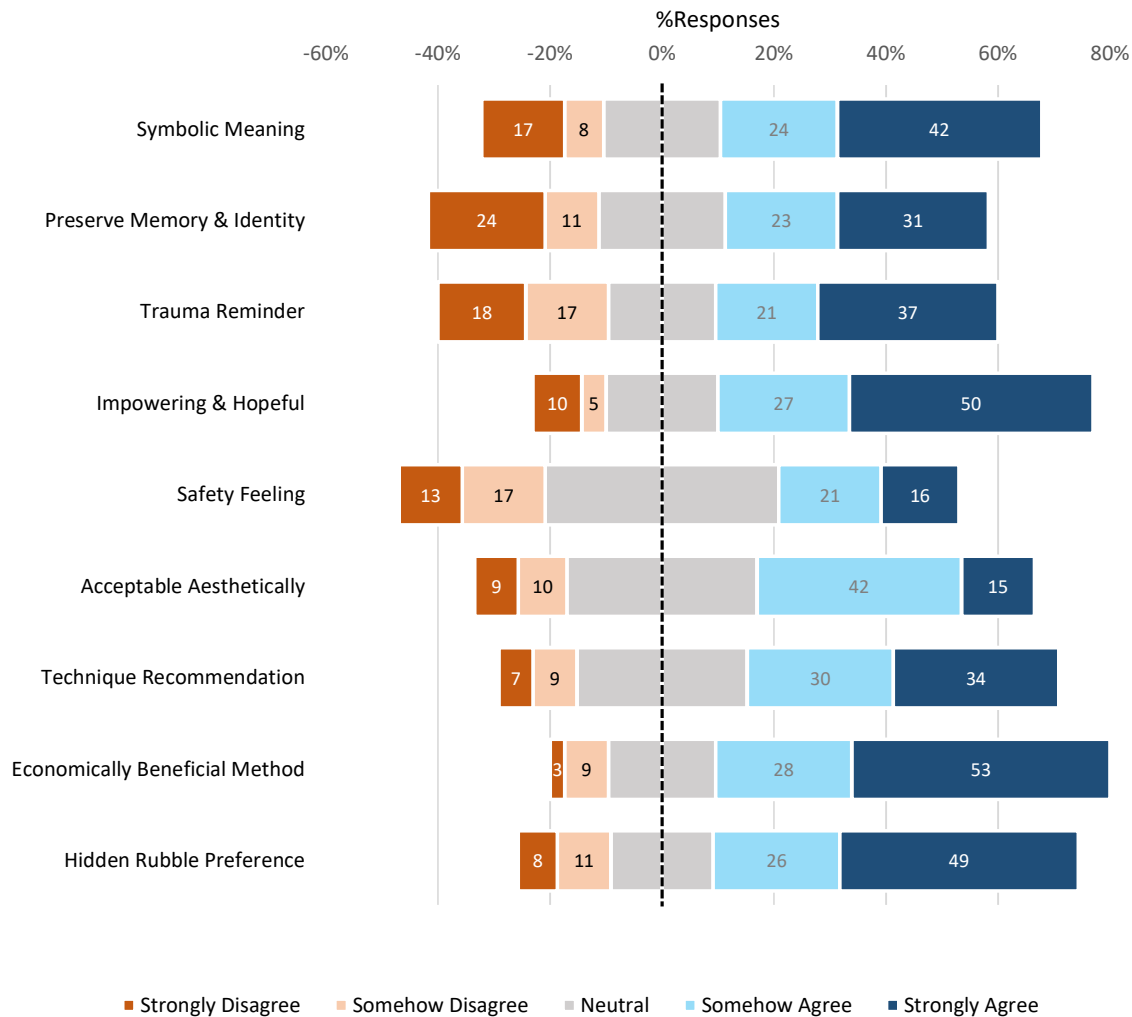


Figure 2. Likert Responses Diverging Summary Bar Chart (Q8-Q16)

6. Inferential Analysis and Hypotheses Testing

To delve into the deeper patterns evident in the data, this section presents the results of inferential statistical analyses with a purpose of studying relationships among demographic factors, contextual experiences, and perceptions of rubble gabion walls. It investigates the sensitive interface of post-conflict reconstruction, applying circular economy principles, and the management of profound psychological trauma. Given the small sample size ($N=115$), all inferential results are interpreted with caution, as statistical power is limited.

- The Psychological Duality of Ruins (H1, H4):** The inferential analysis reinforces the theoretical psychological conceptualization of “double wounds” very strongly. Hypothesis One (H1) illustrates how the immediate, physical loss of a property changes a survivor’s perspective on the material world, immediately impacting them. People who have lost their homes are statistically more likely ($p=0.15$) as shown in Table 20, meeting

the exploratory α value) to perceive recycled rubble not as an abstract and cognitive marker of resilience to the ecological environment, but as a visceral and deeply disturbing image conjuring up memories of violence and loss. This heavy emotional burden flows directly into the architectural and aesthetic preferences of those affected in question, as finally demonstrated by Hypothesis Four (H4). As detailed in Table 23, the strong positive correlation ($p=0.024$) of trauma associations with a clear-cut preference to hide the rubble indicates that the visible, exposed nature of conventional rubble-filled gabion walls acts as a serious psychological catalyst for traumatized groups. In the specific environment of domicile-affected cities, where the population lives in a choking, constant reality of ruin, has been violently exterminated, and requiring vulnerable populations to live surrounded in their environment by cages made of the ruins of their past lives may create barriers that threaten to prevent them from emotionally and socially thriving.

- **The Professional vs. Layperson Perceptual Divide (H2):** As detailed in Table 21, the results suggest that the second hypothesis is partly true, and this hypothesis confirms existing theories of environmental psychology concerning the broad perceptual gap between AEC professionals and the general population. The visual acceptability of gabion walls was rated significantly higher ($p= 0.047$) regarding architectural values by the AEC professionals among those participating in the surveyed group compared to non-professional residents. Whereas Architects and structural engineers have been academically trained to consider the structural honesty, the ethical sustainability, and the abstractive materiality, besides the rubble upcycling high potential. But for laypersons whose basic self-rating metric is based on an acute need for perceived safety, cleanliness, and emotional comfort, may find the exposed rubble gabion walls represent poverty, an unfinished state of disaster, or persistent vulnerability. This finding in statistics highlights a major, critical fallacy in present-day sustainable design through applying professional aesthetics and avant-garde tectonic concepts to particularly vulnerable users without participative consent, which will severely limit the social acceptance of ecologically regionally post-conflict necessary technologies.
- **The Constraint of Awareness (H3):** Hypothesis Three analysis shows a compellingly null result, suggesting that prior awareness does not correlate with psychological or social acceptance. Chi-Square tests don't show any statistically significant relationship between resident gabion walls awareness or general knowledge of rubble reuse and perception of structure safety or willingness to recommend the method. Since each of the p-values are well above the exploratory α level ($p=0.268$ and $p=0.910$) as shown in Table 22, it indicates that merely educating a traumatized community on the technical feasibility of a rebuilding modality is insufficient. For all the intellectual familiarity with sustainable rubble reuse it does little to override the longstanding emotional aversions, trauma triggers, and aesthetic stigmas noted by the other hypotheses. This demonstrates that post-conflict reconstruction strategies cannot depend on rational, top-down informational campaigns alone; to receive true societal acceptance, architectural interventions must explicitly address the visceral, psychological, and aesthetic needs of survivors, rather than simply their technical comprehension.

Table 7. Key Inferential Hypotheses Test Results Summary

<i>Hypothesis Tested/Variables Compared</i>	<i>Statistical Test</i>	<i>P-value</i> <i>alpha (α)=0.15 due to the exploratory nature of the study, the small sample size, and the post-conflict context.</i>	<i>Outcome/Interpretation if Significant</i>
H1: Q5 (Property Loss) and Q8-Q11 (Emotional/Symbolic Perceptions)	Mann-Whitney U Test	Q5 vs Q8 (Symbolic Meaning) = 0.576 Q5 vs Q9 (Preserve Memory) = 0.271 Q5 vs Q10 (Trauma Reminder) = 0.15 Q5 vs Q11 (Empowering & Hopeful) = 0.446 Q5 vs Emotional Construct Q5 vs (Q8, Q9, Q11) = 0.570	Partially Supported Experiencing personal property loss due to war significantly influences whether a respondent perceives the reused rubble as a trauma reminder.
H2: Q4 (Occupation) and Q12 (Safety), Q13 (Aesthetics), Q14 (Recommend), Q15 (Economic Benefit)	Kruskal-Wallis H Test	Q4 vs Q12 (Safety) = 0.699 Q4 vs Q13 (Aesthetics) = 0.047 Q4 vs Q14 (Recommend) = 0.991 Q4 vs Q15 (Economic Benefit) = 0.48 Q4 vs Practical Construct Q4 vs (Q12, Q13, Q14, Q15) = 0.425	Partially Supported Respondents' occupational background significantly affects perceptions of aesthetic acceptability, indicating that AEC professionals and non-professional residents judge the visual appeal of the gabion walls differently.
H3: Q6 (Heard of Gabions)/Q7 (Know of Reuse) and Q12 (Safety)/Q14 (Recommendation)	Chi-Square Test	Q6 vs Q12 (Safety) = 0.268 Q6 vs Q14 (Recommend) = 0.91 Q7 vs Q12 (Safety) = 0.381 Q7 vs Q14 (Recommend) = 0.386 ----- (Likert scale data were re-coded into binary categorical variables)	Rejected/Not Supported Prior awareness of gabion walls (Q6) or knowledge of existing rubble reuse projects (Q7) does not significantly influence respondents' perceived feelings of safety (Q12) or their likelihood to recommend the technique (Q14).
H4: Q10 (Trauma Reminder) and Q16 (Preference for Hidden Rubble)	Spearman's Rank Correlation	Q10 vs Q16 (Preference for Hidden Rubble) = 0.024	Supported There is a statistically significant correlation between viewing the rubble as a trauma reminder and the preference to have the rubble hidden from view. Higher trauma association aligns with a stronger desire for concealment.

- 7. Perceptual and Attitudinal Variables Spearman's Rank-Order Correlation:** The matrix of Spearman rank-order correlation analysis illustrates the relationships of psychological perceptions of respondents to practical attitudes towards rubble gabion walls. Several strong relationships emerge from this analysis. Most notably, viewing the technique as an "Economically Beneficial Method" (Q15) is highly significantly positively correlated with expressing the "Technique Recommendation" (Q14) ($\rho = .536, p < .001$), suggesting that perceived economic viability is a primary driver of endorsement. As for finding the walls are "Acceptable Aesthetically" (Q13), it corresponds highly to recommending this approach ($\rho = .538, p < .001$) and feeling safe (Q12) ($\rho = .466, p < .001$), which highlights that aesthetic acceptance depends on pragmatic approval as well as psychological comfort. As for the psychological results, they also demonstrated complex relationships. By noticing that there is a significant correlation between reusing rubble as "Empowering/Hopeful" (Q11) practice and the positive practical outcomes, including recommending technique ($\rho = .487, p < .001$), its economic benefit from this behavior ($\rho = .401, p < .001$), and feeling comfortable ($\rho = .308, p < .001$). On the other hand, perceived rubble as a 'Loss/Trauma Reminder' (Q10) was negatively related to empowerment/hope ($\rho = -.265, p = .004$) and safety ($\rho = -.201, p = .031$), highlighting the possible psychological challenges to acceptance. Notably, hidden rubble preference (Q16) had very few significant correlations with other variables, indicating that aesthetic disposition seems to operate somewhat independently of broader conceptual or economic support.



* $p < .05$, ** $p < .01$, *** $p < .001$ (The signs (+/-) indicate the direction of correlation)

Figure 3. Spearman's Rank-Order Correlation Matrix for Perceptual and Attitudinal Variables (Q8-Q16) Heat Map

- 8. The Paradox of Rubble and Trauma-Informed Architecture:** The exhaustive synthesis of the empirical survey data and the theoretical background reveals a profound, actionable architectural paradox. The communities in Syria and Palestine exhibit an incredibly high degree of pragmatism; they understand intimately that their cities have been subjected to domicile and that utilizing the tens of millions of tonnes of debris is an unavoidable economic and environmental necessity. They even derive a potent, measurable sense of collective empowerment from the concept of literally rebuilding their nation from the ashes of destruction. However, the statistically significant correlation between trauma reminders and the overwhelming desire to conceal the rubble ($p=0.024$) serves as a direct, undeniable mandate for the immediate implementation of Trauma-Informed Design (TID). In the framework of TID, the built environment must actively and intentionally mitigate environmental stressors to foster neurological and psychological healing. The empirical data strongly dictates that exposed war rubble in a domestic setting act as an acute, triggering environmental stressor. The architectural aestheticization of ruins while intellectually compelling in the academic discourse of post-modern theory or financially viable in the luxury context of a California winery translates exceptionally poorly to the residential reconstruction of domicile victims. For a family violently displaced by urban warfare, a raw, exposed gabion wall filled with pulverized concrete does not symbolize chic, global ecological sustainability; it perpetually and violently mirrors the exact moment of their displacement. This critical divergence is acutely highlighted by the H2 statistical findings ($p=0.047$ for aesthetics), indicating a severe cognitive disconnect between AEC professionals and the lay public. Architects must navigate this gap with extreme care. The findings conclusively suggest that the most socially acceptable, trauma-responsive application of rubble in post-war residential zones is not as an exposed exterior façade, but as an invisible, highly functional structural core. This empirical conclusion aligns perfectly with the advanced engineering research of Hanein and Provis, which advocates for thoroughly crushing the rubble to serve as Recycled Concrete Aggregate (RCA) embedded entirely within new, smooth, monolithic concrete elements. If wire-mesh gabion walls are to be utilized for their exceptional cost benefits, seismic flexibility, and low-tech assembly, the community preference dictates that the mesh and raw stone should be heavily concealed beneath thick layers of traditional plaster, smooth earth-render, or extensive vegetative green-wall systems, effectively shielding the traumatized eye from the visual trigger of the debris. Conversely, the use of exposed, raw rubble may be highly appropriate, and even necessary, in non-residential, public civic spaces. In Aleppo's proposed reconstruction scenarios involving multi-purpose public spaces, the use of debris for solar panel sub-structure infrastructure and visible "memorial aggregate" transfers the heavy burden of memory from the private domestic sanctuary to the collective public realm. In these shared civic spaces, the historical "scar" of the city can be acknowledged and mourned communally, satisfying the need for historical preservation without violating the strict psychological safety parameters required in a private, trauma-informed home.
- 9. Perceived Arguments For and Against the Use of Visible Rubble Gabion Walls (Q17):** When asked to identify the strongest arguments for or against utilizing war rubble in visible gabion walls, respondents feedback coalesced around five primary themes:
- *Economic and Resource Benefits:* The strongest argument for using visible gabion walls is cost savings and the efficient reuse of existing materials. This approach expedites post-conflict rebuilding efforts, conserves national resources, reduces reliance on imported materials, and minimizes waste accumulation, directly contributing to circular economy principles.

- *Memory and Identity Preservation:* A significant portion of respondents supported the visible use of rubble to preserve historical memory. In this context, the material transforms from destroyed debris into a symbol of resilience and strength, ensuring past sacrifices are not erased.
- *Psychological and Aesthetic Concerns:* The primary argument *against* visible rubble is the negative psychological impact. Respondents noted that the sight of war debris can trigger painful memories and stress, particularly for residents and children. Additional concerns included poor aesthetics, low material quality (e.g., fire-damaged concrete), potential structural instability, and long-term durability issues such as metal cage corrosion.
- *Contextual Suitability (Residential vs. Civic):* Many respondents strongly opposed using visible rubble in residential buildings, emphasizing the need to prioritize occupant security and psychological comfort. Conversely, they suggested its application in non-residential structures, public parks, landscape architecture (e.g., retaining walls), or institutional buildings (e.g., museums) where the visual impact serves a deliberate civic purpose.
- *Safety and Logistical Concerns:* Further arguments against the practice highlighted potential health and environmental hazards from explosives or contaminants, the logistical challenges of sorting debris (including the removal of human remains), and technical deficiencies such as poor thermal and moisture insulation, alongside the risk of insect infestation.

To synthesis these responses, the perspectives reveal a profound dichotomy in social acceptance, situated at the intersection of circular economy paradigms and the psychological impact of building materials in post-conflict reconstruction. From a macro-environmental perspective, the direct upcycling of war debris represents a highly efficient resource management strategy that mitigates material scarcity, reduces embodied energy, and accelerates rebuilding efforts. However, these tangible efficiencies are starkly contested by the psychological weight of the material itself, which operates simultaneously as a distressing traumatic trigger rendering it fundamentally unsuitable for residential applications where occupant security and mental well-being are paramount and as a powerful narrative monument of historical resilience when applied to civic, memorial, or landscape architecture. Furthermore, the practical viability of this approach is heavily contingent upon resolving stringent safety and logistical prerequisites, including the remediation of chemical contaminants and the verification of long-term structural durability. Ultimately, successfully navigating these polarized views necessitates a highly contextualized implementation of sustainable reconstruction frameworks, suggesting that rubble gabions must be typologically segregated: leveraging their environmental and economic benefits in public or infrastructural domains while strictly safeguarding the psychological and physical sanctuary of private dwellings.

CONCLUSION

The large scale of physical destruction in these post-conflict areas of the world including the Syrian Arab Republic and the Palestinian territories requires very resource-efficient reconstruction efforts. Dealing with tens of millions of tons of rubble makes conventional waste disposal logistically and environmentally catastrophic; therefore, circular economy elements such as rubble-filled gabion walls and recycled concrete aggregate could be indispensable. But what those technologies can do to address the situation goes well beyond structural engineering and carbon accounting; after domicile, architecture is a basic psychological intervention. Although data from the empirical studies indicates that affected communities are very open to the economic benefits and empowering logic of material

recovery associated with the economic recovery, this pragmatism is inextricably tied to the ongoing trauma of urban war.

There is a profound gap aesthetically between architects, often romanticizing the raw, unvarnished honest tectonic expression of ruins, and traumatized survivors for whom witnessing the effects of war rubble is a significant trauma trigger. The aesthetic of the “ruined” is a luxury of peacetime; survivors long for the visual continuity to flow, smoothness and concealment of devastation traditional “normal” surfaces afford for their personal psychological healing. In order to narrow this gap, architects and developers need to take a relentlessly trauma-informed approach to materiality, including a “Hidden Core” approach. For every residential and domestic structure rebuild, gabion walls and recycled aggregates could be utilized as load bearing structures and thermal mass regulators and boundary perimeters as such structures are among the most cost effective and seismic flexibly deployed. Importantly however, this study suggests that rubble should be completely hidden from daily view with thick earthen plaster, natural lime-render or dense secondary cladding, giving the appearance of solidness and aesthetic comfort that residents seek, but without sacrificing environmental value to cover this hidden debris. The stripped-down, open aesthetics of repurposed rubble with wire mesh and jagged rubble left behind must, for instance, be carefully selected and focused on communal monuments, civic centers, or other high-tech infrastructural building elements to be to be curated architectural exposure through applying differentiating spatial memory strategy. This crucial spatial distinction allows the community to mourn, together, the past, and memorialize it in public spaces without violently intruding upon the visually safe and trigger-free sanctuary of the private home.

Making that approach a reality can only take place through community recovery that builds on a structural safety education that forces professionals and the general public into design through participatory design. If a statistically significant relationship exists between perceived safety and the adoption of approaches to building, reconstruction programs must go from merely providing communities with built structures to the project of actually building with them. It is essential for engineering agencies and NGOs to focus on transparent, community-driven education, hands-on prototyping and material testing workshops that showcase gabion systems when placed into the environment. Through establishing safety in these materials and the respect for survivors’ psychological needs over external design demands, the architectural industry can move from a mechanical mix of ‘urban mining’ and trauma informed design to a practical synthesis which empathic society has sought. Ultimately, through this comprehensive process it is ensured that reconstruction goes beyond ‘just clearing away the tonnage from the streets; such a wide-ranging process is what makes it possible to truly and both literally and metaphorically create both a safe, healing future for these damaged populations that rest on the remains of their tragic past.

ACKNOWLEDGEMENTS

Sincere gratitude to the community volunteers in Syria and Palestine who assisted with the survey distribution and data collection. Special thanks are also extended to the respondents whose valuable input and time made this research possible. This article has been funded with support of the Kemitraan Negara Berkembang (KNB) Scholarship from Ministry of Higher Education, Sciences, and Technology of Republic of Indonesia on behalf of the Government of the Republic of Indonesia. This publication/communication reflects the view only of the author, and the Ministry of Higher Education, Sciences, and Technology of Republic of Indonesia cannot be held responsible for any use which may be made of the information contained therein.

REFERENCES

- Abdelnour, S., & Roy, N. (2025). Processing debris from destroyed and damaged buildings in Gaza: Carbon emissions, time frames, and implications for rebuilding. *Environmental Research: Infrastructure and Sustainability*, 5(3), 035002. <https://doi.org/10.1088/2634-4505/adeadc>
- Ahmad, F., Jhaji, A. K., Stewart, D. E., Burghardt, M., & Bierman, A. S. (2014). Single item measures of self-rated mental health: A scoping review. *BMC Health Services Research*, 14(1), 398. <https://doi.org/10.1186/1472-6963-14-398>
- Allen, M. S., Iliescu, D., & Greiff, S. (2022). Single Item Measures in Psychological Science: A Call to Action. *European Journal of Psychological Assessment*, 38(1), 1–5. <https://doi.org/10.1027/1015-5759/a000699>
- Ames, R. L., & Loebach, J. E. (2023). Applying Trauma-Informed Design Principles to Therapeutic Residential Care Facilities to Reduce Retraumatization and Promote Resiliency Among Youth in Care. *Journal of Child & Adolescent Trauma*, 16(4), 805–817. <https://doi.org/10.1007/s40653-023-00528-y>
- ArchEyes. (2024, October 3). Dominus Winery by Herzog & de Meuron: Shaping Stone with Light. *ArchEyes*, (Architecture, Industrial Architecture). <https://archeyes.com/dominus-winery-by-herzog-de-meuron-shaping-stone-with-light/>
- Azzouz, A. (2023a). *Domicide: Architecture, war and the destruction of home in Syria*. Bloomsbury Visual Arts. <https://doi.org/10.5040/9781350248137>
- Azzouz, A. (2023b, May 5). *Domicide—War on the City*. <https://themarkaz.org/domicide-war-on-the-city>
- Azzouz, A. (2024, January 30). As a Syrian I feel the pain of Palestinians as their homes and lives are destroyed. This is domicile. *The Guardian*. <https://www.theguardian.com/commentisfree/2024/jan/30/syrian-palestinians-homes-lives-war-gaza>
- Baldwin, E. (n.d.). *The Great Gabion: 17 Examples of Architecture Beyond the Wall*. Retrieved <https://architizer.com/blog/inspiration/collections/gabion/>
- Byers, B., Bompa, D., Jin, Q., & de Wolf, C. (2025). *Circular Economy for Post-Hazard Infrastructure Restoration: Strategies for Resilience and Resource Efficiency* [Application/pdf]. <https://doi.org/10.3929/ETHZ-C-000796126>
- Davis, F. D., & Venkatesh, V. (1996). A critical assessment of potential measurement biases in the technology acceptance model: Three experiments. *International Journal of Human-Computer Studies*, 45(1), 19–45. <https://doi.org/10.1006/ijhc.1996.0040>
- Field, A. (2013). *Discovering statistics using IBM SPSS statistics* (4th edition). Sage.
- Gabion Supply. (n.d.). *The Science of Gabions Towards Erosion Control*. Gabion Supply. Retrieved <https://gabionsupply.com/the-science-of-gabions-towards-erosion-control/>
- Gentle, A. C. (2025, December 22). The Aesthetics of Decay: How Ruins Inspire Contemporary Sculpture and Installation Art. *Sculptures*. <https://www.rialtocenter.org/the-aesthetics-of-decay-how-ruins-inspire-contemporary-sculpture-and-installation-art/>
- Grabowska, S. (2021). *Architectural Principles in the Service of Trauma-Informed Design*.
- Guhl, A. (2022, December 15). 5 Principles of Trauma-Informed Design. *Neumann Monson Architects*. <https://neumannmonson.com/blog/principles-trauma-informed-design>
- Hair, J. F., Hult, G. T. M., Ringle, C. M., Sarstedt, M., Danks, N. P., & Ray, S. (2021). *Partial Least Squares Structural Equation Modeling (PLS-SEM) Using R: A Workbook*. Springer International Publishing. <https://doi.org/10.1007/978-3-030-80519-7>

- Halbwachs, M., Coser, L. A., & Halbwachs, M. (1992). *On collective memory*. University of Chicago Press.
- Herzog & de Meuron. (n.d.). *137 Dominus Winery* [Architecture Firm]. Herzog & de Meuron. Retrieved <https://www.herzogdemeuron.com/projects/137-dominus-winery/>
- Hosmer, D. W., Lemeshow, S., & Sturdivant, R. X. (2013). *Applied logistic regression* (3. ed). Wiley.
- Justus, J., & Raghani, S. (2025). Trauma-informed design: Shelter homes for runaway children. *International Journal of Adolescence and Youth*, 30(1), 2445053. <https://doi.org/10.1080/02673843.2024.2445053>
- Kline, R. B. (2011). *Principles and practice of structural equation modeling* (3. ed). Guilford Press.
- Kousa, C., Lubelli, B., & Pottgiesser, U. (2025). Enhancing Community Participation for the Reconstruction of Residential Heritage in the Old City of Aleppo. *Heritage*, 8(8), 319. <https://doi.org/10.3390/heritage8080319>
- Kousa, C., & Pottgiesser, U. (2019). Post Syrian-war material recovery, reuse and transformation in the Old City of Aleppo. *Journal of Cultural Heritage Management and Sustainable Development*, 10(1), 90–103. <https://doi.org/10.1108/JCHMSD-07-2019-0085>
- Lewicka, M. (2008). Place attachment, place identity, and place memory: Restoring the forgotten city past. *Journal of Environmental Psychology*, 28(3), 209–231. <https://doi.org/10.1016/j.jenvp.2008.02.001>
- Marie, M., & SaadAdeen, S. (2021). Mental health consequences of home demolition policy towered Palestinians: Literature review. *International Journal of Mental Health Systems*, 15(1), 51. <https://doi.org/10.1186/s13033-021-00472-0>
- Mickey, R. M., & Greenland, S. (1989). THE IMPACT OF CONFOUNDER SELECTION CRITERIA ON EFFECT ESTIMATION. *American Journal of Epidemiology*, 129(1), 125–137. <https://doi.org/10.1093/oxfordjournals.aje.a115101>
- Natura. (2021, February 24). Transformation of gabion wall as a construction technique into architectural design. *Natura*. <https://www.naturadergi.com/anasayfa/bir-insa-teknigi-olan-gabion-duvarin-mimari-tasarima-donusumu/?lang=en>
- Nilufar, F. (2006). The Architecture of the City—City as evaluated by Aldo Rossi. *Épités - Építészetudomány*, 10, 55–61.
- Osypchuk, K. (2025). *Dismantling the Past, Rebuilding the Future: Politics of Memory and Urban Space in the Public Spheres of Poland and Ukraine* [Unpublished manuscript].
- Owen, C., & Crane, J. (2022). Trauma-Informed Design of Supported Housing: A Scoping Review through the Lens of Neuroscience. *International Journal of Environmental Research and Public Health*, 19(21), 14279. <https://doi.org/10.3390/ijerph192114279>
- Pradhananga, P., & ElZomor, M. (2023). Revamping Sustainability Efforts Post-Disaster by Adopting Circular Economy Resilience Practices. *Sustainability*, 15(22), 15870. <https://doi.org/10.3390/su152215870>
- Rashwani, A., Kadan, B., Seyedian Choubi, S., Alhammoudi, Y., Hanein, T., Guadagnini, M., Meral Akgul, C., & Provis, J. L. (2023). Rebuilding Syria from the Rubble: Recycled Concrete Aggregate from War-Destroyed Buildings. *Journal of Materials in Civil Engineering*, 35(4), 04023010. [https://doi.org/10.1061/\(ASCE\)MT.1943-5533.0004654](https://doi.org/10.1061/(ASCE)MT.1943-5533.0004654)
- Ravasi, D., Rindova, V., & Stigliani, I. (2019). The Stuff of Legend: History, Memory, and the Temporality of Organizational Identity Construction. *Academy of Management Journal*, 62(5), 1523–1555. <https://doi.org/10.5465/amj.2016.0505>
- ReliefWeb. (2024). *Urban Recovery: Using Rubble to Build a New Future*. <https://reliefweb.int/report/world/urban-recovery-using-rubble-build-new-future>

- Reynolds, M. (2021, July 28). *Gabion walls—What is a gabion cage & how to build with them?* Ecohome. <https://www.ecohome.net/en/guides/3565/what-are-gabion-walls-complete-guide-building-with-gabion-cage/>
- Rossi, A. (2007). *The Architecture of the City* (16. print). MIT Press.
- Ruggiero, R., Cocco, P. L., & Cognoli, R. (2025). *The (New) Materiality of Reconstruction: On-Site Automated Recycling of Rubble Aggregates for Rebuilding Earthquake-Stricken Villages*. Engineering. <https://doi.org/10.20944/preprints202512.1730.v1>
- Terrock. (2025, March 28). *Gabions in architecture: Inspiring examples from around the world*. Terrock. <https://terrock.co.uk/gabions-in-architecture-inspiring-examples-from-around-the-world/>
- The University of Sheffield. (2023, April 3). *Recycling rubble left behind by war could help rebuild key infrastructure*. <https://sheffield.ac.uk/news/recycling-rubble-left-behind-war-could-help-rebuild-key-infrastructure>
- Woods, L. (1997). *Radical reconstruction* (1. edition). Princeton Architectural Press.