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Community Service through Building Defect Inspection: Assessing Building Conditions of Orphanages in Cikarang, Indonesia

Pengabdian Masyarakat melalui Inspeksi Cacat Bangunan: Menilai Kondisi Bangunan Panti Asuhan di Cikarang, Indonesia

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ABSTRACT. This community service project was conducted by civil engineering students and lecturers from President University to assess the physical condition of two orphanages in Cikarang, Indonesia. The project focused on identifying visible building defects that may pose risks to safety, comfort, or health. Using non-invasive methods such as visual inspection, photographic documentation, and staff interviews, the students evaluated structural components, material conditions, and environmental factors at Rumah Harapan Graha Asri and Panti Asuhan Rumah Singgah Anak Berkat. Key findings included peeling paint, moisture-induced wall cracks, mold growth, unstable plywood flooring, and deteriorating wooden staircases. These issues were largely attributed to prolonged exposure to humidity, poor construction practices, and the absence of regular maintenance. The proposed actionable recommendations include waterproofing treatments, structural reinforcement, mold remediation, safety improvements, and the implementation of a simple maintenance plan. This project highlights the importance of building defect assessments in community-based facilities and demonstrates how civil engineering students and lecturers can contribute meaningfully to public welfare. It also served as a practical learning experience, allowing students to apply classroom knowledge in a real-world context. The outcomes reinforce the need to integrate social responsibility and technical training into engineering education.

Keywords: building defect inspection; civil engineering; community service; orphanages

ABSTRAK. *Proyek pengabdian masyarakat ini dilakukan oleh mahasiswa dan dosen teknik sipil dari President University dengan tujuan menilai kondisi fisik dua panti asuhan di Cikarang, Indonesia. Proyek ini berfokus pada identifikasi kerusakan bangunan yang terlihat dan dapat menimbulkan risiko terhadap keselamatan, kenyamanan, atau kesehatan. Dengan menggunakan metode non-invasif seperti inspeksi visual, dokumentasi foto, dan wawancara dengan staf, para mahasiswa mengevaluasi komponen struktural, kondisi material, dan faktor lingkungan di Rumah Harapan Graha Asri dan Panti Asuhan Rumah Singgah Anak Berkat. Temuan utama meliputi cat yang mengelupas, retakan dinding akibat kelembapan, pertumbuhan jamur, lantai kayu lapis yang tidak stabil, dan tangga kayu yang memburuk. Masalah-masalah ini sebagian besar disebabkan oleh paparan kelembapan yang berkepanjangan, praktik konstruksi yang buruk, dan kurangnya perawatan bangunan secara rutin. Terhadap temuan ini diusulkan rekomendasi yang dapat ditindaklanjuti seperti perawatan kedap air, penguatan struktur, remediasi jamur, peningkatan keselamatan, dan penerapan rencana perawatan bangunan sederhana. Proyek ini menyoroti pentingnya penilaian kerusakan bangunan di fasilitas berbasis masyarakat dan menunjukkan bagaimana mahasiswa dan dosen teknik sipil dapat berkontribusi secara bermakna bagi kesejahteraan masyarakat. Proyek ini juga berfungsi sebagai pengalaman belajar praktis, yang memungkinkan mahasiswa untuk menerapkan pengetahuan kelas dalam konteks dunia nyata. Penelitian ini menekankan perlunya mengintegrasikan tanggung jawab sosial dan pelatihan teknis dalam pendidikan teknik sipil.*

Kata kunci: *inspeksi cacat bangunan; panti asuhan; pengabdian masyarakat; teknik sipil*

INTRODUCTION

Community service in higher education plays a vital role in shaping socially responsible graduates, particularly in fields such as engineering, where real-world application is critical. Civil engineering, as a discipline focused on infrastructure, safety, and the built environment, offers many opportunities for students to serve the community meaningfully. One practical and impactful way to do this is through building defect inspection, which involves assessing the physical condition of structures to detect early signs of damage or degradation that may affect usability, safety, or health (Begić & Krstić, 2024).

In many developing regions, including parts of Indonesia, social facilities such as orphanages, community shelters, and learning centers often operate in buildings that were either self-constructed or donated without proper design, supervision, or maintenance (Hayati, 2023). As a result, these structures often exhibit signs of deterioration, including moisture intrusion, mold growth, cracking, and structural instability. These issues, if left untreated, can endanger the well-being of residents, particularly children, and compromise the functionality of the buildings.

Addressing these problems is not only a matter of technical repair, but also of social equity and public health. Vulnerable communities, such as orphanages, rarely have access to professional building inspections or repair assessments. Providing even basic building condition evaluations can help prioritize limited resources, prevent further damage, and guide safe renovation efforts. For civil engineering students, contributing to this effort not only develops their technical and diagnostic skills but also nurtures a sense of civic duty and empathy.

This community service project was initiated by the Civil Engineering Study Program at President University. It aimed to inspect and analyze the physical condition of two orphanage buildings in Cikarang, West Java, namely Panti Asuhan Rumah Harapan Graha Asri and Panti Asuhan Rumah Singgah Anak Berkat. These buildings were selected due to their visible signs of deterioration and lack of maintenance. The problems identified ranged from aging materials, moisture damage, poor ventilation, unstable flooring, to structural cracks and mold infestation, issues that pose risks to both safety and health.

This project is aligned with the civil engineering curriculum, which emphasizes not only theoretical mastery in materials, structures, and construction, but also practical application through community engagement (Salazar & Ponton, 2024). Courses such as Building Materials, Structural Systems, Construction Method, and Construction Management directly relate to the inspection, diagnosis, and recommendation process conducted in this project. However, community-based applications of these concepts are rarely documented in academic literature, especially in the context of semi-permanent or informal buildings in low-resource settings. This creates a gap in both research and practice that this paper seeks to address.

The theoretical foundation of this project draws upon fundamental principles of building condition assessment and defect diagnosis, which involve identifying symptoms (e.g., cracks, discoloration, deformations), linking them to likely causes (e.g., moisture, thermal stress, poor construction), and proposing corrective measures (De Fino et al., 2023; Faqih & Zayed, 2021; Pereira et al., 2021). This approach aligns with the concept of preventive maintenance and early intervention, widely recognized in building management and sustainability studies (Liu & Faizal Ardhiansyah Arifin, 2021; Puķīte & Geipele, 2017). By applying these frameworks in real-world conditions, this community service project bridges academic theory with community needs.

Therefore, the main objective of this paper is to document and analyze the results of the building inspections carried out by civil engineering students at President University, including the identification of key building defects, possible root causes, and feasible repair recommendations. In doing so, the paper aims to demonstrate how building defect inspection can serve as a valuable form of community service and student learning, especially when directed toward underserved social facilities.

METHOD

This community service project involved direct building assessments at two orphanages in Cikarang, West Java: Panti Asuhan Rumah Harapan Graha Asri and Panti Asuhan Rumah Singgah Anak Berkat. These locations were selected based on accessibility, social need, and

visible indications of building degradation. The assessments were carried out on July 19, 2025, and July 20, 2025, respectively, by two separate teams of civil engineering students from President University. Each team was supervised by appointed lecturers.

The inspection method employed in this project relied on visual observation techniques. This approach was chosen due to the non-invasive nature of the inspections, the limited access to advanced diagnostic tools, and the educational background of the participants. The students performed a systematic walk-through survey of both the interior and exterior of each building. Key structural and architectural elements such as walls, floors, ceilings, columns, stairs, and roofing systems were visually examined for signs of damage, deterioration, or safety hazards.

To supplement the visual inspections, the students conducted semi-structured interviews with orphanage staff and caretakers. These conversations provided critical background information on the buildings' ages, repair histories, construction methods, and observed problems. For example, in the case of Rumah Harapan Graha Asri, staff explained that the building had sustained roof damage from a windstorm in 2017 and multiple unsuccessful repair attempts thereafter (Figure 1). At the second location, Panti Asuhan Rumah Singgah Anak Berkat, it was revealed that the building had been constructed gradually without professional contractors, using donated and recycled materials (Figure 2).

Figure 1. Rumah Harapan Graha Asri Orphanage

Figure 2. Rumah Singgah Anak Berkat Orphanage

In both locations, the students documented the observed defects extensively with photographs. These photos served as evidence of various issues, including peeling paint, mold growth, structural cracks, material warping, and incomplete construction work. The photographs were cataloged and referenced in the final report to support visual findings and assist in future repair planning.

No destructive testing, material sampling, or computational analysis was carried out in this project, as the scope was limited to observational diagnosis. The assessments were purely qualitative, focused on identifying visible signs of building distress rather than quantifying structural loads or material strength. This method was appropriate for the project's goal: to provide basic but actionable recommendations for maintenance and repair.

The students also referred to basic engineering principles learned from coursework in building materials, construction techniques, and structural behavior (Illingworth, 2000; Wang & Guan, 2011; Ward-Harvey, 2009; Williams, 2009). These concepts guided the interpretation of field findings, such as linking diagonal cracks at wall-floor intersections to potential differential settlement or associating mold growth with high humidity and poor ventilation.

The methodology combined three core components: on-site visual inspections, informational interviews, and photo-based documentation. This low-cost, non-technical approach was suitable for student-led community service projects. It provided valuable insight into the real-world challenges of maintaining safe and healthy building environments in resource-limited settings.

RESULTS AND DISCUSSION

Observations at Rumah Harapan Graha Asri Orphanage

The building inspection at Rumah Harapan Graha Asri Orphanage revealed several visible signs of long-term deterioration, primarily due to moisture exposure and aging construction materials. One of the most prominent defects was peeling paint on exterior and interior wall surfaces, especially at the columns and corners (Figure 3). This damage suggests prolonged moisture intrusion, likely from roof leaks or water seepage through porous surfaces. In some areas, the paint layer had completely detached, exposing raw concrete or plaster underneath.

Structural cracks were also observed, particularly at the base of several columns (Figure 4). These horizontal cracks may indicate differential settlement, a condition where the foundation shifts unevenly over time, or stress due to thermal expansion and contraction. Diagonal cracks were found at the junction between the wall and floor elements, indicating a shift or difference in deformation between the two planes. The exact cause could not be confirmed without structural testing, but the cracks represent a potential hazard if left unmonitored.


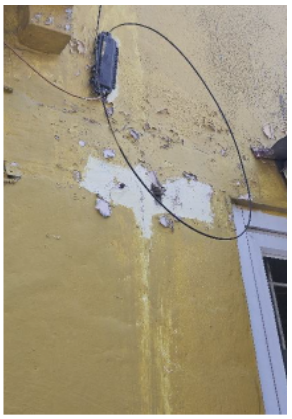

Figure 3. Peeling paints indoor and outdoor

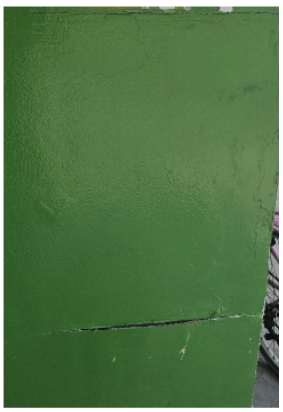


Figure 4. Structural cracks

In addition, the team identified roof-to-wall joint problems, including gaps, discoloration, and signs of previous water leakage (Figure 5). These defects contribute to internal dampness and could worsen during the rainy season. The combination of environmental exposure, inconsistent repairs, and insufficient waterproofing has contributed to a decline in the building's physical condition, warranting immediate preventive action.

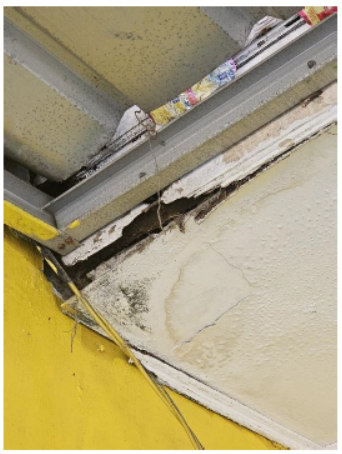


Figure 5. Roof-to-wall joint problems

Observations at Panti Asuhan Rumah Singgah Anak Berkat Orphanage

The inspection at Panti Asuhan Rumah Singgah Anak Berkat revealed even more critical conditions due to the semi-permanent nature of the structure. The second floor was

constructed almost entirely from aged plywood and untreated wood framing, materials that showed signs of warping, delamination, and structural fatigue (Figure 6). The students noted that the plywood flooring was unstable and could collapse under concentrated loads.

The wooden staircase providing access to the second floor also raised safety concerns (Figure 7). It exhibited visible bending, loose connections, and creaking underweight, suggesting it may no longer meet basic load-bearing requirements. In a facility housing children, this represents a serious risk that should be urgently addressed.

Figure 6. Second floor of Rumah Singgah Anak Berkat

Figure 7. Wooden staircase

Another significant issue was the presence of black mold (likely *Stachybotrys chartarum*) on various wall surfaces, particularly in damp areas with poor ventilation (Figure 8). This mold not only damages the building fabric but also poses health risks, including respiratory problems, especially for children with allergies or asthma.

Figure 8. Black molds on walls (Source: Authors' documentation)

Externally, the unfinished masonry walls made of white stone were observed to be unpainted and unsealed (Figure 9). These porous surfaces readily absorb water, accelerating material degradation and potentially allowing further moisture ingress into the interior walls. Collectively, these issues indicate that the building is in a highly vulnerable condition, particularly during the rainy season or in humid weather.

Figure 9. Unfinished walls (Source: Authors' documentation)

Inspection Recommendations

Based on the observations at both sites, there are several practical and context-sensitive recommendations to improve building safety and habitability:

1. Repair and Waterproofing: Damaged surfaces, particularly areas affected by water penetration, should be stripped and refinished with water-resistant coatings. Leaks around roof-wall intersections should be sealed using appropriate flashing or waterproofing membranes.
2. Structural Reinforcement: Weak or unstable elements, such as plywood flooring and wooden stairs, should be replaced with more durable materials like engineered wood, light steel, or reinforced concrete, depending on availability and budget.
3. Mold Remediation: Affected interior walls must be cleaned using mold-killing solutions and repainted with fungal-resistant paint. Improving ventilation is also essential to reduce future mold growth.
4. Safety Improvements: Staircases, ceilings, and floors should be upgraded to meet basic safety standards. This includes securing stair handrails, installing solid flooring, and providing a proper ceiling to reduce heat transfer and dust accumulation.
5. Maintenance Plan: A routine building inspection and minor repair schedule should be established by the orphanage management. This can be supported by training local staff or volunteers in basic maintenance practices to prolong the building's life and avoid costly repairs.

Discussion and Implications

The findings from both orphanage sites clearly illustrate how inadequate construction practices, combined with insufficient maintenance and prolonged environmental exposure, can significantly compromise a building's long-term performance. In both cases, the buildings were constructed using a mix of donated, recycled, or inexpensive materials, such as plywood, untreated wood, plastic crates, and white stone, without professional design oversight or adherence to structural safety standards. While this approach may have helped meet urgent shelter needs in the short term, it introduced long-term vulnerabilities that became increasingly evident through visual inspection.

One of the most serious issues observed was moisture-related damage, including peeling paint, mold growth, and material degradation. These conditions are commonly seen in tropical environments like Indonesia, where high humidity and frequent rainfall can quickly deteriorate exposed or untreated building surfaces (Silveira et al., 2019). Without proper waterproofing, insulation, or ventilation, buildings are left highly susceptible to dampness, which can lead not only to structural deterioration but also to health risks such as respiratory illnesses from black mold exposure (Brambilla & Sangiorgio, 2020). The lack of routine inspection and preventive maintenance further compounded these problems, allowing minor defects to worsen over time.

The project also revealed critical safety hazards, such as unstable plywood flooring and weakened staircases, particularly at the second orphanage (Rumah Singgah Anak Berkat). These conditions pose a direct threat to children, staff, and visitors. Inadequate flooring and

stair supports increase the risk of injury, especially in buildings that experience daily foot traffic. These observations underscore the importance of ensuring that even community-built or volunteer-driven construction projects meet a minimum level of safety and durability. This highlights the importance for community stakeholders to be equipped with basic knowledge on construction safety and building lifecycle management.

From an educational standpoint, this project provided civil engineering students with invaluable exposure to real-world engineering problems that cannot be fully simulated in the classroom. They were required to apply theoretical concepts, such as understanding of load paths, material behavior under moisture, and basic building envelope performance, directly to field observations. Through tasks such as identifying defect patterns, hypothesizing root causes, and proposing repair strategies, students deepened their diagnostic and analytical skills. The project also trained them to communicate technical issues in simple, actionable language suitable for non-engineering stakeholders, an essential skill in professional practice.

In addition to technical competencies, the community service project also strengthened the students' social and ethical awareness. By working closely with underprivileged communities, students witnessed the human impact of engineering decisions. They learned that civil engineering is not only about designing strong and efficient structures, but also about creating safe, healthy, and dignified living environments, particularly for vulnerable groups such as children in the orphanages. This experience fostered empathy, responsibility, and a broader understanding of the role of engineers in society.

Finally, the project addresses a gap in both academic literature and engineering education practice. Most studies and case reports focus on formal buildings and advanced diagnostic methods. At the same time, limited attention is given to informal or low-resource structures, especially those assessed by student-led initiatives. This project shows that even basic visual inspection, when guided by sound engineering principles, can produce meaningful insights and outcomes. It highlights the potential to integrate community-based learning into civil engineering curricula, combining technical training with real-world social impact. The results of this building defect inspection can serve as a reference for stakeholders interested in funding the repair and rehabilitation projects of the two orphanages.

CONCLUSION

This community service project demonstrated the value of conducting basic building defect inspections in socially vulnerable facilities, such as orphanages. Through systematic visual assessment, interviews, and documentation, civil engineering students identified a range of structural and non-structural problems, including moisture damage, unstable flooring, deteriorating materials, and mold growth. These findings reflect common issues faced by informal or low-cost buildings in developing regions, where professional construction standards and routine maintenance are often lacking. The recommendations, ranging from waterproofing and structural reinforcement to mold treatment and safety upgrades, offer practical solutions to extend the lifespan of the buildings and protect the health and safety of their occupants.

Beyond the technical outcomes, this project provided students with a valuable experiential learning opportunity. It allowed them to apply engineering knowledge to real-world challenges while engaging directly with the community. This hands-on experience strengthened their diagnostic, communication, and problem-solving skills; and reinforced the relevance of civil engineering in improving public welfare. It also highlighted the importance of incorporating socially impactful projects into the engineering curriculum, bridging academic knowledge with civic responsibility. Moving forward, similar initiatives can be expanded to other community settings to enhance both educational outcomes and social impact.

On the other hand, this study focuses solely on the technical identification and classification of building defects using forensic engineering methods. Thus, the responses of building managers or occupants to the identified defects were not examined, as the primary objective was to assess the buildings' physical condition and safety risks. Therefore, future studies may integrate forensic findings with stakeholder response analysis to support more comprehensive decision-making analyses.

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