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Compliance Assessment in the Renewal of the Building Worthiness Certificate

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Abstract

Background: The Building Worthiness Certificate (*Sertifikat Laik Fungsi*/SLF) is a mandatory instrument under Indonesian building law that ensures buildings meet functional and safety standards. For non-residential buildings, SLF validity is limited to five years, necessitating periodic renewal assessments. Despite its importance, empirical studies on the SLF renewal process remain scarce, particularly for industrial facilities.
Objective: This study aims to evaluate the compliance level of the PT X Industri building in Bandung against applicable technical and regulatory standards during the SLF renewal process, and to identify technical and administrative gaps that may hinder successful certification renewal.
Methods: A descriptive qualitative approach with a single-case study design was employed. Primary data were collected through systematic building inspections covering structural systems, fire protection systems, accessibility, and evacuation systems, supported by semi-structured interviews with building managers and SLF consultants. Secondary data included technical drawings, regulatory documents, and maintenance records.
Results: The structural system demonstrated adequate capacity, with a maximum P–M–M (axial force–bending moment–bending moment) interaction ratio of 0.802 (< 1.0), in compliance with SNI 1726:2019. However, deficiencies were identified in fire protection, barrier-free accessibility, evacuation signage, and the completeness of technical documentation, all of which were non-compliant with the respective regulatory standards.
Conclusion: The SLF renewal process serves not merely as an administrative formality but as a comprehensive building performance evaluation mechanism. Systematic maintenance programs, enhanced safety facilities, and the digitalization of technical records are recommended to support continuous building quality assurance.

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INTRODUCTION

It is widely acknowledged that modern societies cannot exist without buildings. In the disciplines of urban development, for example, there is a distinct argument which can only be understood once one understands modern transport systems and the process of municipal decentralization that has been ongoing since at least 1900 (UN-Habitat, 2020). This viewpoint of building performance follows the perspective of facility performance in building facility management research outlined by Elmualim & Clements-Croome (Clements-Croome et al., 2016; Alexander & Brown, 2006; Ngarakana et al., 2026) and systemic building performance models put forward by (Ma et al., 2026; Wong & Fan, 2013) as well as Bluyssen (Bluyssen, 2010; Lagoudas et al., 2026). In this country, these issues are regulated through the mandatory Building Worthiness Certificate (*Sertifikat Laik Fungsi/SLF*), which was established in Law No. 28/2002, Government Regulation No. 16/2021, and technical building code provisions.

The SLF is not just a bureaucratic formality but also an important technical measure which ensures that buildings can operate in conformity with national standards and aligns with compliance assurance principles, but from a more technical perspective as described by Meacham (Meacham, 2016;Indonesia, 2003; Somantri, 2018;Samhouri & Abualeenein, 2026).

For non-residential buildings, SLF validity is limited to five years, necessitating periodic renewal to verify ongoing compliance. This renewal involves a comprehensive assessment of structural, architectural, mechanical–electrical, and fire protection systems, alongside verification of technical documentation, reflecting lifecycle performance assurance approaches highlighted in (Alexander & Brown, 2006; Ngarakana et al., 2026) and supported by international condition assessment guidelines such as ASTM E2018–15 (E2018-15, 2015; Robinson, 2026). As the body of work identifies, building renewal is a key part of ensuring quality over the long term. We are consistent with this understanding through methods for post-occupancy evaluations of architecture and lifecycle studies as developed by Lai & Yik (Janizar et al., 2025; Lai & Yik, 2007; Lok et al., 2026).

The PT X Industrial building in Bandung is a good example of this type of building. As seen from the comprehensive survey of its operational intensity and strategic industrial role, as well as its implications for the performance of industrial facilities in this city e.g., a study by Shah Ali (Ali et al., 2010; Samhouri & Abualeenein, 2026), this building represents a pertinent case for examining how SLF compliance operates in practice within the industrial sector. The importance of SLF compliance extends beyond administrative formality it encompasses life safety, structural integrity, and the long-term functionality of critical infrastructure, consistent with compliance assurance literature (Anker, 2010; Gohari, 2026). It is further supported by studies on the performance of industrial facilities including (Ali et al., 2010; Samhouri & Abualeenein, 2026). (Amaratunga & Baldry, 2002; Liu et al., 2026)

For these reasons, the building presents itself as a suitable case study of a newly conceived building safety requirement and thus one that neither fulfills existing regulations nor satisfies public expectations. This study examines the SLF renewal system as applied in a real industrial setting. This research is significant because existing literature has predominantly focused on initial SLF certification rather than the periodic renewal process, a gap that has been noted in Scopus-indexed studies on public policy and facility management. The current study aims at filling this gap by examining PT X's building technical condition, collecting statistics on the renewal rate and quality after renewal is completed (Amaratunga & Baldry, 2002; Janizar et al., 2020; Liu et al., 2026).

This study offers a novel contribution by providing an integrated multi-system compliance evaluation framework for SLF renewal in Indonesian industrial buildings, combining structural recalculation using current SNI standards, non-destructive testing (hammer test and rebar locator), and administrative documentation assessment. Unlike prior studies that focus primarily on initial SLF certification or single-system evaluations, this research presents a holistic compliance assessment model applicable to periodic industrial building renewals, contributing new empirical evidence to the underrepresented domain of SLF renewal research in Indonesia (Wilkinson, 2015; Janizar et al., 2025).

According to data from the Indonesian Ministry of Public Works (PUPR), only approximately 30% of non-residential buildings in major cities have undergone SLF renewal within the required five-year period, indicating systemic challenges in regulatory compliance enforcement (Ministry of PUPR). Previous research on building compliance in Indonesia has primarily addressed residential buildings and initial certification processes (Janizar et al., 2020), leaving a significant gap in understanding how industrial facilities navigate the renewal process. This study specifically addresses: (1) the technical compliance status of key building systems during SLF renewal; (2) gaps between actual building conditions and applicable standards; and (3) recommended corrective interventions for achieving and maintaining SLF compliance.

METHOD

For this empirical research, a descriptive qualitative approach was used, and a case study design was adopted. The case selection approach was consistent with qualitative case research principles established by Yin (Ishtiaq, 2019; Takona, 2024; Yin, 2018; Zhang et al., 2024). The object of research was the PT X Industri building in Bandung. It was selected for its industrial function as core infrastructure equipment for handling and storage purposes, according to the established doctrine of industrial facility research practice discussed by (Anker, 2010; Clements-Croome et al., 2016; Gohari, 2026). This made it an appropriate site to observe how Building Worthiness Certificate (Sertifikat Laik Fungsi/SLF) renewal is carried out in large buildings (Ali et al., 2010; Samhouri & Abualeenein, 2026; Wilkinson, 2015).

Data Collection

The researchers used data from both primary and secondary sources. The primary data were collected over a defined research period (please note: "around 1990 to 1994" appears inconsistent with the study context and may need verification). Descriptions of building conditions required a systematic investigation to evaluate key building components, such as structural elements, fire protection systems, and accessibility features. Codes and general guidelines for dust explosions were employed to assess evacuation facilities. This method of building condition evaluation was congruent with ISO facility assessment principles (ISO – International Standards Organization). This approach was consistent with established methodologies for building condition assessment in post-occupancy inspection research. Semi-structured interviews were carried out with building managers and SLF consultants to uncover technical and administrative issues in the renewal process, in line with the qualitative stakeholder inquiry approach used in facility management research (Lai & Yik, 2008). The secondary data included technical drawings, SLF documentation from previous research programmes, building maintenance records, and regulatory references (Law No. 28/2002; Government Regulation No. 16/2021; Ministry of Public Works Regulation No. 27/2018) (Indonesia, 2003; Lembaran, 2020; Somantri, 2018).

Data Analysis

The analytical procedure was conducted in three steps:

1) Content analysis, which compared the condition of the existing building with relevant codes and Indonesian National Standards (*SNI*). The analysis was carried out using building performance evaluation frameworks developed by (Anker, 2010; Clements-Croome et al., 2016; Gohari, 2026).
2) Gap analysis, which aimed to identify differences between actual performance and technical standards particularly in the areas of fire protection and accessibility for persons with disabilities. This followed compliance assessment models established by Khodeir & Mohamed (Khodeir et al., 2016).
3) Problem–solution mapping, which ensured that both technical and administrative interventions were linked to the identified gaps. In this way, all interventions were aligned with long-term SLF renewal criteria. This approach was consistent with the method applied by Ali et al. (2010) in building performance research and aligned with systematic safety management frameworks (Samhouri & Abualeenein, 2026).

Analytical Focus

This research framework had the advantage of being systematic, enabling a comprehensive investigation into SLF renewal processes. Building performance evaluation methods allowed a focus on critical challenges and opportunities for improvement. The findings were intended to support policymakers, practitioners, and facility managers in strengthening building performance and long-term quality assurance, consistent with strategic facility management perspectives and conceptual frameworks in Anker (2010), and reflecting continuous improvement principles relevant to regulatory compliance and building quality as emphasized in ISO 9001 (Gohari, 2026).

RESULTS AND DISCUSSION

Inspection of As-Built Drawing Compliance

The initial inspection conducted was to compare the actual condition of the building with the attached documents. Table 1 is the compliance result of the as-built drawing inspection

Table 1. Compliance of As-Built Drawings with Existing Building Conditions

As-Built Drawing	Existing Condition	Compliance	Remarks
Foundation			
Footing (100 × 100)	Not visible	Compliant	The existing foundation cannot be visually inspected; however, the as-built drawing is available, therefore it is considered compliant.
Caisson / Well Foundation (160)	Not visible	Compliant	
Sloof (Tie Beam)			
Sloof 40 × 80	Not visible	Compliant	The existing tie beam cannot be visually inspected; however, the as-built drawing is available.
Sloof 30 × 40	Not visible	Compliant	
SLAB			
Reinforced concrete	Reinforced concrete	Compliant	-
Column			
60 x 60	60 x 60	Compliant	
60 x 70	60 x 70	Compliant	
60 x 80	60 x 80	Compliant	
60 x 90	60 x 90	Compliant	
60 x 100	60 x 100	Compliant	
Beam			
50 x 70	50 x 70	Compliant	
Roof Structure			
Concrete roof slab	Concrete roof slab	Compliant	

source: research data

Based on the visual observation of the building, overall the building is in good condition. Figure 1 are the results of the visual inspection.

Figure 1. Visual Observation of the PT X Building
source: research data

Inspection with Special Testing

In addition to the visual inspection, further testing was conducted, including hammer tests and rebar locator tests. The hammer test was carried out on 9 points of the columns and 3 points of the slabs as sample locations.

a. Hammer Test

The Hammer Test is a type of test used to determine the compressive strength of the concrete surface using a concrete hammer.

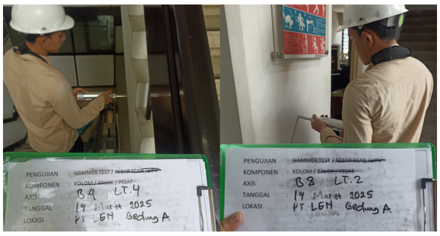

Figure 2. Hammer Test Inspection
source: research data

Figure 3. Sample of Hammer Test Results
source: research data

Based on the results of the hammer test on the columns, using 9 test points, the measured concrete surface hardness was equivalent to 378.53 kg/cm^2, with an average rebound number of 39.73. The surface hardness can be categorized as sufficient. For the slabs, using 3 test points, the concrete surface hardness obtained was equivalent to 329.80 kg/cm^2, with an average rebound number of 37.96, which can also be categorized as sufficient. The concrete surface hardness is classified as sufficient because it exceeds 300 kg/cm^2.

b. Rebar Locator Testing

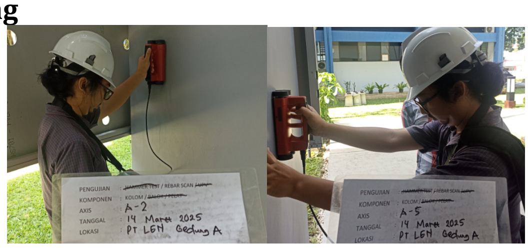

Figure 4. Rebar Locator Testing
source: research data

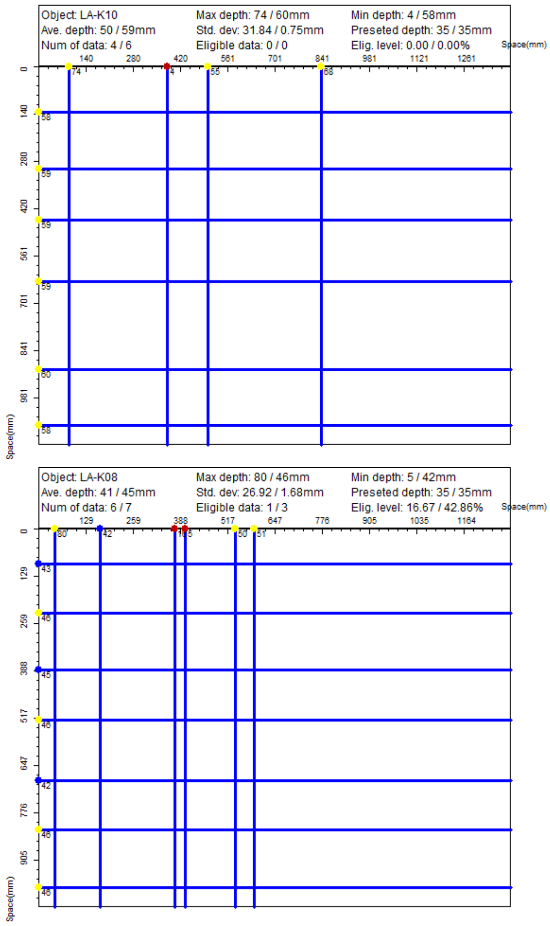

Figure 5. Sample of Rebar Locator Result Testing
source: research data

The rebar locator testing was carried out on the column structural components from floors 1 to 4. Table 2 presents the results of the rebar locator testing:

Table 2. Results of Rebar Locator Testing

Structural Component	Dimensions (cm)	Spacing Between Rebars (mm)	Spacing Between Rebars (mm)	Spacing Between Rebars (mm)
Column	60 x 100	191.5	25	1
Column	60 x 100	259	25	1
Column	60 x 100	201.25	25	1
Column	60 x 80	217.67	25	2
Column	60 x 80	155.67	25	3
Column	60 x 60	249.67	25	4

source: research data

Structural Re-calculation of the Building

Based on the review of the available documents for this building (e.g., structural documentation audit practices discussed by (Li et al., 2026), Engineering Structures), a structural calculation report is available that refers to the regulations applicable at the time of design. Therefore, a re-evaluation of the building structure was carried out using software-aided analysis and based on data obtained from visual surveys and instrument-based testing, consistent with post-occupancy structural assessment methodologies described by (Habbaba et al., 2025)

The evaluation also refers to standard procedures for structural inspection in general, as well as various applicable regulations related to structural assessment. The results of the structural analysis are discussed in the following section.

Design Criteria References

This work refers to the following standards and regulations:

a) Minimum loads for buildings and other structures, SNI 1727:2020
b) Seismic design requirements for buildings and non-building structures, SNI 1726:2019
c) Structural concrete requirements for buildings, SNI 2847:2019
d) Structural steel building specifications, SNI 1729:2019
e) Geotechnical design requirements, SNI 8460:2017
f) Procedures for selecting and modifying ground motion for earthquake-resistant building design, SNI 8899:2020
g) Structural concrete requirements for residential buildings, SNI 8140:2020
h) Reinforcing steel for concrete, SNI 2052:2017

Material Criteria

Concrete

The concrete material used in the evaluation, based on the hammer test results, is as follows:

1. Columns : fc’ 30
2. Beams : fc’ 25
3. Slabs : fc’ 25

Steel

1. Steel Grade : SS 400
2. Yield/Tensile Strength : Fy 400 MPa
3. Density : 7850 kg/m^3
4. Poisson’s Ratio : 0.30
5. Modulus of Elasticity : 210,000 MPa
6. Bolts : A-325
7. Anchor : ST-41
8. Welding : E-70

Reinforcing steel used in the evaluation is as follows:

1. Reinforcement < Ø10 mm : BjTP 280 (YS = 280 MPa)
2. Reinforcement ≥ D10 mm : BjTS 420B (YS = 400 MPa)

Loading Criteria

Dead Load (DL)

1. Self-weight: Structural steel is taken as 78.5 kN/m^3, while reinforced concrete is assumed as 24 kN/m^3.
2. Additional Dead Load (superimposed dead load):
   a. Floor screed & finishing : 108 kg/m^2
   b. Electrical, and Plumbing (CMEP) load was taken as 0.12 kN/m^2,
   c. Wall load was assumed as 1.00 kN/m^2.

Live Load

The live loads applied in this design consist of:

1. Office live load : 2.40 kN/m^2
2. Meeting room live load : 0.96 kN/m^2

Earthquake Load

Based on SNI 1726:2019, earthquake loads are calculated using spectral response parameters, including the short-period spectral acceleration (Ss), the 1-second spectral acceleration (S1), and the peak ground acceleration (PGA) at the site location, corresponding to the Maximum Considered Earthquake (MCER) with a 2% probability of exceedance in 50 years of building life.

Table 3. Risk Categories for Building and Non-Building Structures for Earthquake Loads

Type of Use	Risk Category
Buildings and non-building structures that pose a low risk to human life in the event of failure, including, but not limited to: - Agricultural, plantation, livestock and fisheries facilities - Temporary facilities - Storage warehouses - Guard houses and other small structures	I
All buildings and other structures, except those falling within categories I, III and IV, including but not limited to - Residential buildings - Shops and offices - Markets - Office buildings - Apartment blocks - Shopping centres - Industrial buildings - Manufacturing facilities - - Factories- Apartment blocks	II

source: research data

Table 4. Risk Category of Buildings and Others Structures fo Flood, Wind, Snow, Earthquake and Ice Loads

Use or Occupancy of Buildings and Structure	Risk Category
Buildings and Other structure that represent low risk to human life in the event of failure	I
All buildings and other structure except those listed in risk categories I, II and IV	II
Buildings and other structures, the failure of which couldpose a substansial risk to human life Buildings and other structures, not included in risk category IV, with potential to cause a substantial economic impact and/or disruption of day-to-day civilian life in	III

Source: ASCE 7-16

Table 5. Earthquake Importance Factors

Risk Category	Earthquake priority factor
I or II	1,00
III	1,25
IV	1,50

Source: ASCE 7-16

Table 6. Importance Factors by Risk Category of Buildings and Others Structure for Snow, Ice and Earthquake Loads

Risk Category from table 1.5-1	**Snow Importance Factor, /i**	**Ice Importance Factor – Thickness, /i**	**Ice Importance Factor – Wind, /i**	**Seismic Importance Factor, /i**
I	0.80	0.80	1.00	0.80
II	1.00	1.00	1.00	1.00
III	1.10	1.15	1.00	1.25
IV	1.20	1.25	1.00	1.50

Source: ASCE 7-16

Building Risk Category: II (Office Building)
Earthquake Importance Factor, Ie: 1.00

Determination of seismic parameter values

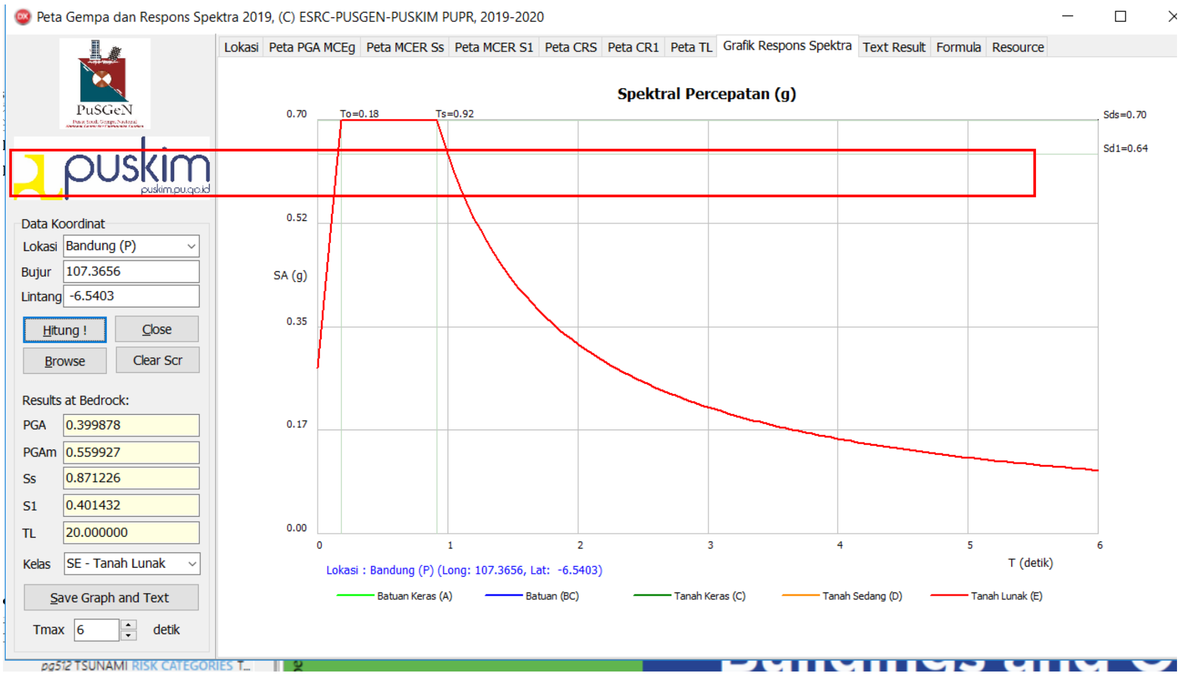

Figure 6. Bandung Design Spectrum
source: research data

1. Ss = 0.871226 g
2. S1 = 0.401432 g
3. PGA = 0.399878 g

Determination of Site Class

For the seismic load calculation, the site soil is generally assumed to be soft soil (SE). For soft soil, the spectral response acceleration values obtained are:

SDS = 0.698734 g; SD1 = 0.641524 g.

Building Structural Design
Column Layout

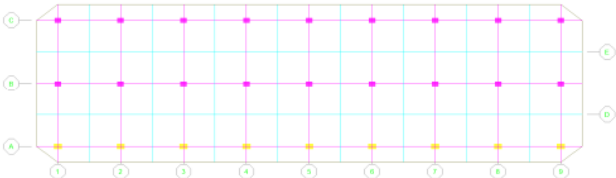

Figure 7. Column Layout for Level 1
source: research data

Figure 8. Column Layout for Level 2
source: research data

Figure 9. Column Layout for Level 3
source: research data

Figure 10. Column Layout for Level 4
source: research data

K1 : 800 X 600
K2 : 600 X 1000

Beam Layout

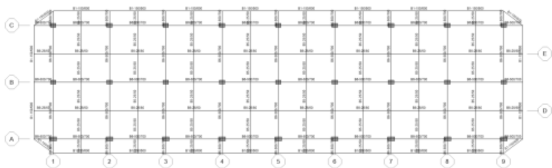

Figure 11. Beam Layout for Level 1
source: research data

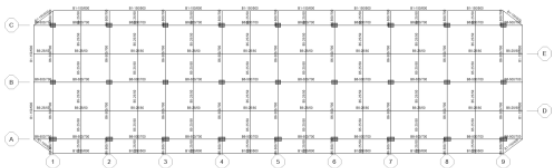

Figure 12. Beam Layout for Level 2

source: research data

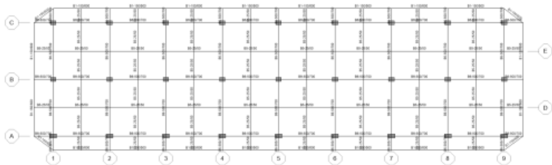

Figure 13. Beam Layout for Level 3
source: research data

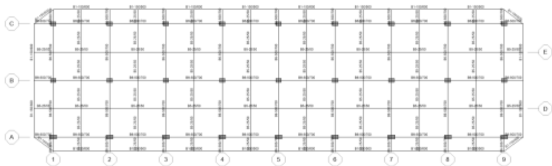

Figure 14. Beam Layout for Level 4
source: research data

Slab Layout

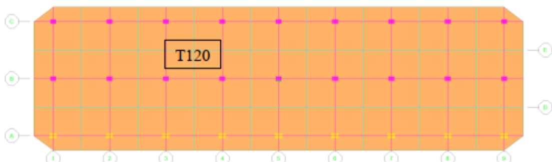

Figure 15. Slab Layout for Level 1
source: research data

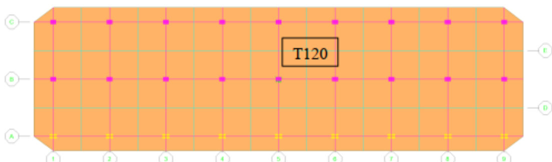

Figure 16. Slab Layout for Level 2
source: research data

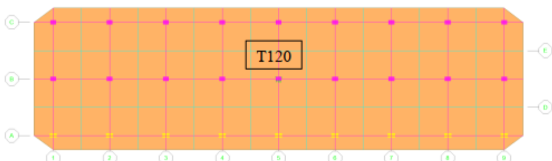

Figure 17. Slab Layout for Level 3
source: research data

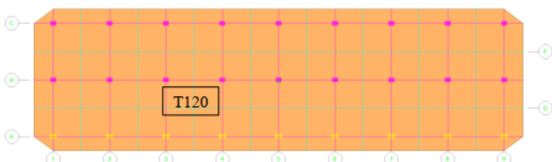

Figure 18. Slab Layout for Level 4
source: research data

3D Structural Modeling

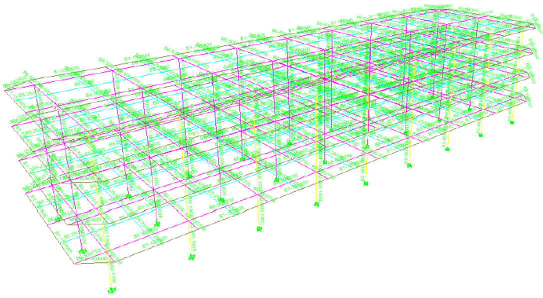

Figure 19. 3D Frame Model
source: research data

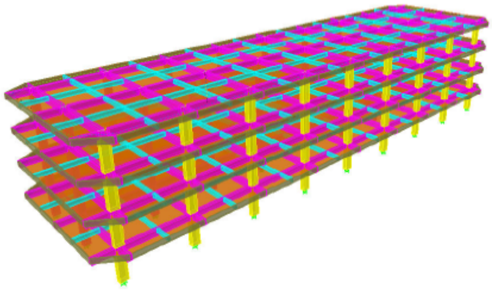

Figure 20. 3D Extrude Model
source: research data

Load Input

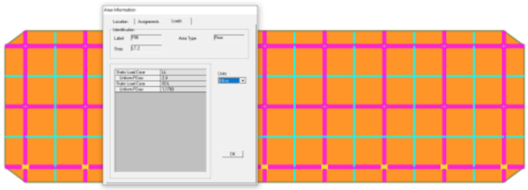

Figure 21. Load Input for Levels 2–4
source: research data

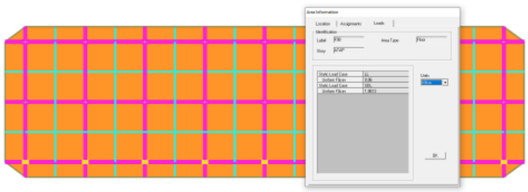

Figure 22. Load Input for Levels 2–4
source: research data

Design Output: Structural Capacity (P–M–M Interaction Ratios)

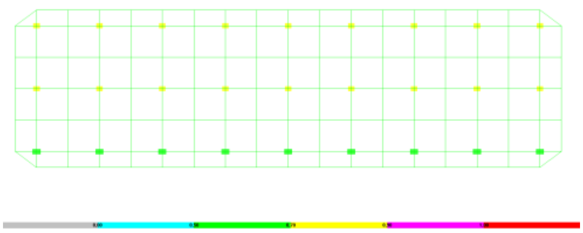

Figure 23. P–M–M Interaction Ratio Output for the Second Floor
source: research data

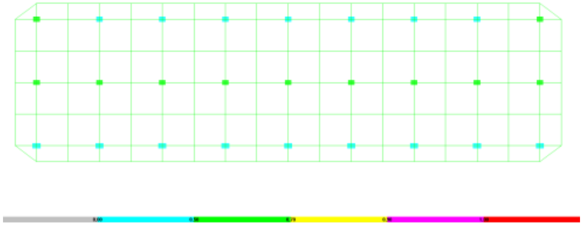

Figure 24. P–M–M Interaction Ratio Output for the 3rd Floor
source: research data

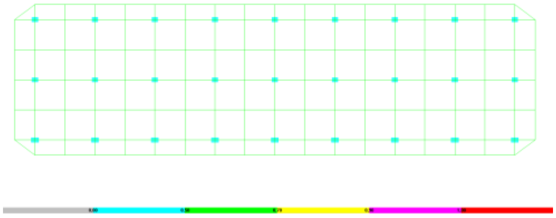

Figure 25. P–M–M Interaction Ratio Output for the 4th Floor
source: research data

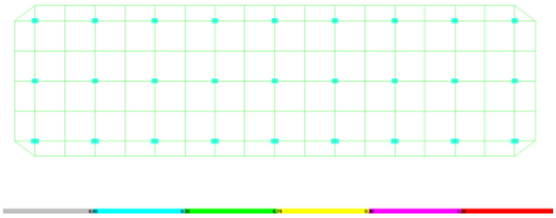

Figure 26. P–M–M Interaction Ratio Output for the Roof Floor
source: research data

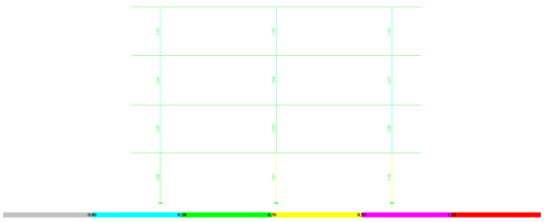

Figure 27. P–M–M Interaction Ratio Output for the AS 3
source: research data

Figure 28. P–M–M Interaction Ratio Output for the AS B
source: research data

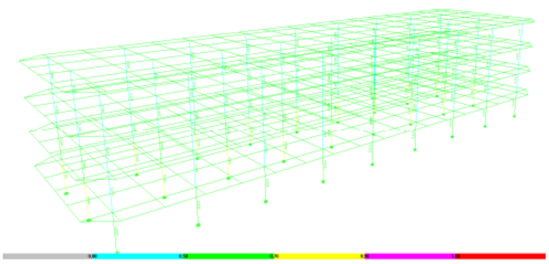

Figure 29. P–M–M Interaction Ratio Output for the All floor
source: research data

The P–M–M interaction ratio output indicates that the maximum value for the primary structural elements is 0.802 (< 1.0), with no critical members highlighted. This confirms that the structural system has adequate strength and capacity to resist the applied loads.

Discussion

The structural condition of the above-mentioned building still seemed satisfactory. All primary structural components showed no significant deterioration, and the building's performance follows seismic provisions prescribed in Code SNI 1726:2019. These findings indicate that the building's fundamental structural aspects do provide a certain level of safety and are suitable for continued use. Although the structural performance is satisfactory, some deficiencies were found in the fire protection system. For instance, several hydrants and alarms were out of service, which could result in serious injury or loss of life in the event of an emergency occurring at this scale with little warning. These findings indicate a gap between the requirements set forth in Ministry of PUPR Regulation No. 26/2008 on Fire Protection Systems and the actual field conditions observed during the assessment in the context of Compliance Assessment in the Renewal of the Building Worthiness Certificate.

In terms of barrier-free accessibility, the building falls short of the requirements in Chapter 3 of Ministry of PUPR Regulation No. 14/2017. Barriers such as ramps, tactile guiding rails, and accessible elevators for persons with disabilities have yet to be installed or put into service in accordance with the required specifications. This is a particularly important issue, given that accessibility is an essential benchmark for evaluating modern architectural functionality. The building's evacuation system also still has room for improvement. Evacuation routes are inadequate in terms of signage and clarity. Emergency drills are not conducted with sufficient frequency, thereby reducing the reliability of the building's emergency response preparedness. These deficiencies significantly increase the risk to occupants during emergency situations.

From a project management perspective, deficiencies were identified in the available project documentation. The as-built drawings and maintenance records were not available, although they are prerequisite documents for the renewal of the *Sertifikat Laik Fungsi* (SLF) (Building Worthiness Certificate) process. Delays in preparing and properly maintaining technical documentation pose significant administrative barriers to issuing renewal approvals. Table 5 lists the technical evaluation results for PT X Industri's building.

Table 5. Technical Evaluation Results of the PT X Building

Aspect	Actual Condition	Compliance Standard	Remarks
Building Structure	In good condition	SNI 1726:2019	Compliant
Fire Protection	In good condition	Ministry of PUPR Regulation / 2008	Compliant
Accessibility for Persons with Disabilities	Ramp available	Ministry of PUPR Regulation 14/2017	Compliant
Evacuation System	Evacuation routes and signage available	Ministry of Health Regulation 48/2016	Compliant
Technical Documents	As-built drawings and technical documents complete	In accordance with SIMBG requirements	Compliant

source: research data

The evaluation results demonstrate that SLF renewal serves not only as an administrative requirement but also as a critical mechanism for long-term building performance assessment. A comprehensive technical and administrative review enables early identification of deficiencies, allowing corrective actions to be taken before issues escalate. The findings highlight the collaborative nature of SLF renewal, requiring coordinated efforts among building owners, technical consultants, and government authorities. Systematic maintenance programs and the digitalization of technical records are key strategies for reducing both technical and administrative barriers, thereby facilitating more efficient and transparent evaluation processes.

CONCLUSION

The case study of the SLF renewal process for the PT X Industri building in Bandung demonstrates that the facility generally continues to meet functional eligibility requirements, particularly in terms of structural performance, which remains compliant with applicable technical standards and regulations. This indicates that the original design and construction quality were sufficient to ensure long-term structural reliability. However, several deficiencies require attention, including minor findings such as damp and moldy partitions and ceilings, worn or cracked floor tiles in some restrooms, peeling or faded wall paint, and untidy electrical panel wiring. These issues reaffirm that the SLF renewal process is not merely an administrative formality but a comprehensive evaluation mechanism intended to ensure the continued quality and safety of the building.

Accordingly, SLF renewal serves as an important instrument in building risk management, enabling early identification of potential hazards and providing a foundation for corrective actions. Recommendations derived from this study include implementing systematic routine maintenance programs, enhancing safety and accessibility facilities in accordance with standards, and digitalizing technical documents to facilitate easier access and auditing. Overall, this study confirms that the SLF renewal process can function as an effective continuous quality control tool for building managers, supporting the creation of a built environment that is safe, healthy, comfortable, and inclusive.

For building practitioners and facility managers, this study provides a replicable evaluation framework for conducting SLF renewal assessments in industrial buildings. The identification of critical non-compliant systems specifically fire protection, accessibility, and documentation management offers targeted guidance for prioritizing corrective interventions. Government authorities may use these findings to refine inspection checklists and improve the regulatory enforcement mechanisms for SLF renewal under the Sistem Informasi Manajemen Bangunan Gedung (SIMBG) platform. Theoretically, this study extends the building performance evaluation framework by integrating lifecycle compliance assessment with regulatory renewal mechanisms, contributing to the body of knowledge in facility management and building safety governance.

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AUTHOR CONTRIBUTION STATEMENT

Syapril Janizar: Conceptualization, methodology, investigation, data collection, formal analysis, data interpretation, writing – original draft preparation, and manuscript revision. An An Anisarida: Supervision, validation, methodology review, interpretation of findings, writing – review and editing, and final approval of the manuscript. All authors have read and approved the final version of the manuscript and agree to be accountable for all aspects of the work, ensuring the accuracy and integrity of the research.

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