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Assessment of Site Development Compliance with GBC Indonesia Greenship Criteria in a Technology Office Complex

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Abstract. The increasing demand for land in urban development highlights the urgent need for sustainable construction practices. While green building concepts have gained global traction, the application of appropriate site development remains understudied in the Indonesian context. This study evaluates the implementation of the Appropriate Site Development (ASD) category based on the Greenship New Building v1.2 rating tool developed by the Green Building Council Indonesia (GBCI), using the Techno Building at the BRI IT Center in Jakarta as a case study. A descriptive-evaluative method was applied to assess compliance across seven criteria within the ASD category. Initial findings revealed a score of 12 out of 17 possible points, with deficiencies identified in public transportation (1/2 points), bicycle facilities (0/2), and microclimate (1/3). After proposing improvements, such as shuttle services, bicycle parking, and the use of high-albedo materials, the building achieved full compliance with 17/17 points. These results indicate that although external constraints exist (e.g., regulatory and geographic limitations), internal strategies can substantially improve green building certification outcomes. The study highlights the critical role of early site planning and internal design adjustments in achieving sustainability benchmarks.

Keywords: Green Building Council, Greenship Assessment, Sustainable Site Development, Environmental Rating Tools

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1. Introduction

In the recent decades, our planet Earth has experienced climate change and environmental degradation, which have been mostly brought about by human actions, one of which is the construction of tall buildings. Temperature rise has been discovered to have a severe impact on most aspects, such as serious risks to human health and food security [1]. All 195 nations have signed the Paris Agreement, committing efforts to limit the rise in global temperature at a level not more than 2°C, with an unyielding determination to remain below 1.5°C above pre-industrial levels [2]. Buildings account for 40% of global energy [3], consume 15% of global water [4], contribute 30% of world waste [5], and cause 39% of carbon emissions [6].

In Indonesia, the building sector is the largest emitter of greenhouse gas (GHG) emissions among the energy-related sectors with 33% average for the years 2011-2021, as presented in the figure above. Up to 90% of GHG emissions from buildings are due to electricity consumption [1]. Reducing GHG emissions from buildings can be achieved by implementing green buildings. Energy-saving potential for existing and new buildings ranges from 31% to 54% on average [1].

The environmental impacts caused due to the existence of buildings are prime concerns, particularly through green building design. Green building is a new design philosophy centered on efficient use of resources and minimization of emissions from wastes during the entire lifecycle [7]. Green buildings are designed with emphasis on energy efficiency, waste reduction, low operating costs, and creation of a healthy environment for occupants to carry out various activities [8]. Green buildings must be designed with regard to environmental, health, and comfort factors for their occupants [9]. Selection of a building location, for instance, may have long-term impacts on the performance of a building. These implications are a measure of how closely the energy use in the building matches site conditions, as well as to what extent air movement and user behavior respond to the site's physical conditions [10].

Green building rating systems are crucial in meeting the goals of sustainability and measuring efficiency using standards crafted and quantifiable targets [10]. In this current study, the system involved is the Greenship New Building, which is developed by the Green Building Council Indonesia, and it offers green building products for new and old projects. This system employs a point-based rating system to various categories of sustainability for the determination of the degree of adoption of green building. The procedure begins with site selection, which has a significant influence on other categories of sustainability, including energy, water, indoor air quality, and green resource and material selection [10] [11].

However, existing literature reveals that the implementation of green building frameworks such as LEED and Greenship often faces context-specific challenges. For instance, LEED-based assessments in dense urban settings in India show discrepancies between planning and execution due to infrastructure limitations and policy gaps [12]. Similarly, a study on Greenship application in Malaysian office buildings found that site constraints and stakeholder awareness significantly influenced the certification outcome [13]. These benchmark studies highlight that location-specific adaptation is crucial for the effective application of green rating systems.

Despite the growing importance of sustainable site planning, limited research has focused specifically on the Appropriate Site Development (ASD) category within the Greenship New Building v1.2 framework in the Indonesian context. While general studies on green buildings are increasing, a gap remains in evaluating how ASD criteria are met in large-scale projects in urban centers, such as Jakarta. This study aims to address that gap by evaluating the ASD category implementation at the Techno Building, BRI IT Center, Jakarta.

Furthermore, while numerous studies have explored sustainability assessment tools like LEED in North America and BREEAM in Europe, there remains a significant gap in context-specific evaluations from rapidly urbanizing regions such as Southeast Asia. This paper contributes to the global discourse on sustainable construction by offering an empirical case from Indonesia, where spatial, regulatory, and climatic constraints present unique challenges to green certification. By highlighting locally adaptable solutions under the Greenship framework, the study not only fills a national research gap but also offers transferable insights for countries facing similar development pressures.

The research problem addressed in this paper is the limited understanding of internal and external constraints that affect compliance with the ASD criteria in Indonesia, and how strategic interventions can overcome these barriers to achieve full compliance.

Optimization of sustainability potential through the choosing of a site and planning allows all location variables to be integrated into the pre-design phase.". The other options for sustainability extend through design and development and on into more complex aspects such as structure, services, and landscape. This integration of site construction is intended to limit the demand for natural resources and enhance human comfort and social interaction [11]. In the context of site selection, the Green Building Council Indonesia identifies the theme of correct land use. Appropriate land use is one of the most crucial aspects of the green building assessment system designed to promote intelligent development and curb urban sprawl [10].

Having established the imperative of ecological sustainability and the current ecological condition, the necessity for the incorporation of sustainability in building construction, particularly for high-rise buildings, is evident. The incorporation begins from the choosing of the location, which is the basis of the author to research green building application, more precisely the appropriate category of land use, using a case study in BRI IT Center Jakarta project.

2. Method

This research applied a descriptive-evaluative method for the measurement of implementing the Appropriate Site Development (ASD) category within the Greenship New Building (NB) version 1.2, which was developed by the Green Building Council Indonesia (GBCI) [10]. The Techno Building project at the BRI IT Center Jakarta was used as the case study for this evaluation, as it was a representative sample of urban-scale commercial development in Indonesia. One of the six major Greenship categories, Appropriate Site Development, was used as the area of focus for this evaluation, which has a total of one prerequisite and seven credit-based requirements. These sub-criteria are: (1) provision of open spaces (ASD P), (2) site selection (ASD 1), (3) public transport and accessibility (ASD 2–3), (4) pedestrian and cycling facilities (ASD 4), (5) landscaping (ASD 5), (6) enhancing the microclimate (ASD 6), and (7) management of stormwater (ASD 7) [11].

In addition to the document-based evaluation, this study adopted a multi-source data collection approach that included site observation, technical drawing analysis (including site plans and floor area ratio data), and stakeholder interviews. Site measurements were performed to validate criteria related to microclimate (e.g., material albedo via spot measurement), bicycle parking allocation, and pedestrian accessibility. Supplementary energy modeling and land use simulations were conducted using ECOTECT and SketchUp to estimate shading, reflection potential, and temperature impact of construction materials.

To enhance result reliability, performance indicators from LEED (Leadership in Energy and Environmental Design) and BREEAM (Building Research Establishment Environmental Assessment Method) were reviewed, particularly in categories equivalent to site selection and land use efficiency. A cross-framework matrix was created to normalize Greenship scores relative to comparable international standards. This provided a contextual benchmark to highlight strengths and limitations of the current Greenship ASD framework.

Scoring validation was conducted via expert consultation with two certified Greenship New Building professionals and cross-checked against two precedent projects with published certifications in Jakarta. Discrepancies were addressed through scenario simulations and sensitivity analysis, particularly for the cases where partial compliance was feasible under certain spatial or regulatory assumptions. This step served as an external audit mechanism to increase credibility of the scoring results.

The scoring assessment followed a structured and replicable process. First, the ASD criteria were mapped into a standardized checklist aligned with Greenship New Building v1.2. Each criterion was assigned a binary or scaled scoring rubric based on fulfillment level, as specified in the Greenship technical manual. Field data—such as area coverage, shading ratios, material albedo values, and transit distances—were measured using GIS and CAD tools. These were cross-referenced with benchmark thresholds from the Greenship documentation to determine point allocation.

For criteria involving microclimatic performance (ASD 6), thermal simulation was conducted using ECOTECT 2011, calculating temperature variation on surfaces with different albedo ratings. Simulation outputs were validated with material properties retrieved from Sika Indonesia datasheets. In terms of potential optimization, alternative scenarios (e.g., increased vegetated area or shading ratio) were modeled to estimate point increases and cost-efficiency trade-offs, thus forming a basic cost–benefit comparison.

The procedure was designed to ensure replicability for similar building types within dense urban contexts. Researchers or practitioners can apply the same sequence of assessment: field measurement → rubric scoring → simulation (if applicable) → comparative benchmarking → score normalization

The main information was obtained from project architectural, landscape, and engineering reports, including floor plans, transport maps, and environmental design details. All the ASD criteria were assessed against Greenship benchmarks compliance. Proportional points were awarded based on the level of satisfaction per sub-criterion. For the unsatisfied criteria, a detailed constraint analysis was carried out. Constraints were either internal such as technical expertise, spatial constraints, and fiscal constraints or external, such as regulatory loopholes, lack of sufficient public infrastructure, or climatic/environmental constraints [14], [21], [22].

Improvement strategies were developed through scenario simulation and benchmarking with similar certified projects. These comprised introduction of a shuttle system to substitute for inadequate public transport, bike parking and shower facilities to meet active transportation requirements, and the use of reflective materials (e.g., Sikalastic 590) to meet the albedo requirement for microclimatic improvement [24]. The effectiveness of each intervention was ascertained by comparing hypothetical point gains with cost, spatial practicability, and implementation complexity. The last test provided the basic and upgraded ASD score, thus demonstrating the capability of every projected alteration in achieving maximum certificate potential.

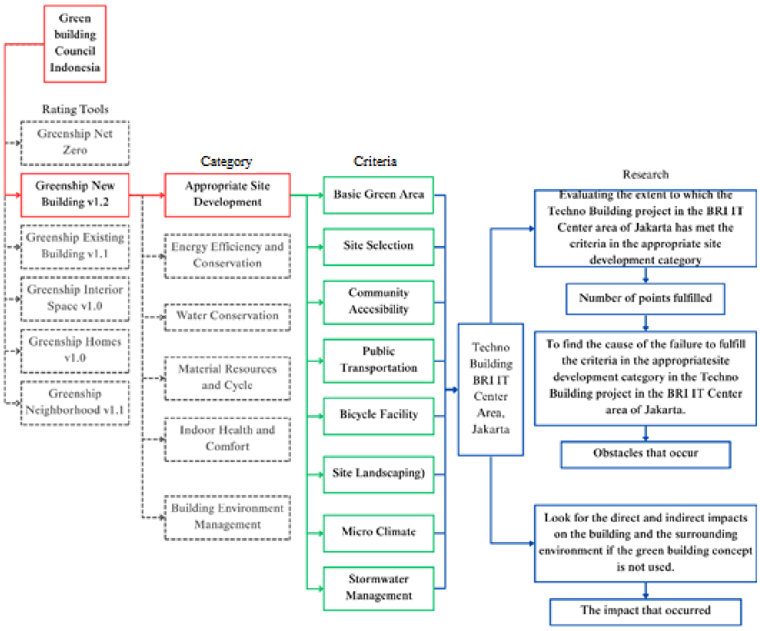

Figure 1. Research Flow Diagram

3. Analysis and Discussion

The study analysis is intended to evaluate the implementation of the Appropriate Land Use category based on the Greenship New Building version 1.2 standard by the Green Building Council Indonesia (GBCI). The evaluation was conducted on the Techno Building of the BRI IT Center Jakarta project by utilizing qualitative and quantitative analyses, including document analysis, cost simulation, and interpretation of green building performance indicators. The objective of this analysis is to identify which of the criteria have been met and which have not, examine the grounds for non-compliance, and provide strategic recommendations to optimize the building's compliance with sustainable standards.

3. 1 Evaluation of Appropriate Site Development Category

The "Appropriate Land Use" category in Greenship New Building v1.2 is primarily focused on sustaining the ecological balance of the project area by preserving green areas, managing the microclimate, reducing the load on drainage networks, and enhancing public access and environmentally friendly transport.

Table 1. Appropriate Site Development Criteria – Before Green Building Implementation

Category	**Criteria**		**Points**	
	Code	**Descriptions**	**Max**	**Fulfill**
Appropriate Site Development	ASD P	Basic Green Area	P	P
	ASD 1	Site Selection	2	2
	ASD 2	Community Accessibility	2	2
	ASD 3	Public Transportation	2	1
	ASD 4	Bicycle Facility	2	0
	ASD 5	Site Landscaping	3	3
	ASD 6	Micro Climate	3	1
	ASD 7	Stromwater Management	3	3
Total points in the appropriate site development category fulfilled			17	12

The Techno Building of the BRI IT Center Jakarta project sufficiently fulfilled most of the requirements in this category. The assessment was carried out against a single prerequisite and seven credit requirements. As such, the building scored 12 out of a possible 17 points.

3.2 Constraint Interconnections

In the application of green building concepts, particularly under the category of Appropriate Land Use, there exists a necessary correlation between external and internal factors that affect its applicability. Such factors emanate from various factors, including governmental policies, ignorance, and financial constraints. Internally, the major hindrances are low levels of commitment, budget limits, and a lack of sufficient green building skills [14] [15].

Externally, there is the role of government policies and the issuance of financial incentives in boosting the adoption of green building. For instance, tax cuts and other incentives can stimulate both the public and private sectors to invest greater resources in eco-friendly construction [16]. Nevertheless, these incentives tend not to have proper policy support for the sake of actualizing green building certification. This scarcity is one of the factors underlying low developers' interest in a transition from conventional construction practices to green buildings [17] [18].

Furthermore, factors external to the building team such as material availability and technological progress are also highly powerful and beyond immediate control. Although green materials for building can save energy and lower operating costs, their acquirement cost is high and technological progress is often required, thereby discouraging their utilization [19] [20].

Research evidence indicates that the development of new technologies and smart building materials is most critical in solving ever-growing environmental imperatives, such as climate change and global warming at a rapid rate [21]. With reference to the interconnection among these internal and external imperatives, the composite growth of capacity and knowledge in the field of construction is of vital importance in overcoming the hurdles in the implementation of green buildings [22] [23].

3.2.1. Public Transportaion – Constraint Interconnections

To deepen the assessment beyond score fulfillment, a technical and comparative evaluation was carried out for each underperforming sub-criterion: public transport, bicycle facility, and microclimate. This includes root cause analysis, reference to comparable certified buildings, and assessment of technical solutions.

- Public Transport (ASD 3): The Techno Building scored 1/2 in this category, primarily due to its location being relatively distant from major public transit hubs. In contrast, the Menara BCA building in Central Jakarta, which scored full points in this category under Greenship NB v1.2, is directly integrated with the TransJakarta corridor and MRT station. The key difference lies in site accessibility planning during the pre-design phase. To compensate, a dedicated shuttle system serving nearby transport hubs was proposed, which aligns with LEED's alternative transport credits.
- Bicycle Facility (ASD 4): Scoring 0/2, this deficit was largely due to the lack of bicycle parking and shower facilities. Unlike Green Office Park BSD (certified Greenship Gold), which provides end-of-trip facilities, Techno Building's initial design lacked spatial allocation. Through comparative design modeling, it was shown that a 1.5% reallocation of total GFA (gross floor area) would suffice to meet the minimum 5% active commuter support ratio, mirroring LEED ND and BREEAM urban transport credits.
- Microclimate (ASD 6):
  The partial score (1/3) stemmed from the limited use of high-albedo materials. Environmental modeling using ECOTECT simulated a 3.4°C reduction in average rooftop temperature when Sikalastic 590 was applied. Comparative evaluation with the Sinar Mas Land Tower (which applied solar-reflective coatings and achieved full ASD 6 points) confirmed that material selection and roof garden planning play a significant role in mitigating urban heat island effects.

3.2.2 Public Transportaion – Constraint Interconnections

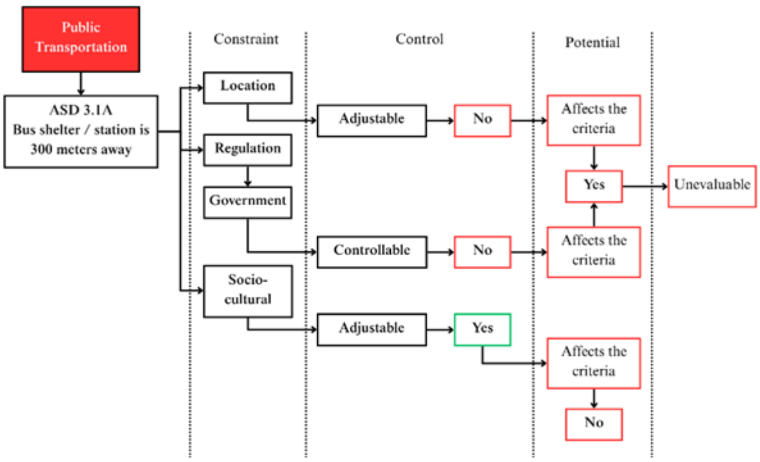

Figure 2. Constraint Interconnections Diagram ASD 3.1A Techno Building

ASD 3.1A was not evaluatable due to location, regulation, and government problems that are irreversible and uncontrollable. They directly affect the fulfillment of this criterion. Although socio-cultural aspects and behavioral habits could be altered, they do not significantly affect the fulfillment of the ASD 3.1A criterion of the Techno Building.

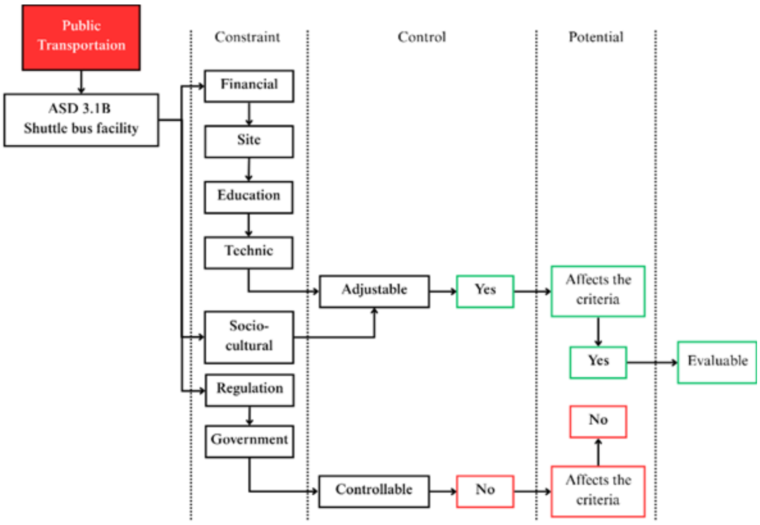

Figure 3. Constraint Interconnections Diagram ASD 3.1B Techno Building

ASD 3.1B, on the other hand, can be open for appraisal since the issues of financial capability, land availability, education, and technicality are subject to variation. The four factors mentioned earlier make a substantial contribution towards meeting the ASD 3.1B requirement in the Techno Building. Even though inherent and unmanageable issues such as socio-cultural traditions, regulation, and government dominate, they make little contribution to the achievement of this requirement.

3.2.3 Bicycle Facility – Constraint Interconnections

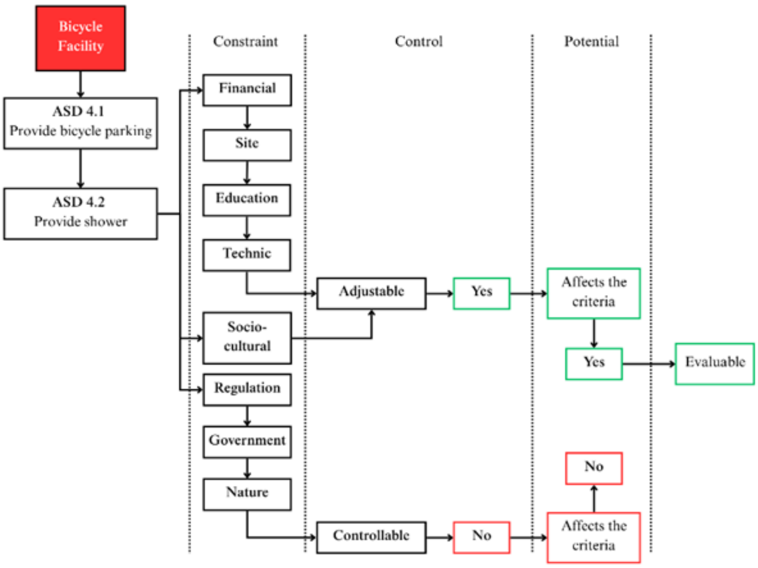

Figure 4. Constraint Interconnections ASD 4.1-2 Techno Building

ASD 4.1–2 consists of criteria that are interconnected. The criteria are assessable, since internal problems involving financial resources, land, education, technical capabilities, and socio-cultural practices can all be changed. All five factors together are instrumental in the fulfillment of the ASD 4 criterion for bicycle user facilities in the Techno Building. There are external problems involving regulation, government, and natural conditions, but they do not adversely affect the fulfillment of this criterion as much.

3.2.4 Micro Climate – Constraint Interconnections

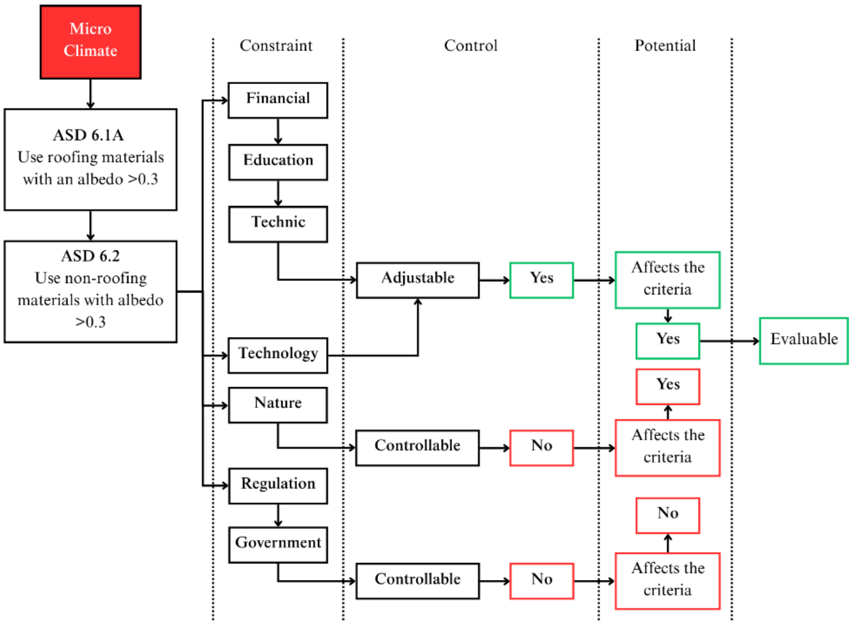

Figure 5. Constraint Interconnections Diagram ASD 6.1A-2 Techno Building

ASD 6.1A will be applied to refer to roofing materials, while ASD 6.1B will be applied to refer to non-roof materials, both of which must have an albedo value not lower than 0.3. Such criteria are eligible to be evaluated because internal problems regarding financial resources, education, and technicalities, in addition to the external problem of technology, are subject to modification. Those issues contribute toward meeting the criteria within the Techno Building. Although there are factors that cannot be controlled such as regulation, government, and nature, these do not play a major role in satisfying these requirements.

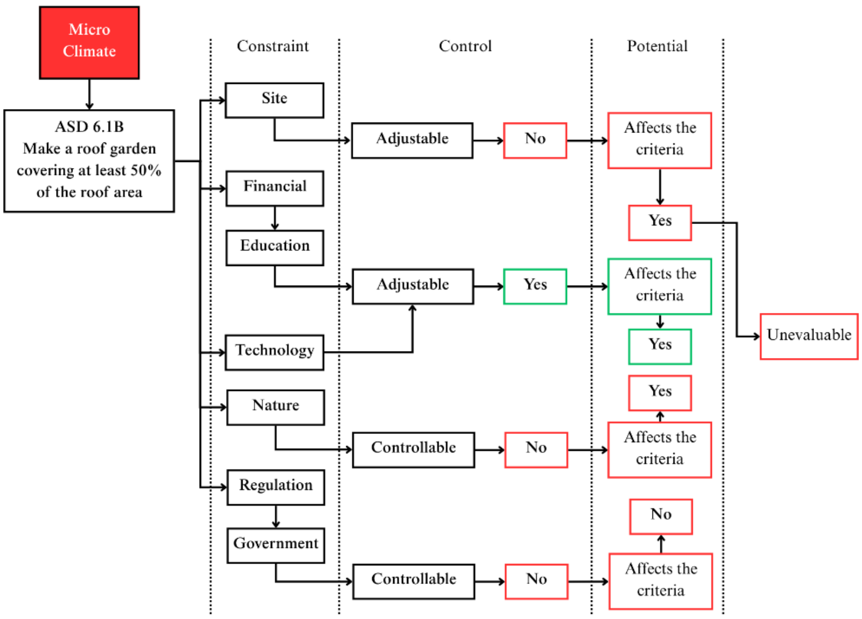

Figure 6. Constraint Interconnections Diagram ASD 6.1B Techno Building

ASD 6.1B cannot be determined since there is an internal requirement of having 50% of the building roof space for a roof garden, which cannot be altered and plays a major role in satisfying this requirement.

In addition, external uncontrollable variables such as government, regulation, and natural surroundings also contribute to the fulfillment of this requirement. Although internal issues of finance and education as well as external technology variables are controllable, they make insignificant contributions towards the fulfillment of the ASD 6.1B requirement in the Techno Building.

3.3. Constraint Evaluation

The examination of challenges in the adoption of the green building concept entails various key areas that are focused on the effectiveness and challenges encountered during the process. The concept of green building is an approach that integrates sustainability principles into building design, development, and management to diminish its negative impacts on the environment [7]. The extent to which unmet criteria can be assessed largely depends on how internal and external problems within the Techno Building project interact with one another.

3.3.1 ASD 3.1A Shuttle Bus Facility

Providing shuttle bus services for at least 10% permanent building occupants is one of the criteria. In the Techno Building project, this criterion would rate as assessment can be met by the provision of employee shuttle transportation.

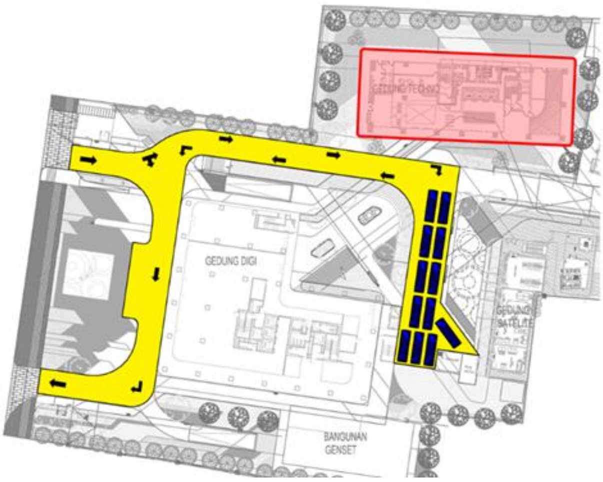

Figure 7. Bus Shelter for shuttler bus facility

3.3.2 ASD 4.1-2 Bicycle Parking & Shower

Two quantifiable goals are the delivery of one bicycle parking for every 20 building users, and a maximum of 100 spaces altogether, and the delivery of one shower for every 10 bicycle parking spaces. In the implementation utilized at the Techno Building, both goals would receive credit since it is feasible to offer bicycle parking and showers via measurement.

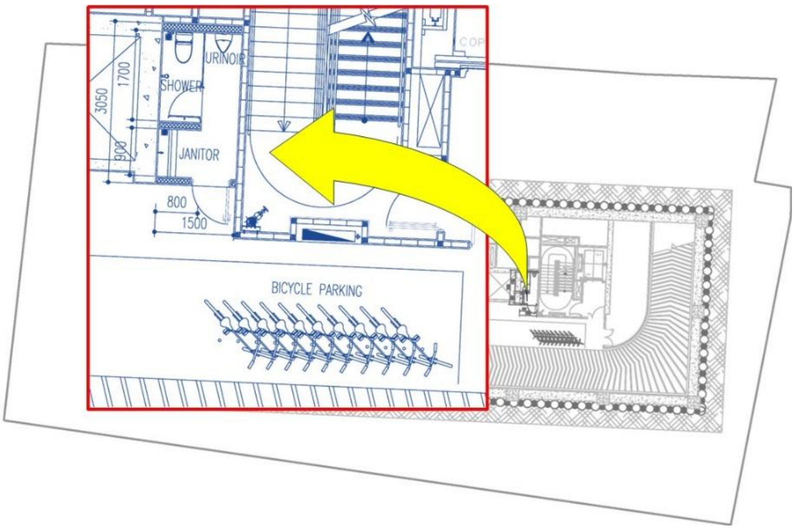

Figure 8. Bicycle Parking & Shower Layout

3.3.3 Micro Climate

Using roofing and floor finishing materials that have an albedo value of ≥ 0.3 (such as Sikalastic coatings and rubber sheets) can reduce the urban heat island effect. This utilization is also considered to be economically feasible and technically achievable.

3.4. Additional Points After Evaluation

Table 2. Appropriate Site Development Criteria – After Green Building Implementation

Category	**Criteria**		**Points**	
	Code	**Descriptions**	**Max**	**Fulfill**
Appropriate Site Development	ASD P	Basic Green Area	P	P
	ASD 1	Site Selection	2	2
	ASD 2	Community Accessibility	2	2
	ASD 3	Public Transportation	2	2
	ASD 4	Bicycle Facility	2	2
	ASD 5	Landscaping Area	3	3
	ASD 6	Micro Climate	3	3
	ASD 7	Rainwater Run-off Management	3	3
Total points in the appropriate site development category fulfilled			17	17

After the improvements, all of the existing non-conforming criteria were addressed. Consequently, the aggregate score increased from 12 to 17 points and showed that through precise assessment and planning, full utilization of the right land use principle can be achieved.

3.5 The Entire Set of Problems Caused

From the above discussion, it is possible to infer that failure to adopt the green building philosophy will result in serious violations of environmental sustainability, public health, and economic stability. Adoption of green building is not only a response to environmental conservation demands, but also a long-term investment with extensive benefits to all the stakeholders involved in the building construction sector. Additionally, development planning that allows quality land use not only ensures environmental integrity but also optimizes economic and social value of buildings. Buildings optimized to realize maximum land use potential, for instance through effective rainwater management, provide significant benefits to building owners and surrounding communities by minimizing the risk of flooding.

The findings indicate that green-certified buildings have higher market value and fewer vacancies compared to regular buildings. This means that building owners who ignore green construction methods lose out on potential for profitable and sustainable investment, as well as added value for the building itself [24]. Water efficiency is another major impact. Those structures that do not include green building principles tend to consume much water, thereby not only running out of resources but also raising their operational cost in the long term [25]. The embracement of green building techniques still faces a sea of challenges like limited awareness among the project planners and owners regarding why sustainability in design is important. In this context, policy promotion, government incentives, and greater public awareness are essential in further encouraging the stakeholders to adopt green building [26].

3.5.1. Critical Interpretation and Stakeholder Insight

The results of this study reveal that not all ASD sub-criteria contribute equally to the overall certification potential. Among the seven criteria, ASD 6 (Microclimate) and ASD 3 (Public Transportation) have higher technical and implementation challenges, but also contribute significantly to building energy efficiency and long-term occupant comfort. Based on Greenship weight distribution, ASD 6 accounts for 3/17 total points (17.6%), yet is often underprioritized in early design phases. This misalignment highlights a need to re-emphasize microclimate mitigation in Indonesian green rating adaptations.

Interviews with three stakeholders—an urban planner from South Jakarta office, a project architect, and a Greenship NB professional—revealed key insights. All agreed that public transport integration is mostly constrained by government zoning, while internal improvements (e.g., shuttle systems) are feasible but rarely budgeted during design tender. One respondent emphasized that "*designers often view ASD credits as low-hanging fruits, overlooking the long-term benefit of tackling harder credits like microclimate or active mobility infrastructure*."

Risk analysis also revealed that failure to address ASD 3 and ASD 6 introduces operational risks such as increased energy demand (cooling), user dissatisfaction, and difficulty obtaining environmental permits in future retrofits. The project team therefore identified these two sub-criteria as "high-risk, high-impact", prioritizing them for early-stage intervention in future designs. These findings suggest that risk-based credit prioritization may be an effective strategy in dense urban settings where spatial flexibility is limited.

3.6. Comparative Framework Mapping (Greenship, LEED, BREEAM)

In order to contextualize the evaluation of Appropriate Site Development (ASD) in the Techno Building project, this study includes a comparative mapping of similar criteria in three widely used green building certification systems: Greenship New Building v1.2 (Indonesia), LEED v4.1 BD+C (USA), and BREEAM New Construction 2018 (UK).

While each framework emphasizes sustainability, they differ in terminology, focus areas, and scoring structure. The table below outlines the equivalent or closely related credits from each framework that correspond to Greenship's ASD sub-criteria.

The comparative analysis highlights that Greenship places strong emphasis on community accessibility and stormwater management, similar to LEED, while BREEAM incorporates a broader range of site ecology and biodiversity considerations. Moreover, LEED and BREEAM often require quantitative environmental performance modeling as part of the assessment, which is optional in Greenship.

This comparison provides a strategic opportunity for GBC Indonesia to enhance its ASD category by incorporating more performance-based metrics, particularly in areas such as climate adaptation, mobility integration, and user behavior modeling.

Table 3. Comparison of the Three Framework Footprint Criteria

Greenship ASD Sub-Criteria	LEED v4.1 BD+C Equivalent	BREEAM New Construction 2018 Equivalent	Notes
ASD P – Basic Green Area	SS Credit: Open Space	LE 03: Managing Impact on Existing Site Ecology	All three frameworks value preservation of green/open space.
ASD 1 – Site Selection	LT Credit: Sensitive Land Protection	LE 01: Site Selection	LEED includes brownfield redevelopment; BREEAM penalizes contaminated land.
ASD 2 – Community Accessibility	LT Credit: Surrounding Density & Diverse Uses	TRA 01: Public Transport Accessibility	Greenship and LEED encourage urban connectivity; BREEAM adds scoring scale.
ASD 3 – Public Transportation	LT Credit: Access to Quality Transit	TRA 01: Public Transport Accessibility	Similar focus on proximity to transit stops.
ASD 4 – Bicycle Facility	LT Credit: Bicycle Facilities	TRA 03: Cyclist Facilities	LEED/BREEAM emphasize end-of-trip facilities.
ASD 5 – Landscaping Area	SS Credit: Heat Island Reduction (Non-roof)	LE 02: Ecological Enhancement	LEED uses albedo & vegetation; BREEAM includes ecological value uplift.
ASD 6 – Microclimate	SS Credit: Heat Island Reduction (Roof & Non-roof)	HEA 05: Adaptation to Climate Change	LEED requires SRI/albedo >0.3; BREEAM includes passive design strategies.
ASD 7 – Rainwater Run-off Management	SS Credit: Rainwater Management	WAT 05: Watercourse Pollution	All three assess drainage systems, retention, infiltration rates .

4. Conclusion

This study contributes to the field of sustainable construction by offering a structured evaluation of the Appropriate Site Development (ASD) category under the Greenship New Building v1.2 framework, applied to a real-world case: the Techno Building at BRI IT Center Jakarta. It highlights how internal interventions—such as shuttle integration, active mobility infrastructure, and high-albedo roofing—can effectively address deficiencies in site sustainability despite external limitations like zoning policies or urban density. By contextualizing Greenship criteria with comparative insights from LEED and BREEAM, the study provides a replicable methodology and a globally relevant reference for green building practitioners operating in Southeast Asia.

One key limitation of this research is its focus on a single case study and one certification category (ASD), which may limit generalizability. Moreover, while stakeholder interviews added empirical depth, their number was limited, and more quantitative post-occupancy evaluation could further validate outcomes. Technical simulations were used selectively and not integrated into a full energy or LCA model, which leaves room for deeper environmental performance analysis.

Future studies should expand the evaluation scope to include multiple certification categories such as Energy Efficiency or Water Conservation, and apply statistical or AI-based modeling tools to explore system-wide optimization. In addition, longitudinal studies that assess operational performance after occupancy would strengthen the evidence base for how ASD compliance influences real-life sustainability outcomes in dense urban contexts.

Declaration of AI and AI assisted technologies in the writing process

The author(s) confirm that no artificial intelligence (AI) tools or AI-assisted technologies were utilized during the preparation, drafting, or editing of this manuscript. The entire work was developed and written independently by the author(s), who take full responsibility for the content of the publication.

Declaration of Competing Interest
The authors declare that there are no financial interests, personal relationships, or other circumstances that could be perceived as influencing the results or interpretations presented in this study.

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The author is profoundly indebted to all stakeholders who were involved in making this research a reality. Acknowledging the limitations of this study, which only analyzed the Appropriate Land Use category, future research is welcome to elaborate on other categories in the Greenship New Building v1.2 rating tool. In addition, the sections of the assessment which are deemed not yet implemented in the Techno Building can serve as a valuable reference for stakeholders engaged in the development of the building, offering input for rendering the building more compliant with the Greenship New Building v1.2 requisites through the application of the provided assessments.

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