

# Precedent Approach and Technical Planning of the SMPN 1 Multipurpose Building: A Sustainable Design Strategy in East Kalimantan

Affit Adriani<sup>1</sup>, Maraden Panjaitan<sup>2</sup>, Wahyu Mahendra Trias Atmadja<sup>3</sup>

Master of Civil Engineering, Faculty of Engineering, 17 August 1945 University of Samarinda, 75124, East Kalimantan, Indonesia.

Email : [gratiaiwant@gmail.com](mailto:gratiaiwant@gmail.com)<sup>1</sup>, [maradenpanjaitan27@gmail.com](mailto:maradenpanjaitan27@gmail.com)<sup>2</sup>

\* Correspondence: [gratiaiwant@gmail.com](mailto:gratiaiwant@gmail.com)

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**Abstract:** The construction of the Multipurpose Building at SMPN 1, Sangatta Utara Subdistrict, is part of the strategic regional infrastructure strengthening program aimed at improving equitable access to public services in East Kutai Regency. The planning, conducted during the 2023 fiscal year, followed a systematic approach involving architectural precedent studies, site analysis based on tropical climate conditions, and the application of adaptive and environmentally friendly design concepts. The building is designed as a two-story structure with a primary system of reinforced concrete and lightweight steel, incorporating materials suitable for tropical climates, such as AAC lightweight bricks, GRC panels, and green façade elements. The planning methodology combined inductive and deductive approaches, resulting in a comprehensive Detail Engineering Design (DED) document that addresses technical aspects, spatial functionality, and architectural aesthetics. The Bill of Quantities (BoQ) was prepared based on construction cost references from Sangatta City, accompanied by procurement documents that include technical specifications, administrative documentation, and an engineer's estimate. Evaluation results indicate that the design meets user needs within the available budget constraints. This planning output serves as a key reference for the effective, targeted physical development of the building and supports the region's medium-term development plan.

**Keywords:** East Kutai; Educational Infrastructure; Procurement Documents; Regional Development; Site-Based Budgeting; Tropical Architectural Design



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## 1. Introduction

The Unitary State of the Republic of Indonesia (NKRI) is a final form that must be preserved and defended by all citizens as a reflection of national commitment (Hafizan et al., 2025). In maintaining national integrity and improving public welfare, national development serves as a strategic instrument grounded in the values of Pancasila, which guide both policy direction and implementation (Kusmawati et al., 2022; Septiana & Salahudin, 2021). National development is not solely aimed at enhancing economic growth but also embodies comprehensive social, cultural, and political transformation (Ningsih et al., 2025). As an archipelagic nation with vast territorial coverage, development must be implemented evenly from the central to the regional levels, including in East Kalimantan. East Kutai Regency, as part of the province, plays a vital role in strengthening public service infrastructure at the local level. One such implementation is the planning of the Multipurpose Building at SMPN 1 in Sangatta Utara Subdistrict, carried out during

the 2023 fiscal year by the Department of Public Works and Spatial Planning, under the Human Settlements Division. This building project is intended to support educational activities and social functions for the local community (Panoyo, 2024), while prioritizing principles of comfort, safety, and accessibility (Widodo, 2018). Furthermore, the planning process adopts a sustainable and environmentally conscious development approach that actively involves community participation (Fuady, 2012; Kharismania & Priyanti, 2023; Pirnanda, 2021). Accordingly, the construction of this Multipurpose Building is expected to enhance the quality of educational facilities and strengthen infrastructure support in strategic areas of Sangatta Utara through an integrated and representative design.

## **2. Materials and Methods**

The planning of the Multipurpose Building at SMPN 1, Sangatta Utara Subdistrict, was designed based on the need for spatial functions that are flexible and adaptable to tropical climate conditions. The selection of building materials was guided by principles of structural efficiency, ease of maintenance, modern aesthetic value, and the potential for development toward a Green Building concept. The main materials used are summarized as follows:

**Tabel 1.** Summary of Main Technical Specifications

<b>Building Element</b>	<b>Main Material</b>
Structure	Reinforced concrete (K-300 grade) and U-40 profile steel for strength and efficiency
Wall	AAC (Autoclaved Aerated Concrete) lightweight blocks with instant mortar plaster
Flooring	Granite ceramic tiles for main areas and polished concrete for the multipurpose room
Roof	Lightweight steel frame with heat-resistant coated galvalume covering
Facade	GRC (Glass-fiber Reinforced Cement) panels, perforated metal, and green wall system
Ventilation and windows	Low-E tempered glass with anodized aluminum frames
Ceiling	Moisture-resistant gypsum with galvanized hollow frame
Sunshades and overhangs	Metal canopies with natural shading screens to support cross-ventilation

The materials were selected based on their durability in wet tropical climates, energy efficiency, and compatibility with a modern architectural appearance that retains a minimalist tropical character. The use of local materials such as natural stone and engineered wood is encouraged as accent elements.

### **2.1. Methodology**

The method employed in the planning process involved an approach based on architectural and structural precedent studies (Zhang, 2024), combined with principles of modern tropical architecture and contemporary public building design standards.

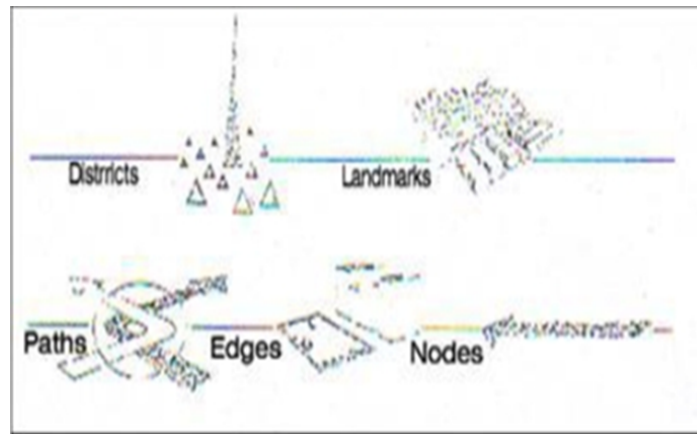


Figure 1. Urban Space and Open Space

a) Precedent Study

The study was conducted on several local and regional multipurpose buildings, focusing on:

- Spatial layout (multipurpose functionality, accessibility, flexibility)
- Two-story building mass responsive to tropical climate
- Application of modern facades combining aesthetic and thermal efficiency
- Use of earthquake-resistance structures and lightweight roofing

From this study, several design principles were synthesized:

- Building forms that are dynamic yet efficient
- Functional circulation that can be easily modified
- Adaptation to advances in construction technology

b) Design Approach

The planning adopted a contextual and responsive design method, using both inductive and deductive approaches:

- Inductive: Deriving Planning principles from precedent-based comparative studies
- Deductive: Applying national technical standards as a regulatory framework

The methodological scope included:

- Site and climate analysis: considering sun orientation prevailing wind direction
- Building mass modelling: optimizing natural lighting and ventilation
- Structural concept: concrete and lightweight steel frame designed for ease of assembly
- Circulation and human scale: referring to theories by Yoshinobu Ashihara and Kevin Lynch
- Long-term use scenarios: Enabling adaptive, multi-functional spatial configurations



Figure 2. Design Approach

c) Construction Method

The construction is designed using the following methods:

- Cast in situ for the main structure (foundations, columns, beams)
- Prefabrication for the roof and façade elements (to improve time and quality efficiency)
- Dry construction for partitions and ceilings
- Modular systems for building façades and sunshades

### 3. Results

In terms of financing, once the final design has been determined, the total area of facilities and infrastructure—including the building and other components—can be calculated. This enables a cost estimate to be prepared based on the standard construction prices in Sangatta City, East Kutai Regency, East Kalimantan Province. The Bill of Quantities (BoQ) is developed comprehensively with the objective of completing the entire physical construction of the building. This physical construction encompasses all phases, including preparatory work, structural components, mechanical and electrical systems, and architectural finishing. It is therefore understood that the planning of the Multipurpose Building at SMPN 1, Sangatta Utara Subdistrict, currently being carried out, is intended to fulfill the operational needs of the users and the directives of the client regarding the required infrastructure. The planning process must take into account the cost constraints in accordance with the budget ceiling for the 2023 fiscal year.

Therefore, several aspects can be evaluated in relation to the current planning decisions within the scope of the available budget constraints. These include:

1. The final design accommodates all inputs from both the client and end users, and has been mutually agreed upon.
2. The Detail Engineering Design (DED) provides a comprehensive plan covering the entire building.
3. The Bill of Quantities (BoQ) outlines the total estimated cost for all construction works.

### 4. Discussion

The planning activity for the Multipurpose Building at SMPN 1, Sangatta Utara Subdistrict, produced a set of technical and architectural documents that reflect the completeness of the planning process—both in terms of technical standards, regulatory compliance, and cost efficiency. These planning products serve as the primary reference for the physical construction implementation in accordance with the 2023 budget ceiling.

#### 4.1. Planning Documents Produced

The following is a list of the key planning deliverables:

**Table 2.** Planning Documents Produced

No	Planning Product	Description
1	Preliminary, Interim, and Final Draft Reports	Contains the entire planning process presented chronologically and systematically
2	Soil Testing Reports (Sondir and PDA)	Provides soil bearing capacity data as the basis for foundation calculations
3	Structural Calculations	Includes calculations for beams, columns, floor slabs, foundations, and reinforcement
4	Complete Technical Working Drawings	Floor plans, elevations, sections, construction details, and scope of work based on the budget
5	Tender Documents (Specifications, RKS, BoQ)	Prepared according to government procurement standards
6	Engineer's Estimate (EE)	Estimated value of construction work as a reference for contractor bidding

#### 4.2. Specifications and Features of The Planned Building

The multipurpose building is designed as a single-story structure with spatial flexibility to accommodate a wide range of school and community activities.

**Table 3.** Specifications and Features of the Planned Building

Component	Technical Specification
Building Area	± 400 m <sup>2</sup>
Structural System	Reinforced concrete, earthquake-resistant, compliant with SNI 1726:2019
Foundation	Mini pile foundation based on Sondir and PDA data
Roof Structure	Lightweight steel frame with zincalume covering
Flooring	Heavy-duty ceramic tiles, child-friendly
Ventilation and Lighting	Cross ventilation and natural openings, energy-efficient LED lighting
Support Facilities	Stage, toilets, storage, changing room, folding bleachers, disability access

#### 4.3. Integration of Modern Design Principles

The building design integrates modern and tropical architectural principles with an environmentally conscious approach:

1. Use of eco-friendly and recyclable materials
2. Arrangement of open space around the building for airflow and water infiltration
3. A clean, functional architectural appearance that reflects the identity of the school

### 5. Conclusions

The planning of the Multipurpose Building at SMPN 1 Sangatta Utara illustrates how educational infrastructure development can serve as a tangible expression of national development principles grounded in Pancasila, particularly in promoting equitable regional development. Positioned within East Kutai Regency, the project responds to the need for improved public service facilities while reinforcing the role of schools as social and community-oriented spaces.

The planning process was conducted comprehensively, integrating architectural, structural, and environmental considerations appropriate to tropical and seismic conditions. Material selection, building systems, and spatial configurations were designed to ensure durability, flexibility, and user comfort, while supporting long-term sustainability. The adoption of modern construction methods and climate-responsive design strategies further enhances the building's functional efficiency.

Methodologically, the combination of precedent-based analysis and regulatory compliance enabled a balanced design approach that is both context-sensitive and technically sound. Community and user inputs were incorporated to align the final design with actual operational needs. The resulting planning outputs—including the Detail Engineering Design, cost estimates, and tender documents—provide a complete and implementable foundation for construction within the 2023 fiscal constraints. Overall, this planning framework demonstrates an integrated approach to public educational facility development that is adaptable, accountable, and sustainable.

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