
Infrastructure Development in Residential Areas within Regional Strategic Zones at the Regency/City Level, Involving the Planning of a Multipurpose Building for Public Junior High School 1 (SMPN 1), North Sangatta District

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Abstract: The planning of the Multipurpose Building for SMPN 1 in North Sangatta District is part of the East Kutai Regency Government's efforts to provide integrated and representative educational facilities that support both urban and rural development. This project is managed by the Department of Public Works and Spatial Planning, Division of Human Settlements (Cipta Karya), under the 2023 Fiscal Year Budget, as a response to the growing demand for educational and community facilities. The planning methodology adopts a modern tropical architectural approach and the principles of sustainable building. The building structure utilizes reinforced concrete with K-300 quality and a modular prefabricated system. Technical planning focuses on basic infrastructure systems, including the provision of clean water through an 18 m³-capacity Ground Water Tank (GWT), a wastewater treatment system consisting of four closed septic tank zones with a total capacity of 17.28 m³, and a primary electrical system with a capacity of 11,000 VA supported by a backup generator. The building design incorporates human scale principles, natural lighting and ventilation, as well as a green façade concept adapted to the local climate. The overall design integrates functional analysis, spatial efficiency, and compliance with technical standards in accordance with prevailing regulations. The outcome of this planning is expected to serve as a reference for the development of similar sustainable and context-sensitive educational facilities aligned with the growth of Sangatta City.

Keywords: Building Planning; East Kutai; Educational Facilities; GWT; Septic Tank; Tropical Architecture



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1. Introduction

In the 2023 Fiscal Year, one of the projects managed by the Department of Public Works and Spatial Planning, Division of Human Settlements (Cipta Karya), of East Kutai Regency in East Kalimantan Province is the planning of a Multipurpose Building for SMPN 1, North Sangatta District. This initiative arises in response to the increasingly intensive development within North Sangatta, prompting the East Kutai Regency Government to enhance and balance the provision of regional governmental facilities for all segments of the community (Matondang et al., 2024; Sitepu & Mahesa, 2022). This effort represents a tangible manifestation of the regional government's commitment to improving public infrastructure in rural

areas through representative, integrated, and well-coordinated facilities to support oversight and community services (Napitupulu et al., 2024; Swasman, 2023). It is intended to better equip the region in anticipating future urban development within the regency, aiming to establish a city that is competent, livable, and conducive for working, residing, and daily life (Mahi & Resosudarmo, 2025; Telaumbanua et al., 2024; Wiratama et al., 2023). The planning of the Multipurpose Building for SMPN 1 in North Sangatta, undertaken in the current year, is one of the achievements aimed at supporting the development of an integrated urban zone that caters to the activities of all community sectors—especially in relation to the availability of activity facilities for school-aged children from the North Sangatta area. The facility is envisioned to provide a dedicated space for learning during their educational period in Sangatta. Regional Strategic Zones (Kawasan Strategis Daerah/KSD) refer to specific areas within a regency or city that hold significant value for economic, social, or ecological development (Fauzi et al., 2022). Within this context, infrastructure development in residential areas—including the provision of public facilities such as schools, open spaces, and educational infrastructure—is a critical factor in improving the quality of life (Fernández et al., 2025; Hassanain et al., 2022). Well-planned infrastructure contributes to the establishment of a healthy, safe, and productive environment (Alnsour et al., 2024). SMPN 1 North Sangatta is situated within one of East Kutai Regency's strategic areas. As a junior secondary education institution, it has an urgent need for a proper multipurpose facility to support teaching and learning activities, as well as extracurricular programs. To date, collective school functions such as flag ceremonies, indoor sports, parent meetings, and arts events have lacked a representative physical space (Hashem, 2022). The planning of this multipurpose building in a strategic residential area goes beyond merely fulfilling spatial requirements; it must also take into account environmental carrying capacity, spatial integration, and land-use efficiency. Consequently, this initiative serves as a critical model in the delivery of infrastructure within strategic residential zones at the regency/city level.

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2. Materials and Methods

2.1. Scope of Planning

- Architectural design of the building (floor plans, elevations, and sections)
- Structural planning (Slabs, beams, columns and foundations)
- Utility Planning (Clean water supply, electrical systems, and ventilation)
- Soil test analysis (Cone Penetration test [CPT] and Pile Driving Analyser [PDA])
- Preparation of complete technical drawings
- Compilation of administrative and technical documents for tendering

2.2. Implementation Methodology

The planning was carried out through the following stages:

1. Field Study and Technical Survey
 - Site observation
 - Collection of spatial data
 - Coordination with the school and relevant government agencies
2. Soil Testing and Geotechnical Investigation
 - Cone Penetration Test (CPT) and Pile Driving Analyzer (PDA) tests to determine soil bearing capacity
 - Determination of foundation type based on test results
3. Structural Planning
 - Structural calculations for both superstructure and substructure using technical software
 - Evaluation of seismic forces, dead loads, and live loads in accordance with Indonesian National Standards (SNI)
4. Architectural Planning
 - Design of functional spaces based on the school's needs
 - Consideration of natural lighting and cross-ventilation

5. Preparation of Technical Drawings and Documents

- Complete working drawings
- Technical specifications and tender documents (Work Specification Document [RKS], Bill of Quantities [BQ], and Engineer's Estimate [EE])

The planning method adopts an architectural design approach (Hassanpour & Şahin, 2021), which aligns with a quantitative research methodology based on a naturalistic paradigm that seeks to interpret truth values grounded in the natural conditions of the site. The reasoning logic applied for drawing conclusions combines inductive reasoning—deriving general insights from detailed descriptions—and deductive reasoning—drawing specific conclusions from general premises. Hence, inductive logic is used where necessary, while in other contexts, deductive logic serves as the guiding framework.

ARCHITECTURAL DESIGN PROCESS

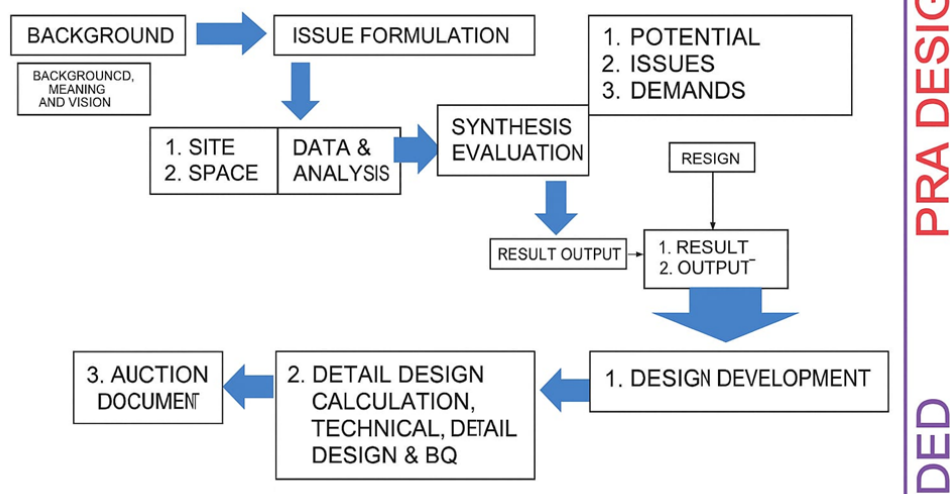


Figure 1. Architectural Design Development

3. Results

3.1. Design Development Directive

Design directives serve as guidelines for implementing and elaborating the Design Concept. In the presentation of the final design, it must be in accordance with the current design directives. The existing design directives are expected to be reflected in the design form, ultimately realizing the objectives and goals of implementing the previously established conceptual ideas.



Figure 2. Design Directive

3.2. Design Concept

In relation to the application of architectural design concepts, it is essential to develop and integrate all previously elaborated concepts in order to realize the intended form in the planning of the Multipurpose Building for SMPN 1, North Sangatta District.

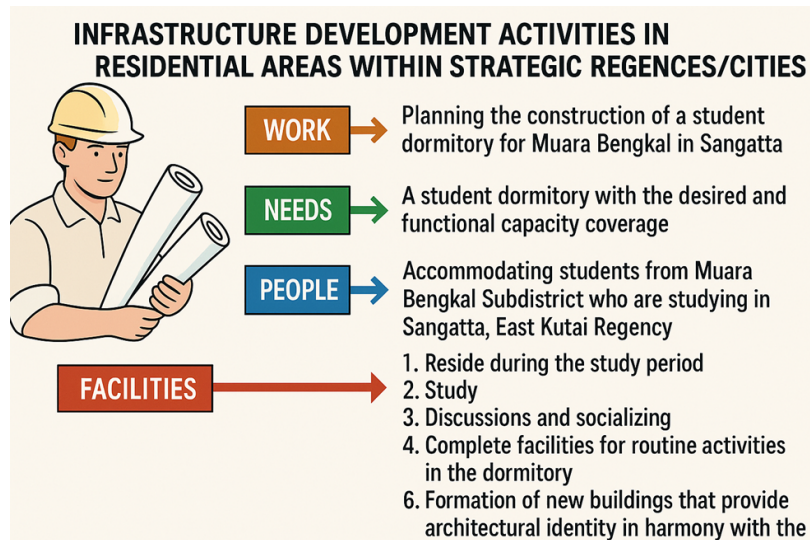


Figure 3. Concept Design

In addition, the structural solution is also directed toward implementing the Design Concept by utilizing the existing natural ventilation and lighting.

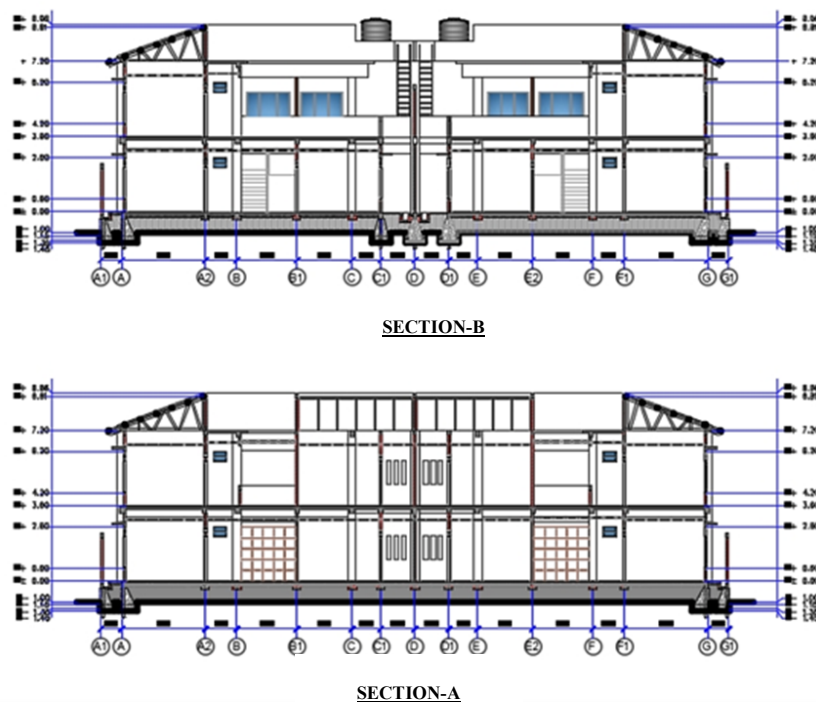


Figure 4. Concept Design 2D

4. Discussion

The planning of a multipurpose building at SMPN 1 Sangatta Utara serves as an example of implementing educational infrastructure development in a regional strategic area. This activity demonstrates that the design of public buildings within residential zones cannot be separated from the context of their surrounding environment (Hu et al., 2023). Strategic areas such as Sangatta Utara are experiencing population growth and high spatial density. Under such conditions, infrastructure development must take into account land-use efficiency, structural feasibility, and environmental carrying capacity (Estutama &

Adhi Kurniawan, 2021). The application of tropical architectural concepts and the use of local materials enable energy and cost efficiency while also providing a distinct character to the school building. Furthermore, fulfilling technical aspects such as soil testing results, structural calculations in accordance with national standards (SNI), and the completeness of tender documents ensures that the construction process can proceed in accordance with safety, comfort, and functionality standards. This study recommends that infrastructure development in strategic regional areas be aligned with long-term spatial planning, particularly in the education, health, and public facility sectors. Such alignment is essential to ensure that regional growth remains well-directed and continues to support the quality of life for the community.

5. Conclusions

This section is mandatory but can be added to the manuscript if the discussion is unusually long or complex and add research limitations and policy implications to the theory and practice.

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