

Redesign Of Brawijaya Terminal, Banyuwangi, Using A Sustainable Architecture Approach

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ABSTRAK

Banyuwangi terus berkembang sebagai destinasi wisata utama, sehingga meningkatkan kebutuhan akan infrastruktur transportasi yang memadai. Terminal Brawijaya, fasilitas Tipe-B yang melayani rute antar kota dan lokal, saat ini dibatasi oleh tata letak bangunan yang terfragmentasi, sirkulasi yang tidak efisien, fasilitas penumpang yang tidak memadai, dan kurangnya responsivitas budaya dan lingkungan. Masalah-masalah ini menyoroti kebutuhan akan desain ulang yang meningkatkan kinerja sekaligus mengintegrasikan prinsip-prinsip arsitektur berkelanjutan dan identitas lokal. Studi ini menggunakan metode deskriptif kualitatif, menggabungkan observasi lapangan, survei, dokumentasi, dan tinjauan pustaka. Analisis berfokus pada organisasi spasial, pola sirkulasi, iklim mikro, vegetasi, dan kebutuhan pengguna. Temuan menunjukkan bahwa sirkulasi yang tumpang tindih antara bus, minibus, kendaraan pribadi, dan pejalan kaki mengurangi keselamatan dan efisiensi. Orientasi bangunan yang buruk membatasi pencahayaan dan ventilasi alami, menciptakan kondisi termal yang tidak nyaman. Ruang terbuka hijau tidak cukup untuk mendukung iklim mikro dan penyerapan air hujan. Desain ulang menerapkan prinsip-prinsip arsitektur berkelanjutan, termasuk penataan massa yang kompak, orientasi yang lebih baik, ventilasi alami, energi terbarukan, pemanenan air hujan, dan penggunaan material lokal. Area hijau, permukaan yang permeabel, dan koridor pejalan kaki yang teduh mendukung kinerja lingkungan dan kenyamanan pengguna. Area tunggu semi-terbuka dan sirkulasi yang mudah diakses meningkatkan pengalaman penumpang, sementara elemen budaya Osing memperkuat identitas lokal. Hasil penelitian menunjukkan bahwa penerapan desain berkelanjutan dapat meningkatkan kinerja lingkungan, efisiensi sirkulasi, dan ekspresi budaya dalam infrastruktur publik. Terminal Brawijaya yang didesain ulang menawarkan fasilitas yang fungsional, nyaman, dan bermakna secara kontekstual yang dapat menjadi model pengembangan transportasi berkelanjutan di Indonesia.

Kata kunci: desain ulang terminal, arsitektur berkelanjutan, transportasi umum, Banyuwangi.

ABSTRACT

Banyuwangi has continued to develop as a major tourism destination, increasing the need for adequate transportation infrastructure. Brawijaya Terminal, a Type-B facility serving intercity and local routes, is currently limited by fragmented building layouts, inefficient circulation, insufficient passenger facilities, and a lack of cultural and environmental responsiveness. These issues highlight the need for a redesign that improves performance while integrating sustainable architectural principles and local identity. This study uses a qualitative descriptive method, combining field observations, surveys, documentation, and literature review. The analysis focused on spatial organization, circulation patterns, microclimate, vegetation, and user needs. Findings show that overlapping circulation between buses, minibuses, private vehicles, and pedestrians reduces safety and efficiency. Poor building orientation limits natural lighting and ventilation, creating uncomfortable thermal conditions. Green open space is insufficient to support microclimate and rainwater absorption. The redesign applies principles of sustainable architecture, including compact massing, improved orientation, natural ventilation, renewable energy, rainwater harvesting, and the use of local materials. Green areas, permeable surfaces, and shaded pedestrian corridors support environmental performance and user comfort. Semi-open waiting areas and accessible circulation improve passenger experience, while Osing cultural elements reinforce local identity. The results demonstrate that applying sustainable design can improve environmental performance, circulation efficiency, and cultural expression in public infrastructure. The redesigned Brawijaya Terminal offers a functional, comfortable, and contextually meaningful facility that can serve as a model for sustainable transportation development in Indonesia.

Keywords: terminal redesign, sustainable architecture, public transportation, Banyuwangi.

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INTRODUCTION

Banyuwangi has experienced rapid development in recent years, making it one of Indonesia's leading tourism destinations. The increase in visitor numbers requires adequate transportation infrastructure, especially a terminal that operates efficiently and represents local identity (Helton et al., 2014; Zhang et al., 2015). A terminal does not only function as a transportation node, but also as an urban gateway that reflects the culture and environmental awareness of a region (Mengfan & Yunliang, 2020).

Brawijaya Terminal, which is classified as a Type-B terminal, serves intercity and local transportation in East Java. However, its current facilities are inadequate, its spatial layout is inefficient, and its architectural design does not yet reflect the cultural characteristics of Banyuwangi. In addition, the terminal has not applied sustainable architectural principles such as energy efficiency, environmentally friendly materials, and water conservation (Lai et al., 2014).

This study aims to redesign Brawijaya Terminal using a sustainable architecture approach that emphasizes resource efficiency, user comfort, and the integration of Banyuwangi's cultural identity, particularly the Osing tradition. The redesigned terminal is expected to serve as a reference model for the development of sustainable transportation infrastructure in Indonesia.

In line with the growing emphasis on environmentally conscious urban development, the redesign of Brawijaya Terminal adopts sustainability as its core design philosophy. Sustainable architecture in public infrastructure seeks to minimize environmental impact by optimizing natural resources such as sunlight, air circulation, and rainwater, while ensuring user comfort and operational efficiency (Sassi, 2006). In the case of Brawijaya Terminal, the application of these principles not only supports energy conservation but also aligns with global efforts to achieve the Sustainable Development Goals (SDGs), particularly in promoting sustainable cities and communities. The integration of renewable energy sources, green open spaces, and local materials is expected to create a transportation hub that embodies ecological balance and cultural authenticity.

Cultural integration plays an important role in strengthening Banyuwangi's local identity, which is known for its distinctive Osing cultural heritage. Architectural elements inspired by traditional Osing houses, such as sloping roofs, natural ventilation, and the use of earth-tone colors, can be harmoniously incorporated into the terminal design. The inclusion of Osing batik motifs and traditional patterns on the facade or interior elements strengthens the relationship between the built environment and local culture. This approach not only enhances the terminal's aesthetic value, but also creates a sense of

belonging among the community, making the terminal a cultural landmark rather than merely a transit facility.

From a functional perspective, this redesign focuses on improving circulation, accessibility, and user comfort. The current irregular layout of Brawijaya Terminal creates conflicts between vehicle and pedestrian movements, resulting in congestion and safety risks. Therefore, the new design proposes clear zoning for different modes of transportation, dedicated pedestrian paths, and barrier-free access for people with disabilities. The addition of open waiting areas with natural ventilation, shaded pedestrian corridors, and efficient traffic flow ensures that the terminal operates smoothly while maintaining a comfortable environment for all users. These interventions demonstrate how sustainability can coexist with functionality to produce an efficient, human-centered terminal.

METHOD

This study uses a qualitative descriptive approach with Brawijaya Terminal, Banyuwangi, as the case study. The research stages include data collection, analysis, and the development of a sustainable design concept.

Research Location

The study area is located at Brawijaya Terminal, Jl. Brawijaya No. 7A, Kebalenan Village, Banyuwangi District, Banyuwangi Regency, East Java, with a total site area of approximately 18,100 m². As the main bus terminal in downtown Banyuwangi, this location plays an important role in supporting regional mobility by connecting local routes within the province and long-distance routes serving interprovincial destinations such as Bali, Central Java, and Yogyakarta. Although strategically located, the existing terminal facilities are fragmented, consisting of several building masses such as the terminal office, ticket counters, waiting areas, toilets, and prayer room that are not physically integrated. This condition results in inefficient movement patterns and reduces the user experience.



Figure 2 Existing Site

Source: Author's Work

Data

Primary data were obtained through a series of field observations, site surveys, and on-site documentation. The field observation activities included mapping the terminal's spatial layout, identifying

the condition and distribution of facilities, and recording user flows and vehicle movements within the site. These observations enabled the researchers to directly understand the physical and operational constraints that contribute to inefficiency within the terminal.

Secondary data were collected from literature related to transportation terminal typologies, sustainable architecture, and principles of urban development. These sources were used to provide a theoretical foundation for the design strategy and to compare best-practice models. The theoretical references include sustainable design principles that address land management, energy efficiency, water conservation, material selection, and community integration.

Government regulations also constitute an important source of secondary data. These secondary data sources include Minister of Transportation Regulation No. 31 of 1995 and Minister of Transportation Regulation No. 24 of 2021, both of which outline terminal classification standards, minimum facility requirements, and operational guidelines. These regulations help determine the redesign parameters and ensure that the proposed terminal facilities comply with national transportation policy.

Analysis Method

The analysis method adopted in this study follows a qualitative descriptive approach. The process began by interpreting primary data from field observations to identify the existing spatial layout, user behavior, building conditions, and operational performance of the terminal. Information collected on site was analyzed to determine system deficiencies, such as circulation conflict points, inadequate passenger facilities, and the lack of environmentally responsive measures.

After the field analysis, the data were categorized based on thematic variables: site conditions, building massing, microclimate, circulation, utilities, and user needs. Each category was evaluated in relation to sustainable architectural principles to assess the potential for improvement. This allowed the researchers to examine how ecological strategies, such as maximizing natural ventilation, increasing permeable surfaces, and optimizing building orientation, could be applied in the design.

This method also involved integrating secondary data in the form of design standards, regulations, and theoretical frameworks into the analysis process. This ensured that the recommendations were contextually relevant and aligned with national regulations. Comparative analysis with precedent cases helped identify successful spatial layouts and sustainable solutions adopted in other terminals, contributing to the refinement of the redesign strategy.

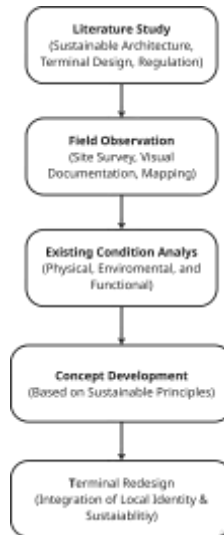


Figure 1 Flowchart

Source: Author's Work

FINDING AND DISCUSSION

The main theme used is Sustainable Architecture, an architectural approach that balances functional, aesthetic, and environmental aspects. Through this theme, the terminal design is intended to minimize negative impacts on nature by optimizing the site's potential and local resources. Sustainable principles are applied through energy efficiency, water management, the use of environmentally friendly materials, and the creation of green open space that meets the standard of 30% of the site area. Thus, the terminal is not only transportation infrastructure but also part of an urban ecological system that actively supports environmental quality.



Figure 3 Building Water Cycle Diagram

Source: Author's Analysis

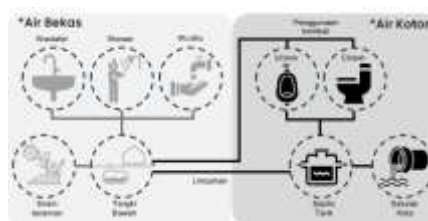


Figure 4 Building Water Cycle Diagram

Source: Author's Analysis

The main design principles are applied in four key aspects: energy efficiency, the use of local materials, environmental quality improvement, and the strengthening of local cultural values. Energy efficiency is achieved through natural cross-ventilation, an east-west building orientation, and the use of a secondary skin to control sunlight and heat. Materials such as concrete ventilation blocks and wood plastic composite (WPC) are selected to balance strength, beauty, and sustainability. Meanwhile, the management of green space and local vegetation serves to maintain natural air circulation and support thermal comfort within the terminal area.

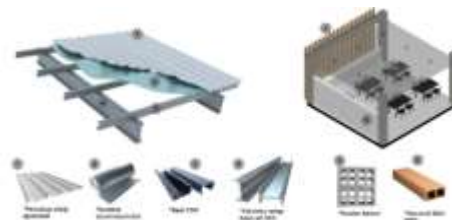


Figure 5 Materials

The architectural form of the terminal is inspired by the roof of the traditional Osing house, which symbolizes Banyuwangi's cultural identity. This element is translated into a layered and dynamic modern roof form, creating an impression that is both light and monumental. The design philosophy reflects the spirit of harmony between tradition and modernity, in which local values are elevated as an integral part of sustainable contemporary design. Visually, the traditional Osing roof is interpreted through sloping planes and lightweight materials, strengthening the building's character as a new transportation icon that is culturally rooted and environmentally conscious.



Figure 6 Front View

Source: Author's Analysis

Analysis of Existing Conditions

The design site is located at Jl. Brawijaya No. 7A, Kebalenan, Banyuwangi District, Banyuwangi Regency, East Java, with a total area of approximately $\pm 18,100 \text{ m}^2$. The location is strategic because it is situated in the city center and close to public facilities such as offices, commercial areas, and residential neighborhoods. The site boundaries consist of Jalan Brawijaya to the north, the Samsat Office to the west, residential areas to the south, and shop-house areas to the east. Its position along a main city corridor gives the terminal strong potential as an intercity and intermodal transportation node. The existing condition shows an unintegrated massing arrangement, where separate buildings lack clear circulation connections, thereby obstructing the smooth flow of terminal user activities.



Figure 7 Site Boundary Photo

Source: Author's Analysis

Climatically, observations and data from BMKG Banyuwangi indicate that the dominant wind direction comes from the east-southeast during the dry season and from the west-northwest during the rainy season, with an average speed of 2.5-5.5 m/s. Therefore, the terminal design needs to consider natural cross-ventilation so that airflow can pass through the building effectively. Meanwhile, the site orientation extends from east to west, making the northern and southern sides areas with softer solar exposure. The design response is to place the building mass lengthwise in an east-west direction and add a secondary skin made of wood plastic composite (WPC) to reduce excessive heat from the east and west while strengthening the facade aesthetics.



Figure 8 Site Development Boundary

Source: Author's Analysis

From the perspective of existing circulation and zoning, the movements of users, public vehicles, and private vehicles still overlap. The entry and exit routes for buses, public minibuses, and private vehicles have not been properly separated, resulting in congestion and accumulation in several areas. In addition, the scattered zoning of the buildings makes public functions such as waiting areas, ticket counters, and commercial areas difficult to access efficiently. Visitor parking areas are also inadequate, while green open space accounts for less than 20% of the total site area, still below the 30% building

coverage regulation standard. This condition indicates the need for a comprehensive redesign of circulation patterns, spatial layout, and green open space.



Figure 9 Existing Site Zoning

Source: Author's Analysis

Sustainable Architecture Design Concept

The sustainability concept in the redesign of Brawijaya Bus Terminal, Banyuwangi, covers four main aspects: land, energy, water, and materials. In terms of land use, a compact and efficient single-mass pattern is applied, along with the separation of circulation among users to optimize spatial utilization.



Figure 10 Site Zoning

Source: Author's Analysis

In the energy aspect, the building design maximizes natural lighting and ventilation, utilizes solar panels on the roof, provides EV charging station areas and bicycle parking, and uses energy-efficient equipment such as LED lighting and ceiling fans.

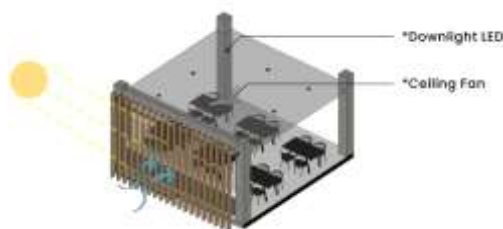


Figure 11 Ventilation and Lighting Concept

Source: Author's Analysis

In water management, a rainwater harvesting system is applied, along with the separation of greywater and blackwater, as well as sustainable landscaping using local vegetation and porous pavement to support natural infiltration.



Figure 12 Building Water Cycle

Source: Author's Analysis

Meanwhile, in terms of materials, readily available local materials are used to reduce transportation emissions, along with well-insulated materials such as foil-coated metal roofing, hollow ceilings, and concrete ventilation blocks to create thermal comfort and energy efficiency.

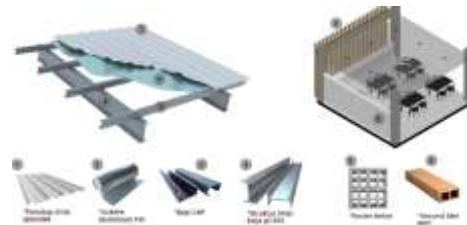


Figure 13 Use of Local Materials

Source: Author's Analysis

Building Structure and Utility Systems

The structural concept for the redesign of Brawijaya Bus Terminal, Banyuwangi, consists of three main parts: the substructure, superstructure, and roof structure. The substructure uses pad foundations with dimensions of 150 x 150 cm and a depth of 2.5 m, combined with reinforced concrete tie beams measuring 25 x 50 cm as connectors between foundations. This system was selected because it can distribute building loads evenly and is suitable for stable soil conditions. The building superstructure uses a reinforced concrete rigid-frame system with a 6 x 6 m grid, 35 x 35 cm columns, 25 x 50 cm main beams, and 20 x 40 cm secondary beams, resulting in flexible and efficient interior spaces. Meanwhile, the roof structure uses WF steel profiles and C-channel frames that are strong, lightweight, and easy to install, with the consideration that they can support the additional load of solar panels as part of the application of sustainable architectural principles.

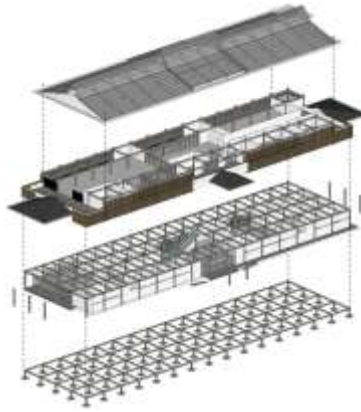


Figure 14 Schematic Diagram of Building Structure

Source: Author's Analysis

Design Results

The design results represent the synthesis of the site analysis, sustainable architecture principles, circulation planning, structural considerations, and local cultural interpretation developed in the previous sections. This part presents the main visual outcomes of the redesign, including the site plan, front elevation, and bird's-eye view, as evidence of how the proposed concept is translated into architectural form and spatial organization.

a. Site Plan

The site plan describes the spatial organization of the redesigned terminal area by clarifying the relationship between arrival zones, departure areas, pedestrian corridors, parking spaces, green open areas, and supporting facilities. The arrangement is intended to reduce circulation conflicts, improve accessibility, and strengthen the efficiency of land use within the terminal site.



Figure 15 Site Plan

b. Front View

The front elevation emphasizes the terminal as a public gateway that combines functional clarity with local architectural expression. The facade treatment, roof profile, shading elements, and material composition are arranged to create a recognizable identity while supporting thermal comfort, daylight control, and a more welcoming passenger experience.



Figure 16. Front View

c. Bird's-Eye View

The bird's-eye view presents the overall spatial composition of the redesigned terminal, showing how the building mass, circulation network, open spaces, and landscape elements work together as one integrated transportation environment. This perspective helps explain the relationship between the terminal building, vehicle movement, pedestrian access, and green infrastructure within the broader urban context of Banyuwangi.



Figure 17. Bird's-Eye View

CONCLUSION

The redesign of Brawijaya Bus Terminal, Banyuwangi, focuses on improving functional quality, comfort, and building efficiency through the application of a sustainable architecture concept. The main principles applied include optimizing land use, improving energy efficiency, managing water, and selecting environmentally friendly local materials. A more compact building mass arrangement, organized circulation, and the application of natural lighting and ventilation successfully create a comfortable and energy-efficient terminal environment. The integration of green areas, sustainable drainage systems, and architectural elements inspired by Osing culture makes the terminal not only functional and modern, but also strongly rooted in local character. Through this approach, Brawijaya Terminal can become a model for the development of sustainable public transportation infrastructure that is contextual and adaptive to the development of Banyuwangi City.

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