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Research Article

Design Concept of Mixed Use Building Connection Bridge of Al Amin Living Lab and Industrial Park Main Plaza at Desa Sampe Cita, Kutalimbaru

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Abstract: Universitas Pembangunan Panca Budi plans to develop Al-Amin Living Lab and Industrial Park. In the center of this area is the main plaza which has a series of mixed use buildings that need to be connected. This study aims to understand the design of the connection bridge at the main plaza of Al-Amin Living Lab and Industrial Park in Sampe Cita Village, Kutalimbaru District, and how it will serve pedestrians. The research subject is the site location in Sampe Cita Village, Kutalimbaru District, Deli Serdang Regency, with the observed parameters being the physical and non-physical conditions of the design location. The results of this study show that the facilities and infrastructure of the connection bridge for the Mixed-Use Building of Al-Amin Living Lab and Industrial Park consist of circulation pathways connecting the Mixed-Use buildings and a viewing deck, and the design direction of the Mixed- Use Building of Al-Amin Living Lab and Industrial Park meets the criteria.

Keywords: Planning, Industrial Park, Connection Bridge.

1. Introduction

Al-Amin Living Lab and Industrial Park is an area located in Glugur Rimbun, precisely in Sampe Cita Village, Kutalimbaru District. The planned area located in the Glugur Rimbun area, specifically in Sampe Cita Village, Kutalimbaru District, this site is projected to become a center for Mixed-Use Buildings that provide facilities for all study programs at UNPAB. The area, which is also planned to become a Mixed-Use Building, will be named the Al-Amin Living Lab and Industrial Park Mixed-Use Building. One of the functions to be developed in this area includes a restaurant, café, and meeting room.

The Mixed use building desined at the outer circle of the main plaza of Al Amin Living Lab and Industrial Park. The overall building consist of 4 building part ar each side of the main plaza. therefore it needs a bridge to connect the building and the activities accommodated.

The bridge planed to connected the buildings at the main plaza of Al-Amin Living Lab and Industrial Park in Sampe Cita Village, Kutalimbaru District, is highly diverse and encompasses various aspects that provide significant benefits to the community. The bridge links the buildings in the main plaza, allowing pedestrians to move easily from one point to another without having to traverse vehicle traffic. This enhances connectivity between buildings and encourages people to walk more, supporting a more active and sustainable lifestyle.

The design of a building connection bridge at the main plaza is a crucial step in urban infrastructure development, allowing pedestrians to move safely and efficiently between various key points within an area. This bridge is expected to enhance connectivity between surrounding buildings, providing easy accessibility for local residents and visitors. During the design phase, careful consideration of the bridge's function, aesthetics, safety, and sustainability is essential.

In bridge design, the analysis of gradients and pedestrian pathways is a primary focus. Steep gradients can make access difficult for people with disabilities or those using wheeled

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vehicles. Therefore, the design must account for appropriate accessibility needs and ensure that the bridge is accessible to everyone without obstacles. Additionally, the bridge can serve as an architectural element that creates an area's identity. A well-designed aesthetic can enhance the area's appeal and create a visual icon (Fitri & Siregar, 2023).

2. Literature Review

2.1. Bridges

A bridge, in general, is a structure that functions to connect two segments of a road that are interrupted by obstacles such as deep valleys, river channels, lakes, irrigation channels, streams, railway lines, or intersecting highways, among others (Barokah & Purwantoro, 2014). A bridge is a construction used to extend a road over an obstacle that lies at a lower level. These obstacles typically include other roads (waterways or regular traffic routes).

A bridge is a type of structure that, when modifications are needed, cannot be easily altered, requires relatively high costs, and impacts traffic flow during the construction work (Busri, 2014). Bridges are built with a design life of 100 years for major bridges, with a minimum usable life of 50 years. This means that, in addition to the strength and capability to serve traffic loads, good maintenance of the bridge must also be considered (Siregar et al., 2023).

The classification of bridges based on their function, location, construction materials, and structural types has evolved rapidly with advances in time and technology, ranging from simple to state-of-the-art constructions. According to their purpose, bridges can be classified as follows (Asrizal et al., 2015):

a. Highway bridge
b. Railway bridge
c. Waterway bridge
d. Pipeway bridge
e. Military bridge
f. Pedestrian bridge or footbridge

2.2. Skybridge

A skybridge is a type of enclosed pedestrian bridge that connects two or more buildings in densely populated areas. Sometimes referred to as skyways or skywalks, a skybridge is a pedestrian pathway elevated to a certain height, developed over centuries (Ikhsan, 2020). In modern times, skybridges are often found in transit hubs, airports, malls, and apartment complexes. Beyond serving as pedestrian walkways, contemporary skybridges are also designed to offer scenic views.

2.2. Types of Skybridge

Generally, skybridges can be categorized into two types based on ownership or purpose, and based on the distribution of loads they support (Ilmawan & SM, 2019).

a. Public Skybridge

This type of skybridge is freely accessible to the general public. Anyone can access both the connected buildings and the skybridge itself. As the name suggests, public skybridges serve as public facilities aimed at facilitating ease of movement for people between different buildings. Examples include the Calgary Skybridge and the Terminal Tirtonadi Solo Skybridge. Public skybridges are typically located in government or privately-owned buildings or public facilities. They are mostly built and managed by the government, connecting public facilities such as airports, terminals, stations, hospitals, and other public amenities, where the connected buildings are generally also government-managed (Wardiningsih & Hendarto, 2019). Besides public facilities, public skybridges are also constructed by the government to connect multiple buildings, whether owned by the government or private sector, to alleviate traffic congestion.

Figure 1. Examples of Public Skybridges: (a) Palembang Airport Skybridge and (b) Tirtonadi Terminal Skybridge

b. Private Skybridge

Unlike public skybridges, not everyone can access private skybridges. Private skybridges are managed by specific institutions or companies that oversee all or part of the connected buildings. Access to the skybridge is restricted to users of the connected buildings or by permission of the skybridge manager (PUTRI, 2019). Private skybridges often serve not only as pedestrian walkways but also as iconic features of buildings and places that offer beautiful views. In some world-renowned apartments and hotels, skybridges are used as luxurious amenities, featuring rooms with luxurious facilities such as swimming pools, cafes, gyms, and restaurants. For example, the Petronas Twin Towers in Malaysia have skybridges that serve as tourist destinations (Novalinda, 2023).

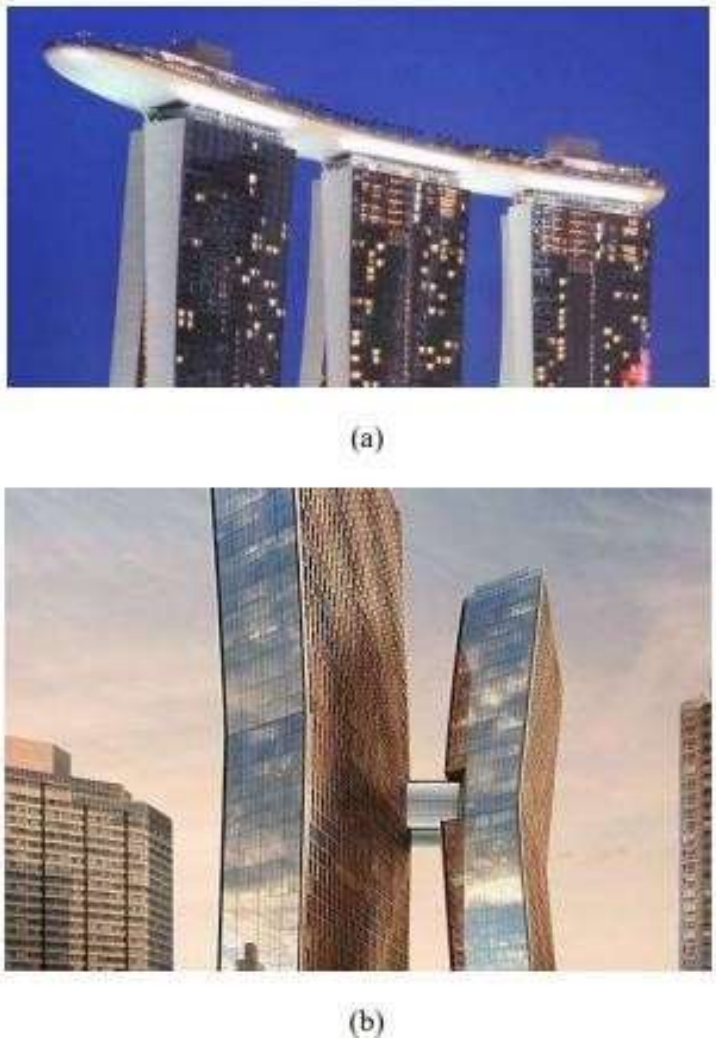

Figure 2. Examples of Private Skybridges: (a) Marina Bay Skybridge and (b) American Copper Buildings Skybridge

2.3. Skybridges Seen from Load Distribution

a. Attached Skybridge

An attached skybridge is connected to a building or buildings and is used in specific conditions. One such condition is when the elevation of the skybridge from ground level is sufficiently high. For instance, skybridges located at mid-level or rooftop of skyscrapers that need to be connected (Suseno & Widiyastika, 2022). Another condition is when the area below the skybridge does not allow for support pillars, such as skybridges located above highways. Examples of attached skybridges include the Petronas Twin Towers in Malaysia and Linked Hybrid in China.

Figure 3. Attached Skybridge at Linked Hybrid, Beijing, China

b. Independent Structure Skybridge

Independent Structure Skybridge is a type of skybridge where the structure stands on its own without being attached to the buildings it connects. This type of skybridge can independently support all the loads it receives (SIDDIQ, 2021). The main characteristic of an independent structure skybridge is the presence of support pillars. These pillars distribute the load from the skybridge structure to its foundations.

Figure 4. Independent Structure Skybridge at University of Leeds, Ohio

c. Semi-Independent Skybridge

In this type of skybridge, it can be said to combine characteristics of both attached and independent structure skybridges. The skybridge structure is attached to the buildings it connects and also has support pillars. The loads received by the skybridge are distributed to the connected buildings and the support pillars, which then transfer the loads to the foundations—either the building foundations or the foundations of the support pillars themselves (Rahayu et al., 2020).

Figure 5. Semi-Independent Skybridge in Davenport, USA

3. Method

3.1. Research Material

The research material is the site location in Sampe Cita Village, Kutalimbaru Subdistrict, Deli Serdang Regency, the needs of the academic community of Panca Budi Development University for research land and the potential for regional development as a tourist facility, in this case the building ini the main plaza of Al Amin Living Lab and Industrial Park.

3.2. Research Procedure

The research procedures to be followed are as follows:

a. Field survey
b. Data compilation (field and references)
c. Documentation
d. Data analysis
e. Discussion and debate
f. Making conclusions and proposed structures

g. Research report

Observed Parameters:

a. Physical Conditions of Design Location (Contour, Area, Climate, Architectural Form Structure, etc.).
b. Non-Physical Conditions (Needs of UNPAB academic community, culture, local, potential for structural development, etc.).

3.2.1. Place and Time of Research

This research is conducted at Al-Amin Living Lab and Industrial Park in Sampe Cita Village, Kutalimbaru Subdistrict, for a duration of 1 (one) year.

3.2.2. Type and Scope of Research

This research is a qualitative descriptive analysis, within the main plaza area of Al Amin Living Lab and Industrial Park.

3.2.3. Data Collection Techniques

The required data for this research is a Data collection techniques are with a qualitative approach, so the data collection techniques used by the author in this study include:

(1) interviews,
(2) literature studies,
(3) field observations,
(4) documentation,
(5) data validation,
(6) data analysis.

4. Results and Discussion

4.1. Al Amin Living Lab and Industrial Park

Al Amin Living Lab and Industrial Park is designed to become a field laboratory and workshop center that accommodates all study programs at UNPAB. This area is also planned to become Ecoedutourism. In this planning, UNPAB involves all study programs (study programs) in its nature. Basic Concepts The land development meets the needs of UNPAB's learning, practicum, research and innovation center which can become an income generator. Al Amin Living Lab and Industrial Park has 4 main themes: 1. Tri Dharma of Higher Education UNPAB 2. Eco-Tech-Edu Tours 3. Fitrah (Islamic) based education 4. Economic mutualism symbiosis.

Therefore, Al Amin Living Lab and Industrial Park proveides spacess and activities that are mutually sustainable internally and externally. Tri Dharma of Higher Education UNPAB Tri Dharma PT has 3 points, namely Education and Teaching, Research and Development, and Community Service. Al-Amin Living Lab and Industrial Park was developed as a land for educational and learning applications, research and trials of the UNPAB academic community, therefore there are facilities such as workshops, research land provided and can be seen by visitors as UNPAB educational show cases. It is also hoped that with the cooperation of villages and the surrounding community, Community Service can be carried out in the form of cooperation, counseling, and even services so that surrounding villages can become part of PT UNPAB's Tri Dharma application.

Eco-Tech-Edu Tourism The combination and integration of learning across applicable programs is expected to be part of the educational tour of Al-Amin Living Lab and Industrial Park for general visitors. Apart from being a place of entertainment, visitors will be shown and can interact with learning objects so as to understand that technological, educational, and economic developments can take place without leaving religious, spiritual, cultural, and natural sustainability values. Education based on Fitrah (Islam) UNPAB with its pearls of wisdom which aims as a place for human spiritual training will include religious values in all its activities. The concept of halal and tayyib in education, animal husbandry, agriculture, to the creation of a reflection of an independent civilizational ecosystem. Economic Symbiosis Mutualism Economic Symbiosis Mutualism in this case is the participation of the role of the surrounding community in UNPAB Tri Dharma activities through cooperation with villages and surrounding communities. This is aligned with the understanding of UNPAB Living Lab which adheres to the concept of circular economy education based on Islamic and

humanitarian values. The pportunities for the Development of Al-Amin Living Lab and Industrial Park Areas with the concept of Eco-Tech-Edu Tourism that has an understanding of circular economy education (CED) are still very minimal in North Sumatra, Al-Amin Living Lab and Industrial Park can be pioneers in spreading this CED understanding where there is an integration of economic and educational activities that at the same time help preserve nature. Encouraged by the development of the Independent Learning Curriculum (KMB), it is hoped that Al-Amin Living Lab and Industrial Park can become a place for research, service and practicum of the UNPAB academic community that increases awareness of the need for nature conservation. Because Green Technology from across fields of science is still very minimally discussed and is still often partially researched, UNPAB can be an example of integration of fields of science into practical, dynamic, educational and economic value innovations.

4.2. Al Amin Living Lab and Industrial Park

Al Amin Living Lab and Industrial Park is expected not to be exclusive as tourist areas in general, with the concept of CED, Al Amin Living Lab and Industrial Park will not only help become an income generator & source of educational land for the academic community, but also help the welfare of the village and the surrounding community. The idea of Spaces zonning at Al Amin Living Lab and Industrial Park is divided into several areas according to their activities and functions, namely:

Table 1. Al Amin Living Lab and Industrial Park Programming Facilities

Area	Space requirements	
Welcome area	Information centre	Parking
	Gate	Landscaping garden
Rest area	Cafe & restaurant	Marketplace, Product gallery
	Office	Mosque
	Toilet	Garden
Service area, Office & Administrative Area	Generator	Reservoir air
	Garbage bank & hygiene	Control room & security
	Boarding house	Amenities
Educational area research, Workshop & production area	Hall	Museum
	Workshop	Laboratory
	Production & packaging room	
Public recreational area	Camping ground & Picnic area	River tourism
	Outbond & outdoor playground	
Agro-wisata	Agriculture	Animal husbandry
	Processing of production products	Packaging of production
	Waste	

Source: Al Amin Living Lab and Industrial Park

4.3. Conceptual Zonning

The space needs are allocated to development zones as seen in the illustration of the zoning concept planning area below:

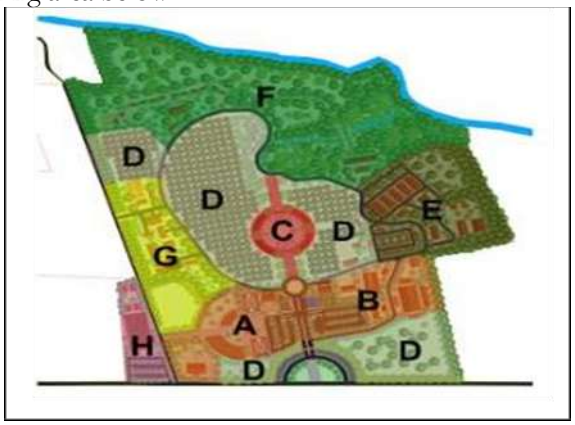

Figure 6. The Zoning Concept of Al-amin Science and Industrial Park Area

where:

A. Reception zone, sports centre, and rusunawa
B. Product Processing Zone and Marketplace
C. Main Plaza Zone and Area Management Office
D. Agricultural and plantation zones
E. Animal husbandry Zone
F. Nature Zone and Outdoor Recreation
G. Service Zone
H. Al-Amin Mosque zone

4.4. Project Overview

The Mixed use building desined at the outer circle of the main plaza of Al Amin Living Lab and Industrial Park. The overall building consist of 4 building part ar each side of the main plaza. therefore it needs a bridge to connect the building and the activities accommodated.

The bridge planed to connected the buildings at the main plaza of Al-Amin Living Lab and Industrial Park in Sampe Cita Village, Kutalimbaru District, is highly diverse and encompasses various aspects that provide significant benefits to the community. The bridge links the buildings in the main plaza, allowing pedestrians to move easily from one point to another without having to traverse vehicle traffic. This enhances connectivity between buildings and encourages people to walk more, supporting a more active and sustainable lifestyle.

The bridge connecting the buildings to the main plaza aims to facilitate pedestrians moving between buildings in a safe manner. It also helps reduce the risk of accidents that often occur on the roads. This building-to-plaza bridge is crucial for providing comfort to pedestrians who want to move between buildings without worrying about crossing the street, as there is already a bridge in place (Nuraini et al., 2022).

The bridge connecting the buildings at the main plaza of Al-Amin Living Lab and Industrial Park in Sampe Cita Village, Kutalimbaru District, is highly diverse and encompasses various aspects that provide significant benefits to the community. The bridge links the buildings in the main plaza, allowing pedestrians to move easily from one point to another without having to traverse vehicle traffic. This enhances connectivity between buildings and encourages people to walk more, supporting a more active and sustainable lifestyle.

The bridge also provides a dedicated path for pedestrians separated from vehicle traffic, thereby enhancing their safety. This reduces the risk of traffic incidents and pedestrian accidents, especially in densely populated urban areas.

4.5. Analysis

4.5.1. Site Location

The planned location of this Mixed Use Building, with an area of 2,865 m2 is in the middle of the Al-amin Science and Industrial Park planning area, in the main plaza area and surrounded by agricultural areas.

Figure 7. The Research Location

The location of the Mixed Use Building design in the center of the area, which is the main gathering point of the Al-amin Science and Industrial Park Area, supports the purpose

of the Mixed Use Building design as a center of activities and information center for the area, not only for those in the Al-amin Science and Industrial Park Area but also for the surrounding community and visitors to the area.

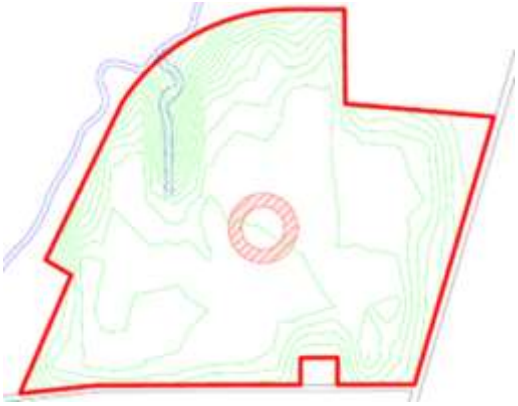

Figure 8. Contour Condition

The location of the Mixed Use building design is on the top contour of a relatively flat land surface area.

4.5.1. Site Position Towards the Grand Concept of the Design

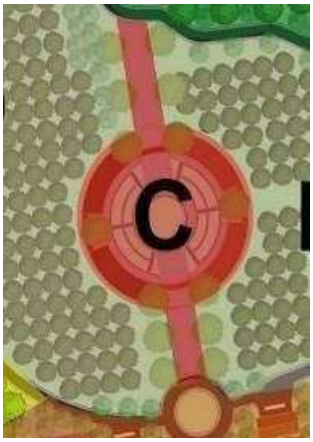

Figure 9. Site Location

In the image above, it can be seen that in the concept of regional zoning, the location of the Mixed Use Building design is in zone C.

The location of the Mixed Use Building site is in the center of the planning area as a center of activity and connecting areas in the area. As seen in the picture below:

Figure 10. Mixed Use Building Site in the Center of the Main Planning Area

The capacity and space requirements of the the Mixed Use Building Connection Bridge at Al Amin Living Lab and Industrial Park consist of:

a. Connecting circulation between Mixed Use buildings
b. Viewing Deck (observation area)

4.6. Design Result

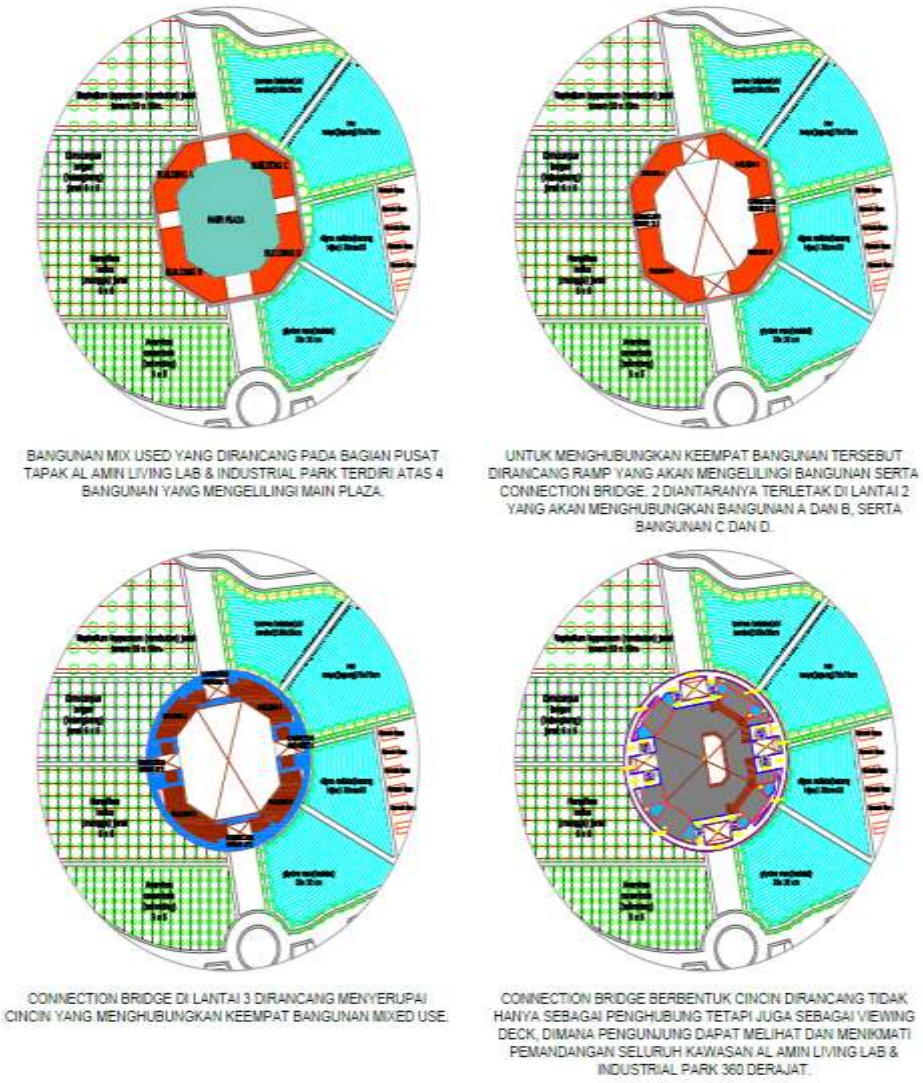

Figure 11. Connection Bridge Design Concept

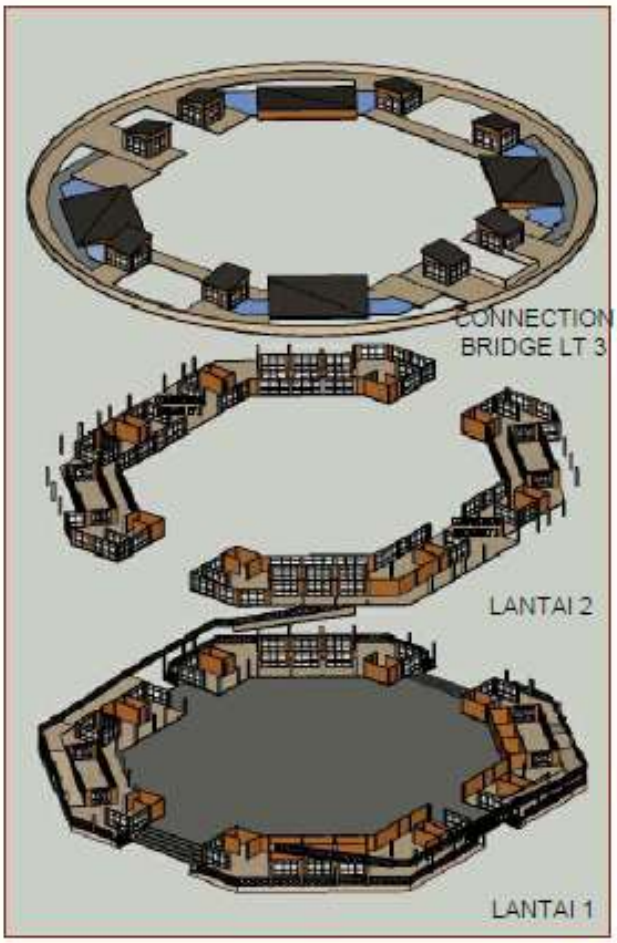

Figure 12. Connection Bridge Isometric

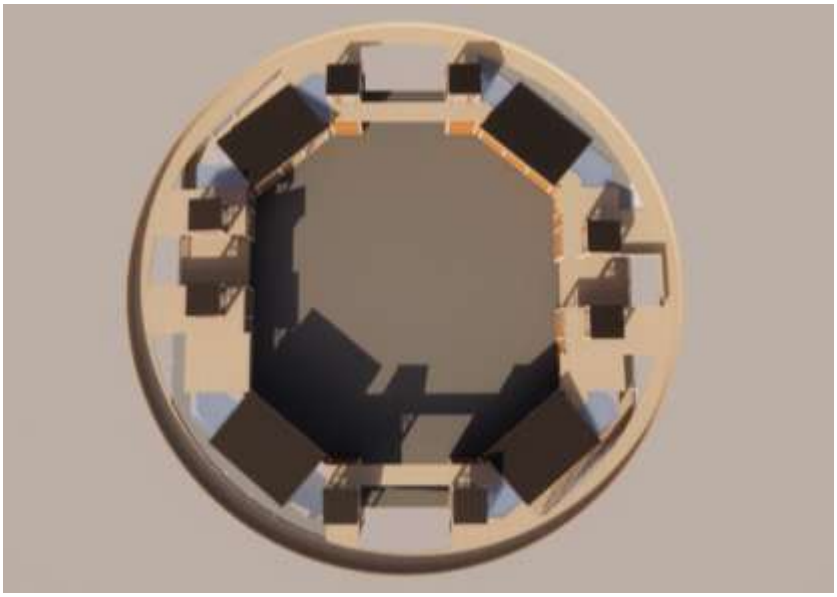

Figure 13. Connection Bridge Site Plan

Figure 14. Connection Bridge Top View

Figure 15. Connection Bridge 3D Illustration

5. Conclusions

The facilities and infrastructure of the Mixed Use Building Connection Bridge at Al Amin Living Lab and Industrial Park consist of:

a. Connecting circulation between Mixed Use buildings
b. Viewing Deck (observation area)

Guidelines for the design of the Mixed Use Building Connection Bridge at Al Amin Living Lab and Industrial Park meet the following criteria:

a. Align with the overall concept of the Al Amin Living Lab and Industrial Park area planning;
b. Harmonize with the design of the Mixed Use buildings at the main plaza of Al Amin Living Lab and Industrial Park;

c. Synergize with the landscape design of the surrounding area, considering the site's location surrounded by agricultural areas;
d. Adhere to intensity, building codes, and applicable regulations;
e. Innovative and implementable in terms of construction and financing;
f. Serve as a focal point and viewing area for the entire Al Amin Living Lab and Industrial Park area.

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