

To cite this article: Adiesty Aininaya and Dwira Nirfalini Aulia (2026). A STUDY ON WELFARE-ORIENTED BUILT ENVIRONMENT DESIGN FOR STRAY DOGS AND CATS IN MEDAN THROUGH BEHAVIORAL OBSERVATION AND ANIMAL-AIDED DESIGN APPROACH, International Journal of Education and Social Science Research (IJESSR) 9 (3): 255-274 Article No. 1246, Sub Id 1907

A STUDY ON WELFARE-ORIENTED BUILT ENVIRONMENT DESIGN FOR STRAY DOGS AND CATS IN MEDAN THROUGH BEHAVIORAL OBSERVATION AND ANIMAL-AIDED DESIGN APPROACH

Adiesty Aininaya¹ and Dwira Nirfalini Aulia²

¹Universitas Sumatera Utara, Department of Architecture,
Jl. Perpustakaan 20155, Medan, Indonesia.

²Universitas Sumatera Utara, Department of Architecture,
Jl. Perpustakaan 20155, Medan, Indonesia.

DOI : <https://doi.org/10.37500/IJESSR.2026.9320>

ABSTRACT

Animal shelters in Indonesia generally focus on basic care such as feeding and housing, while spatial design supporting animal behavior is often overlooked. This study develops a behavior-based design framework for stray dogs and cats in Medan using the Animal-Aided Design (AAD) approach. The research applied a qualitative-descriptive method through structured observations at 35 locations and semi-structured interviews with two veterinarians. The findings reveal that dogs tend to occupy street corridors and garbage areas, while cats prefer shaded spaces and elevated structures. Major stress factors include tropical heat, noise, overcrowding, and poor sanitation. Based on these findings, the study identifies key spatial requirements and proposes a shelter design framework integrating the Five Freedoms principle, AAD, and veterinary health protocols. The framework aims to improve animal welfare, reduce zoonotic risks and human-animal conflicts, and provide a replicable model for shelters in tropical urban areas.

KEYWORDS: Design Concept, Animal Welfare, Built Environment Design, Stray Animal, Behavioral Observation, Animal-Aided Design

1. INTRODUCTION

The relationship between humans and animals can have both positive and negative impacts on the health of individuals, families, and communities, depending on how animals are treated and managed. This relationship can also affect animal health and welfare, cause traffic accidents, attacks on humans, an increase in the number of stray animals that can pose a threat to public health, environmental damage due to disturbance to wildlife, and environmental pollution [5] Garcia et al., 2018

Urban ecology shows that stray dogs and cats are part of the urban ecological system. Cats roaming freely in cities can also be a public nuisance through urine and feces that pollute the environment. They can also transmit various diseases to wildlife, pets, and humans, including spreading toxoplasmosis (*Toxoplasma gondii*) through oocysts excreted in feces [12] Zhang et al., 2022. The same applies to dogs. Dogs can affect human health through bites and pathogen transmission, especially in countries with limited resources, where dogs, including those kept as pets, are generally allowed to roam freely. [2] Silva et al., 2022

Officially published in 1979, the Five Freedoms are global animal welfare standards adopted by international organizations such as WOA (formerly OIE) and WSPA. The main principles include:

1. Freedom from hunger and thirst: Provision of nutritionally balanced feed and ad libitum access to drinking water according to the natural needs of the species.
2. Freedom from discomfort: Provision of a suitable living environment, shelter, and nesting with consideration for optimal temperature, humidity, and ventilation.
3. Freedom from pain, injury, and disease: Emphasis on preventive measures, rapid diagnosis, and appropriate medical treatment.
4. Freedom from fear and distress: Implementation of procedures that minimize trauma and provision of adaptation periods to the environment and technical treatment.
5. Freedom to express natural behavior: Provision of sufficient space, enrichment facilities, and social interaction in accordance with the animal's natural nature.

Animal shelters in Indonesia generally focus on basic accommodation facilities and do not consider the behavioral needs or emotional experiences of animals. In fact, the implementation of this type of design has various positive effects, including the expansion of green spaces, diversification of ecosystem services, and protection of natural habitats. However, there are still few animal-based sustainable designs being implemented, especially at the national level. [8] Tüzen et al., 2023

Animal-Aided Design (AAD) has the idea of considering the needs of one or more target species from the early stages of project planning so that they can become an integral part of the design. Animal-Aided Design (AAD) seeks solutions that meet the needs of both humans and animals and makes animals stakeholders, namely species that are targeted in the design process selected by humans. [6] Weisser et., al 2020

In the book *Animal-Aided Design: A New Approach to Promoting Biodiversity in the City* written by Thomas E. Hauck and Wolfgang W. Weisser (2020), the principles of Animal-Aided Design are as follows:

1. The specifications begin with target species: AAD requires designers to determine target animals at the earliest stage of planning. Animals are not added later as “natural decorations,” but become the main parameters that shape the design of the space.

2. Design must be based on critical life cycles: design must meet critical needs in all life cycles (nesting, foraging, sheltering, transit, and reproduction).
3. Meet the ecological needs of species through design elements: ecological needs must be translated into technical specifications (dimensions, materials, orientation, substrate, and others).
4. Integration of ecological functions with social and technical functions of the city: the design created must be compatible with human use, safety, and city maintenance.
5. Connectivity: Design must form a habitat network (corridors, stepping stones, dark corridors) so that populations can interact and maintain genetic diversity.
6. Mitigation of urban threats (predators, disturbance, light, noise): identify key threats at the site (e.g., cats, lights, human disturbance).
7. Integrated maintenance planning: maintenance schedules must be synergistic with biological needs, and operations manuals must include wildlife-friendly protocols.
8. Regulatory compliance and legal risk assessment: ensure AAD activities comply with species protection laws, building codes, and public safety requirements

Human-animal interactions have been shown to improve the quality of life for both parties, ranging from psychological benefits through activities with dogs to increased serotonin levels from interactions with cats [1] Brown et al., 2020; Uqbah 2019 Therefore, animal-friendly built environment design is a crucial element in sustainable urban development. This study seeks to fill the design gap in Medan by integrating field observations, expert interviews, and the theories of Animal-Aided Design (AAD) and Five Domains to develop a built environment design framework oriented towards animal welfare and positive human-animal interactions.

2. METHODS

2.1 Research Design

This study uses a qualitative descriptive method to describe phenomena systematically and accurately according to field conditions without intervention. This approach is in line with the principles of Animal-Aided Design (AAD), which focuses on observing species behavior and ecological needs to be translated into design strategies. Primary data obtained through field observations and expert interviews were integrated with literature reviews as a theoretical basis. Analysis was conducted inductively by processing animal behavior and spatial patterns data, such as feeding locations, shelter, and stress areas, which became recommendations for applicable architectural designs.

2.2 Population and Sample

Research population: stray dogs and cats in public areas of Medan City, such as Medan Maimun, Medan Selayang, Medan Baru, Medan Tembung, Medan Polonia, and Medan Helvetia. Observation sample: 15 observation points for dogs and 20 observation points for cats.

Expert informants: Dr. Riska Arlisa Fitri, DVM, as a clinic veterinarian at Medvet Animal Clinic, and Dr. Jessy Filomena Fernanda Bento, DVM, as a clinic veterinarian at JJ Vet Care, interviewed using a semi-structured interview on November 17, 2025.

2.3 Instrument

The instruments used in this study included a structured observation form to record time, location, number of animals, activities, environmental conditions, and behaviors. A documentation camera was used to capture visual evidence during field observations. In addition, a semi-structured interview guide was applied to obtain supporting information from relevant informants, and Animal-Aided Design literature was used as a theoretical reference for the study.

2.4 Procedures

Observations were conducted by dividing the sessions into morning, afternoon, and evening. Data were coded into behavioral categories. Interviews were recorded. Triangulation was conducted between observations, interviews, and literature to produce design recommendations.

3. RESULTS

3.1 Field Observation Results

3.1.1 Dogs

Field observations show that stray dogs in Medan most often appear on roads near Temporary Waste Collection Point/TPS. This is consistent with the findings of [2] Silva et al., 2022, who state that roads form pathways for dogs that facilitate movement and often provide access to food sources, such as roadside garbage, garbage collection points, and possible animal carcasses. The observed behavioral patterns recorded during field surveys are summarized (Figure. 1) which illustrates the dominant activities of stray dogs, including scavenging behavior near garbage sources and frequent wandering along roadside areas.

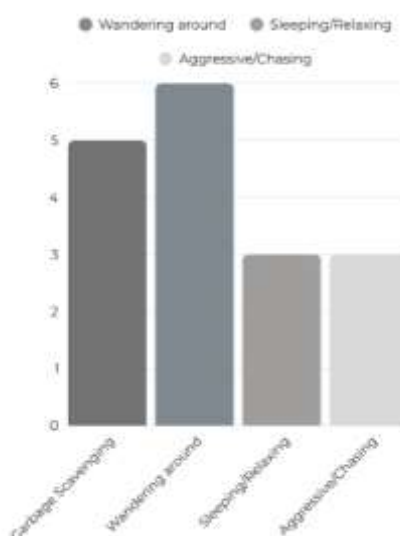


Figure 1: Street Dog Activity in Medan City

3.1.2 Cats

Cats in Medan are most often found in residential areas and campuses in groups and near sources of garbage. The population density of cats in campus areas is relatively high because students on campus often feed and pet cats. [12] Zhang et al., 2022. Cats have a strong tendency to remain in areas where they are fed and show a strong selection for abundant resources and a sense of security. [3] Dunford et al., 2024). [7] Julianti et al., 2021 observed that feral cats tend to utilize anthropogenic resources rather than actively hunting, indicating a complex relationship with potential prey. The daily behavioral patterns recorded during field observations are presented (Figure. 2) showing that gathering or lying down near feeding areas is the most frequently observed activity, followed by garbage scavenging, resting, and eating behaviors.

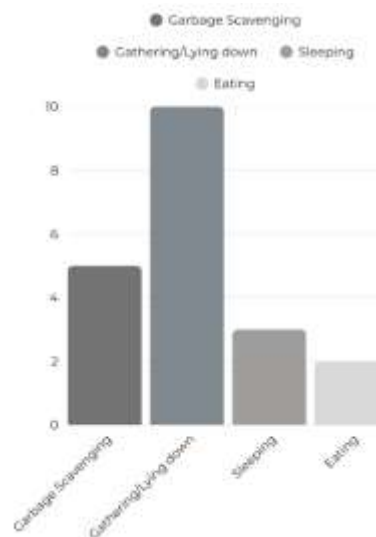


Figure: 2 Street Cat Activity in Medan City

3.2 Interview Results

Respondent are Dr. Riska Arlisa Fitri S.KH (25 years old), clinic veterinarian at Medvet Animal Clinic, Medan, and Dr. Jessy Filomena Fernanda Bento S.KH (25 years old), clinic veterinarian at JJ Vet Care, Bali. The interview took place on November 17, 2025.

Table 1: Summary of Interview Results

Theme	Respondent Finding (Interview)	Preliminary Conclusion
Environmental Stressors	“Sudden noises... that's what usually stresses them out.” (Dr. Riska, 2025) “Noisy environmental factors... and unpleasant odors.” (Dr. Jessy, 2025) “The tropical climate... causes heat stroke, which can lead to seizures.” (Dr. Jessy, 2025)	Sudden loud noises, heat, crowds, and unpleasant odors increase stress and the risk of heat stress.
Behavioral Differences Between Dogs and Cats	“Dogs are usually friendlier than cats.” (Dr. Riska, 2025) “Cats... prefer to be alone.” (Dr. Riska, 2025) “Dogs prefer open spaces... cats... closed and high places.” (Dr. Jessy, 2025)	Dogs are more social, like open areas and playing; cats like climbing, high areas, enclosed spaces, and hiding spots.
Safe / Anxious Indicator	“Its tail is tucked between its legs...”	A tucked tail, dilated pupils,

	they are afraid.” (Dr. Riska, 2025) “It’s fur is standing on end... its pupils are dilated.” (Dr. Riska, 2025) “Its tail is down, its eyes are dull, its body is curled up.” (Dr. Jessy, 2025)	and bristled fur mean fear for dogs; a raised tail and purring mean safety for cats.
Preparedness for Adoption and Socialization	“Once they meet people, they are not afraid... in fact, they sometimes approach them.” (Dr. Riska, 2025) “When... they are about to be fed, they are not overprotective.” (Dr. Jessy, 2025)	Can be adopted if healthy, not afraid of humans, approaches independently, not aggressive.
Spatial and Material Features	“Cats... need to be provided with... materials for them to scratch.” (Dr. Riska, 2025) “Cats... sleep... in places that are somewhat high.” (Dr. Riska, 2025) “Smooth and cold materials... slippery	Cats need places to climb, scratch, and hide; dogs need spacious areas and soft textures; avoid materials that are too cold or slippery.

	metal causes stress in animals.” (Dr. Jessy, 2025)	
The Impact of the Tropical Climate	“Heat stress... can cause them to suddenly have seizures.” (Dr. Riska, 2025) “Their drinking water is warm... they don't like it... they hold back from drinking.” (Dr. Riska, 2025)	High temperatures can cause heat stress, dehydration, and rapid breathing; water must be fresh.
Human–Animal Interaction	“Don't grab them... suddenly.” (Dr. Riska, 2025) “Talk to them, pet them first... to gain their trust.” (Dr. Riska, 2025) “The animal is not stressed... or has finished traveling.” (Dr. Jessy, 2025)	Interaction should be gradual and calm; do not grab suddenly; trauma should be avoided.
Health and Disease Isolation	“An isolation room must be provided... it must not be in the same air circulation.” (Dr. Riska, 2025)	Sick animals must be separated; quarantine ventilation must not be shared; litter

	“Isolation SOP... specialized veterinarian.” (Dr. Jessy, 2025)	boxes must not be shared.
Visitor Management and Animal Movement	“It's okay to let them go... but don't let them into the sick animal room.” (Dr. Riska, 2025) “It's best to stay in the controlled zone.” (Dr. Jessy, 2025)	Healthy animals may roam freely within limits; sick animals must be separated; the risk of transmission from visitors must be controlled.
City Shelter Policy and 5 Freedoms	“At least one shelter per region... reducing overpopulation... sterilization.” (Dr. Riska, 2025) “Separate cages. Unlimited water. Isolation SOP. Focus on the 5 freedoms.” (Dr. Jessy, 2025)	The shelter must be spacious, soundproof, far from residential areas; it must be sterile; population reduction; Five Freedoms standards.

The results of the study show that stray dogs and cats in Medan adapt to the urban environment and tropical climate. Dogs tend to stay in road corridors near food sources (landfill sites) and are

exploratory in nature, while cats prefer residential areas or canteens that provide hiding places and tall structures.

Extreme heat, noise, and crowded conditions are the primary stressors for animals, as confirmed by Dr. Riska and Dr. Jessy, often leading to stress, dehydration, and heat stroke. In terms of interaction, the approach toward animals must be gradual and responsive to their body signals. Animals are considered ready for adoption when they demonstrate the confidence to approach humans independently and are in good physical condition. Furthermore, proper shelter operations must adhere to the Five Freedoms principle, implement a strict isolation system, provide spatial separation based on age and health conditions, and enforce mandatory sterilization to control overpopulation and prevent disease transmission.

4. DISCUSSION

The Animal-Aided Design (AAD) approach places the biological needs of animals at the center of the design process. By combining field observation data from Medan with the Five Freedoms principles, this discussion demonstrates how spatial design can improve the welfare of stray dogs and cats while remaining compatible with urban social functions.

4.1 Determination of Target Species

In this study, stray dogs and cats were selected due to their high population, consistent movement patterns, and frequent interactions with humans in Medan. Field observations indicate that dogs are commonly found near garbage collection points, roadsides, and areas with potential food sources, while cats are predominantly observed on campuses, in residential areas, and within shaded vegetation. These spatial patterns provide an important basis for determining habitat needs and spatial interventions within the design.

4.2 Fulfilment of Critical Life Cycles

AAD emphasizes that spatial design should accommodate the critical life-cycle needs of animals. Dogs typically exhibit foraging behavior around waste disposal areas and roads while resting in shaded locations within residential environments [2] Silva et al., 2022. Therefore, design interventions include protected feeding stations, circular movement paths that simulate natural patrolling routes, and large shaded shelters such as tree canopies or shade structures. In contrast, cats tend to search for food near canteens or residential areas and prefer resting in elevated or enclosed locations such as building edges or dense vegetation. Consequently, the design incorporates vertical structures, hiding boxes, vegetated shading elements, and shaded circulation paths. These strategies support several aspects of the Five Freedoms, particularly the freedom to express normal behavior, freedom from discomfort, and freedom from hunger and thirst.

4.3 Interpreting Ecological Requirements into Technical Specification

AAD requires ecological requirements to be translated into measurable spatial and material specifications. For dogs, soft ground surfaces such as grass or compacted soil are used to reduce surface heat and body pressure, while vegetative acoustic buffers help minimize sudden noises that can trigger stress responses. Wide activity paths allow exploratory movement and social interaction, and wall materials at a height of approximately 30–80 cm are designed with softer or layered finishes to reduce the risk of tail injuries, including Happy Tail Syndrome caused by repeated collisions. For cats, the design integrates scratching elements and play structures to accommodate natural behaviors, along with vertical structures and dense vegetation that provide cooling microclimates and retreat spaces. These strategies support the Five Freedoms by reducing physical discomfort, preventing injury, and creating environments that minimize fear and distress.

4.4 Integration of Ecology with Social Functions of Cities

AAD demands that animal-friendly designs remain compatible with human activities. In ecological terms, dogs and cats can contribute to small-scale pest control by preying on or repelling rodents and invertebrates in human-dominated areas. Their movement patterns may also influence nutrient distribution through the relocation of organic waste and disturbance of soil surfaces, processes that can create localized nutrient hotspots [4] Eldridge et., al 2009. In addition, behavioral changes in animals may function as informal bioindicators of environmental stress, such as excessive heat, noise, or pollution.

From a human perspective, the presence of animals also offers several benefits. Studies indicate that dog ownership encourages physical activity and increases the use of public spaces through daily walking routines [1] Brown et., al 2020. Interaction with animals, including cats, may also contribute to emotional well-being by increasing serotonin levels and reducing stress and loneliness [9] Uqbah, 2019. Furthermore, animals often function as social connectors in public environments, facilitating casual interactions and friendships among people [11] Wood et al., 2020. In certain contexts, animal shelters also provide social protection services, allowing individuals to seek assistance without abandoning their pets [10] Valiyamattam et al., 2022. These interactions illustrate how the Five Freedoms framework can coexist with human-centered urban design through hygienic feeding areas, shaded public spaces, safe interaction zones, and proper sanitation systems.

4.5 Habitat Connectivity

AAD emphasizes the importance of habitat connectivity to allow animals to move safely within urban landscapes. In this study, connectivity is supported through sequential stepping-stone spaces, vegetated low-light pathways preferred by cats, and circulation layouts that avoid dead-end conditions which may trigger aggression or territorial conflict. These strategies enable animals to move freely while reducing stress and supporting their natural behavioral patterns.

4.6 Mitigating Urban Threats

AAD requires the identification of potential threats such as excessive heat, noise, artificial night lighting, predation, and human disturbance. In the context of Medan, the primary threats include heat stress caused by the tropical climate, sudden noises such as vehicle horns that may trigger panic responses, the presence of garbage that can lead to human–animal conflicts, and hot asphalt surfaces that may injure the animals paw pads. To mitigate these risks, the design incorporates several strategies, including tall shading structures, tree canopies, heat-resistant flooring materials, vegetative buffer zones, and minimal lighting along cat pathways. These interventions support the Five Freedoms by reducing environmental discomfort through better thermal protection and ventilation, while also minimizing fear and distress caused by excessive noise and lighting.

4.7 Maintenance and Operations

AAD requires that maintenance and operational practices remain consistent with the biological needs of animals. In practice, this includes implementing regular cleaning schedules, providing litter boxes with an approximate 1:2 ratio, maintaining hygiene at feeding stations, and trimming vegetation without eliminating important habitat structures. In addition, quarantine rooms should be equipped with independent ventilation systems to prevent cross-contamination. These operational strategies support several aspects of the Five Freedoms, particularly the freedom from hunger and thirst through the provision of fresh water and consistent feeding schedules, the freedom from pain, injury, and disease through sanitation and quarantine systems, and the freedom from discomfort through the maintenance of a clean and odor-free environment.

4.8 Risk and Regulatory Compliance

AAD requires compliance with animal protection regulations and public safety standards. Design and operational strategies therefore include the separation of cages for healthy and sick animals, the implementation of waste management standard operating procedures to prevent pathogen transmission, and population control through sterilization programs. Additionally, public spaces within the facility must be designed to minimize risks of bites or aggressive interactions between animals and visitors. These measures contribute to the Five Freedoms by reducing the risk of disease, injury, and distress for both animals and humans while ensuring a safe and controlled environment.

4.9 Location

The location was selected based on the highest frequency of animal sightings during field observations. Of the 35 observation points (15 dogs, 20 cats), the highest concentration was found in Medan Selayang District, specifically at Jl. Bunga Raya 47, Asam Kumbang, Medan Selayang District, Medan City, North Sumatra 20128. Additionally, this location is approximately 10 km from the center of Medan City, aligning with the recommendation by Dr. Jessy Filomena Fernanda Bento, DVM (2025), who emphasized that, *“The location must be suitable, spacious, and soundproof to avoid disturbing nearby residents; it is preferable to be located far from residential areas.”* This location meets both

criteria: it has a high animal presence and is at a safe distance from densely populated residential areas. The spatial position of the selected site within the urban structure of Medan is illustrated in Figure. 3.

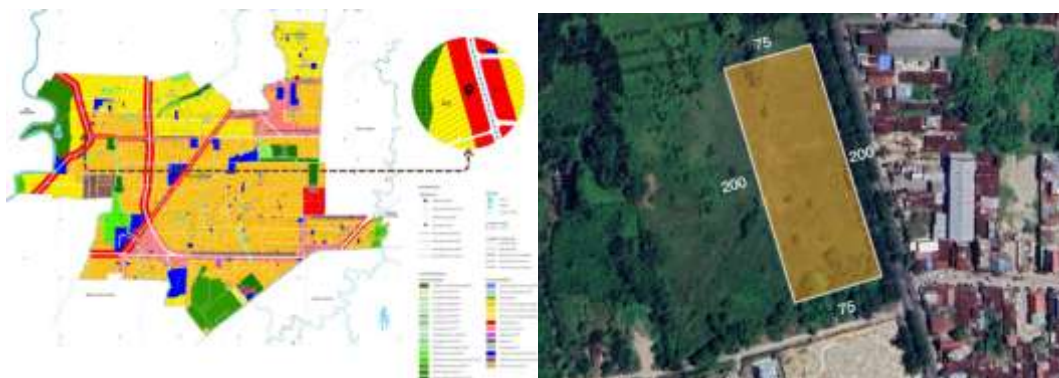


Figure 3: Site Location

The project is located on a site with a total area of 15,000 m² and falls within the Commercial and Services zone (Code Zone: K). More specifically, it is categorized under Subzone K-1, which refers to Commercial and Services at the WP (Wilayah Perencanaan) scale. Based on the spatial intensity regulations, the site allows a Building Coverage Ratio (KDB) of 80%, a Floor Area Ratio (KLB) of 16, and requires a Green Open Space Coefficient (KDH) of at least 20%.

The closeness of the site to Penangkaran Buaya Asam Kumbang provides additional ecological potential in the formation of an urban fauna corridor. The existence of this conservation area indicates that there are still relatively stable fragments of habitat and green space around the site, which can function as ecological stepping stones in the green space network of the city of Medan.

4.10 General Shelter Zone Concept

The zoning of the shelter is arranged in layered and hierarchical sequences to regulate the movement of animals, visitors, and staff while also maintaining proper airflow and sanitation management throughout the facility. The spatial organization begins with the public zone located at the front area of the site, which includes the reception area, adoption gallery, and entrance plaza (Figure. 4). This zone functions as the primary interface between the shelter and visitors, allowing public engagement activities such as adoption processes and educational visits without disturbing the animals primary living spaces.

Moving deeper into the site, the semi-public zone accommodates areas that support interaction but require controlled access, including the pet café and enrichment spaces. These areas serve as transitional spaces where visitors can engage with animals under supervision, encouraging socialization and promoting the adoption program while maintaining the welfare of the animals.

Further inward, the private zone contains spaces dedicated to animal care and operational activities, such as the medical and examination rooms, and isolation facilities. These spaces are intentionally located away from the public circulation routes to minimize stress on the animals and maintain hygiene control within the shelter environment.

Furthermore, the internal organization of the shelter clearly separates the dog zone and cat zone (Figure. 5). Each species occupies designated housing, enrichment, and care spaces within the building layout. This separation aims to prevent disease transmission, reduce inter-species conflict, and create a calm and safe environment for animals while supporting sustainable human-animal interaction within the shelter.

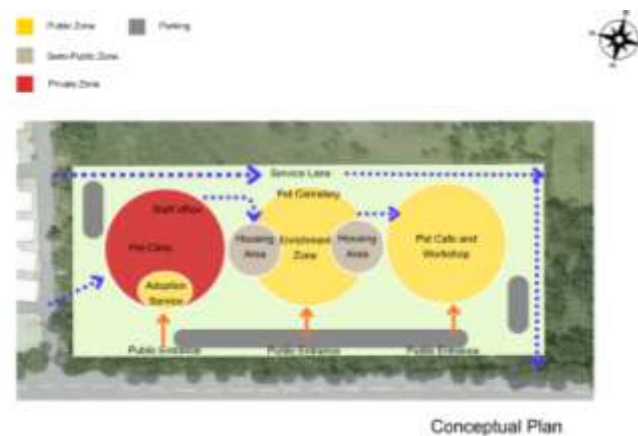


Figure 4: General Shelter Zone Concept

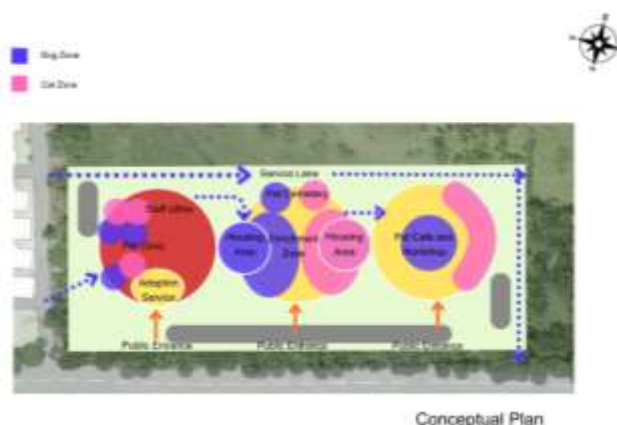


Figure 5: Concept of Division between Dog and Cat Zones

4.11 Concept of Dog Zone

The Dog Zone is designed to accommodate the biological needs and natural behavioral patterns of dogs, including active movement, patrolling, social interaction, and resting in a safe and comfortable

environment in accordance with animal welfare principles. The spatial organization prioritizes both the physical and psychological well-being of the animals while maintaining operational efficiency for shelter management.

The conceptual layout integrates several key functional spaces that support the daily activities and care of dogs (Fig. 6). The adoption service is located near the entrance to facilitate visitor access and allow potential adopters to interact with animals that are ready for adoption. Adjacent to this area is the examination room, which functions as the primary space for medical assessment and initial health checks of incoming dogs.

The central portion of the zone consists of the housing area, where dogs are accommodated in kennels designed to provide sufficient space for basic movement such as standing, turning, and lying down comfortably. These housing spaces are complemented by enrichment areas that allow dogs to express natural behaviors such as running, exploring, and playing. Enrichment spaces are essential to reduce stress, prevent boredom, and maintain the animals' physical and mental health during their stay in the shelter.

Additional facilities include an interaction area in pet café, where supervised interaction between visitors and dogs can take place, as well as a pet café, which functions as a social space to encourage public engagement and support adoption activities. The layout also incorporates a pet cemetery, providing a dedicated and respectful area for burial, ensuring that deceased animals are handled in a dignified and safe manner.

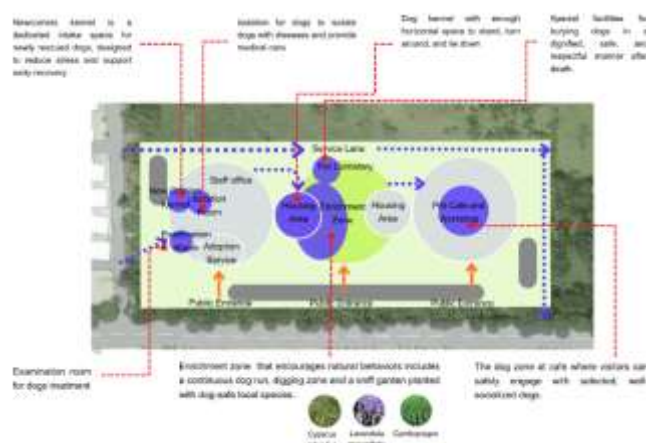


Figure 6: Concept of Dog Zone

Elements and Materials:

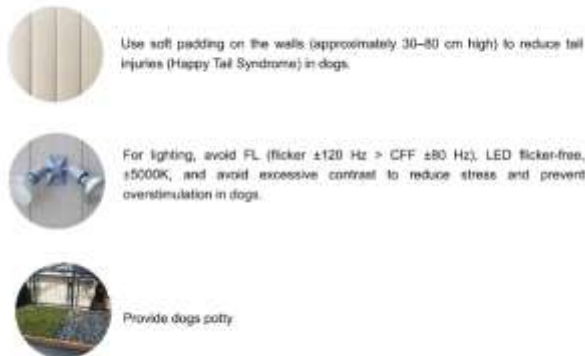


Figure 7: Material for Dog Zone

Supporting design elements for dogs are also integrated to enhance animal welfare (Fig. 7). Such as padded wall surfaces to reduce tail injuries, appropriate lighting systems that minimize flicker and overstimulation, and designated outdoor areas for dogs' sanitary needs.

4.12 Concept of Cat Zone

The Cat Zone is spatially organized to respond to the behavioral characteristics of cats, particularly their territorial instincts, preference for calm environments, and tendency to seek protected retreat spaces. The design therefore emphasizes a balanced environment where cats can explore, hide, observe, and interact within a controlled and low-stress setting. Zoning, circulation, and supporting facilities are arranged to minimize disturbance while maintaining operational efficiency for shelter management.

The conceptual plan is the primary interface between cats, staff, and visitors (Fig. 8). The spatial configuration begins with the adoption service near the main entrance, allowing potential adopters to access healthy and adoptable cats without entering the deeper housing areas. This layout supports a controlled public interaction zone while maintaining the animals' sense of security. Adjacent to the adoption service is the examination room, which provides veterinary assessment and basic medical treatment. Its proximity to the entrance ensures that newly arrived cats can undergo health checks before entering the shelter environment.

Further inside the layout, the housing areas are positioned as the central component of the Cat Zone. These housing spaces are directly connected to enrichment areas, which allow cats to express natural behaviors such as climbing, observing their surroundings, and engaging in light social interaction. The enrichment zones are intentionally integrated within the housing cluster to provide daily behavioral stimulation without exposing cats to excessive human traffic.

The pet café provides a semi-controlled environment where visitors can interact with cats in a relaxed setting. These spaces are designed to encourage human–animal bonding while ensuring that the

animals retain access to retreat areas. Additionally, a pet cemetery is included as a dedicated space for respectful and dignified burial of deceased animals, acknowledging the ethical and emotional aspects of animal welfare within the shelter environment. Green buffers and distributed parking areas surround the complex, helping reduce noise and maintain a calm atmosphere for the animals.

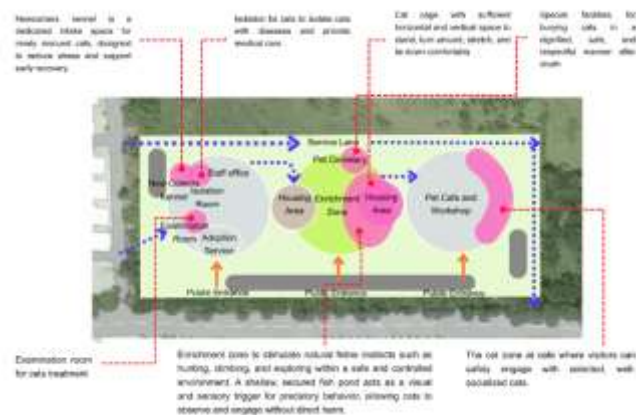


Figure 8: Concept of Cat Zone

Elements and Materials:



Use a synthetic pheromone diffuser to help reduce stress and anxiety in newly arrived cats.



For lighting, Prioritize 4000K LEDs (close to CIE D65 daylight), multi-source lighting (4000K LEDs + 2950K fluorescent + narrow spectrum blue/indigo/dark red LEDs) so cats don't get stressed.



Provide a litter box with a minimum ratio of 1:2.

Figure 9: Materials for Cat Zone

Supporting design elements for cats are also integrated to enhance animal welfare Figure. 9). Such as synthetic pheromone diffusers to create a calming environment for newly arrived cats, combined with well-balanced, low-flicker lighting systems (around 4000K) to reduce visual stress and overstimulation, and provide adequately distributed litter boxes (minimum 1:2 ratio) to support hygiene, comfort, and natural elimination behavior.

5. CONCLUSION

This study demonstrates that the integration of behavioral observation and the Animal-Aided Design (AAD) approach can provide an effective framework for developing welfare-oriented shelter environments for stray dogs and cats in tropical urban contexts such as Medan. The findings reveal

that stray dogs and cats exhibit distinct spatial and behavioral adaptations to urban environments. Dogs tend to occupy roadside corridors and areas near waste disposal sites due to food accessibility and exploratory behavior, whereas cats prefer shaded, elevated, and enclosed environments that provide security and territorial control. Environmental stressors such as excessive heat, noise, overcrowding, and poor sanitation were identified as major factors affecting animal welfare and psychological stability.

The integration of field observations, expert veterinary interviews, and the Five Freedoms principles enabled the formulation of spatial and operational design strategies that respond directly to the biological and behavioral needs of animals. These strategies include species-specific zoning, shaded and ventilated environments, enrichment facilities, circulation systems that reduce stress, quarantine and isolation protocols, and material selections that improve comfort and safety. The study further confirms that animal welfare-oriented design is not only beneficial for animals, but also contributes to healthier human–animal interactions, improved public health management, and reduced urban conflict related to stray animal populations.

From an architectural perspective, this research expands the implementation of Animal-Aided Design within the context of tropical urban shelters in Indonesia, where such approaches remain limited. The proposed framework offers a replicable model for future shelter developments by integrating ecological considerations, operational efficiency, public interaction, and animal welfare standards into a unified design strategy. Furthermore, the study highlights the importance of considering animals as active stakeholders within urban environments rather than passive occupants of shelter facilities.

Nevertheless, this research is limited by its qualitative scope and observation coverage within selected districts of Medan. Future studies are recommended to incorporate quantitative behavioral measurements, post-occupancy evaluations, environmental performance analysis, and long-term monitoring of animal stress indicators to further validate the effectiveness of welfare-oriented shelter design. Comparative studies across different climatic and cultural contexts may also enrich the development of more adaptive and globally applicable Animal-Aided Design frameworks.

6. REFERENCES

- [1] Brown, B. B., & Jensen, W. A. (2020). Dog ownership and walking: Perceived and audited walkability and activity correlates. *International Journal of Environmental Research and Public Health*, 17(4). <https://doi.org/10.3390/ijerph17041385>
- [2] Cunha Silva, L., Friker, B., Warembourg, C., Kanankege, K., Wera, E., Berger-González, M., Alvarez, D., & Dürr, S. (2022). Habitat selection by free-roaming domestic dogs in rabies endemic countries in rural and urban settings. *Scientific Reports*, 12(1). <https://doi.org/10.1038/s41598-022-25038-z>

-
- [3] Dunford, C. E., Loca, S., Marks, N. J., & Scantlebury, M. (2024). Seasonal habitat selection and ranging of domestic cats (*Felis catus*) in rural and urban environments. *Animal Biotelemetry*, 12(1). <https://doi.org/10.1186/s40317-024-00367-0>
- [4] Eldridge, D. J., & James, A. I. (2009). Soil-disturbance by native animals plays a critical role in maintaining healthy Australian landscapes. In *Ecological Management and Restoration* (Vol. 10, Issue SUPPL. 1). <https://doi.org/10.1111/j.1442-8903.2009.00452.x>
- [5] Garcia, R. C. M., Amaku, M., Biondo, A. W., & Ferreira, F. (2018). Dog and cat population dynamics in an urban area: Evaluation of a birth control strategy. *Pesquisa Veterinaria Brasileira*, 38(3), 511–518. <https://doi.org/10.1590/1678-5150-PVB-4205>
- [6] Hauck, T. E., & Weisser, W. W. (2024). *Animal-Aided Design: A New Approach to Promoting Biodiversity*.
- [7] Julianti, S., Qomariah, I. N., Al Anshari, M., Salimah, I., & Widayati, K. A. (2021). Aktivitas Harian dan Perilaku Makan Kucing Domestik Liar di Lingkungan Kantin IPB. *Al-Kauniyah: Jurnal Biologi*, 14(2), 244–253. <https://doi.org/10.15408/kauniyah.v14i2.15730>
- [8] Tüzen, M., & Aycı, H. (2023). The Role of Animal-Aided Design in Sustainable Architecture. *International Journal of Built Environment and Sustainability*, 11(1), 59–74. <https://doi.org/10.11113/ijbes.v11.n1.1195>
- [9] Uqbah, I. (2019). If You Love Your Child, Dare to Scold; If You Love Your Cat, Guarding It. *Journal of Clinical Cases & Reports*, 2(S1), 4–5. <https://doi.org/10.46619/joccr.2019.2.S1-1002>
- [10] Valiyamattam, G. J., Kritchevsky, J., & Beck, A. M. (2022). Demographics and outcome of dogs and cats enrolled in the PetSafe program at the Purdue University College of Veterinary Medicine: 2004-2019. *Journal of the American Veterinary Medical Association*, 260(2), 220–233. <https://doi.org/10.2460/javma.20.09.0522>
- [11] Wood, L., Martin, K., Christian, H., Nathan, A., Lauritsen, C., Houghton, S., Kawachi, I., & McCune, S. (2020). The pet factor - Companion animals as a conduit for getting to know people, friendship formation and social support. *PLoS ONE*, 10(4). <https://doi.org/10.1371/journal.pone.0122085>
- [12] Zhang, Z., Li, Y., Ullah, S., Chen, L., Ning, S., Lu, L., Lin, W., & Li, Z. (2022). Home Range and Activity Patterns of Free-Ranging Cats: A Case Study from a Chinese University Campus. *Animals*, 12(9). <https://doi.org/10.3390/ani12091141>

7. Author Profile



Adiasty Aininaya is 4th year undergraduate student in the Department of Architecture at Universitas Sumatera Utara. This paper was written as part of her final undergraduate project, which investigates how architectural design can be shaped by animal behavior through the implementation of the Animal-Aided Design (AAD) approach. Her research aims to strengthen the integration of animal welfare principles within architectural design, particularly in the development of humane and sustainable shelter environments for stray animals in urban areas.



Dwira Nirfalini Aulia is a lecturer in Architecture Department Universitas Sumatera Utara. She is a Professor in the field of housing and settlements Graduated with an undergraduate degree from the Department of Architecture, University of Indonesia, followed by Master's and Doctoral Degree from the Faculty of Housing, Building, and Planning at University Science Malaysia.