NEIGHBORHOOD-SCALE STRATEGIES FOR SUSTAINABLE URBAN MOBILITY: LESSONS FROM VAUBAN FOR INDONESIAN URBAN NEIGHBORHOODS

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ABSTRACT

Rapid motorization in Indonesia has worsened traffic, air quality, and urban sprawl, while transport policies continue prioritizing road expansion over sustainable alternatives. This study analyzes how Quartier Vauban in Freiburg, Germany, implemented integrated mobility strategies that reduced private car dependence, and examines how Indonesian neighborhoods could adapt these strategies toward more sustainable and resilient mobility systems. A qualitative document analysis was employed, drawing on official planning documents from German and Indonesian authorities, peer-reviewed literature on sustainable transport, and published case studies on Vauban's mobility policies, analyzed thematically to assess transferability to the Indonesian context. Vauban's success stems from demand-responsive parking policies, peripheral collective garages, traffic-calming zones, strong public transport links, and active promotion of cycling and walking, measures that halved per capita transport emissions, improved social equity, and created a quieter living environment. While direct replication in Indonesia is impractical due to differing institutional capacities, socioeconomic conditions, and governance structures, the underlying principles, such as regulatory flexibility, economic disincentives for car use, and community involvement could possibly offer adaptable lessons. Neighborhood-scale policies can serve as catalysts for broader sustainable mobility transitions toward more inclusive, equitable, and environmentally resilient cities.

Keywords: car-reduced development, neighborhood-scale planning, sustainable mobility, urban transport policy, vauban Freiburg

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1. INTRODUCTION

The dominant culture that underpins prevailing discourses regarding the “good life” has been aptly characterized by [1], who highlights the centrality of the automobile within contemporary mobility systems. The widespread availability and use of private cars have demonstrably reduced travel time and distance while facilitating access to goods, services, and economic opportunities. This has contributed to the emergence of a pervasive car-oriented culture. However, as with many technological shifts, the proliferation of automobiles entails both positive and negative externalities. Over time, car ownership has transitioned from a marker of affluence to an almost universal necessity, with vehicle ownership rising substantially in recent decades [2], [3]. Furthermore, the ownership of private cars or motorbikes nowadays has shifted from a symbol of luxury to an essential mode of daily transport—describing a car-dependent urban form [1], [3].

Indonesia, as one of the largest developing countries in Southeast Asia, has experienced particularly dramatic increases in both car and motorbike ownership over the past decades. For example, data from Statistics Indonesia indicate that the number of registered motorcycles rose from approximately 21 million units in 2000 to more than 120 million units by 2020, while private car ownership more than tripled over the same period [4]. This explosive growth has contributed to a series of cascading effects, including

worsening urban heat island intensity, rapid conversion of permeable land to paved surfaces, increased air and noise pollution, and the proliferation of road infrastructure designed primarily to serve automobiles.

These trends have also transformed everyday mobility patterns at the neighborhood scale. Empirical studies have shown that in many Indonesian cities, residents increasingly rely on motorbikes even for extremely short trips of less than one kilometre [5]. This preference is often reinforced by fragmented pedestrian networks, lack of safe cycling infrastructure, and cultural perceptions equating motor vehicle ownership with social status and modernity [6]. As a consequence, urban neighborhoods are becoming progressively less walkable and more car-dependent, undermining public health, social interaction, and environmental quality.

Despite the increasing urgency of these problems, policy responses in Indonesia frequently remain oriented toward large-scale infrastructure investments and technological solutions, such as road widening or traffic management systems, rather than integrated neighborhood-scale interventions. One study emphasized, the neighborhood is the spatial unit where daily mobility decisions are most directly shaped by urban design, infrastructure provision, and social norms [7]. Therefore, neighborhood-scale planning represents a critical leverage point to influence travel behavior and cultivate sustainable mobility practices that can be scaled up to the urban level over time.

Vauban, a district in Freiburg im Breisgau, Germany, provides a compelling example of how integrated, participatory neighborhood planning can successfully reverse car dependence and promote sustainable mobility. Developed in the 1990s on the site of a former military base, Vauban adopted a comprehensive approach that combined high-density mixed-use development, extensive pedestrian and cycling infrastructure, strong disincentives for private car ownership, and active involvement of residents through the Forum Vauban association [8], [9]. As a result, the district achieved car ownership rates of approximately 17%—less than half the average in Freiburg—and high levels of walking, cycling, and public transport use [2].

Given the pace of motorization in Indonesia and its documented impacts—ranging from increased urban heat island intensity to declining air quality and the erosion of neighborhood walkability [7], it is imperative to explore how Vauban strategies to achieve sustainable neighborhood can be adapted to local conditions. Therefore, this study seeks to address two interrelated research aims: first, to analyze how Vauban has implemented integrated mobility strategies that successfully reduced dependence on private cars; and second, to examine how neighborhoods in Indonesian cities could adopt and adapt these strategies to cultivate more sustainable, inclusive, and resilient mobility systems. This study focuses on the neighborhood scale as a unit of analysis. The rationale for selecting the neighborhood lies in its manageable scale, which offers unique opportunities for reshaping travel behavior and cultivating new cultural norms around short-distance mobility. If such approaches are widely adopted across neighborhoods, they can collectively contribute to the realization of sustainable cities. Ultimately, this paper seeks to provide actionable recommendations that can inform governments and other stakeholders in designing transport policies and interventions aimed at reducing dependence on private cars and motorcycles. Such efforts are critical to preventing entrenched car dependency from becoming an irreversible trajectory and the defining characteristic of future transport systems [7].

2. RESEARCH METHODS

This study adopts a qualitative research approach centered on document analysis to investigate strategies for promoting sustainable neighborhood-scale mobility. Document analysis is widely recognized as an appropriate method for exploring complex planning practices and policy interventions, as it enables researchers to systematically review and interpret a range of textual data to derive insights and identify patterns [10]. Data collected from these sources were then analyzed through a thematic coding process: key mobility strategies were identified from the Vauban literature, grouped into thematic categories (e.g., parking management, traffic calming, public transport integration, and community participation), and subsequently evaluated against the Indonesian regulatory and urban context to assess their transferability and potential for adaptation.

2.1 Data Collection

The research relies exclusively on secondary data obtained from three principal sources:

1. Official documents, reports, and planning guidelines produced by government agencies, municipal authorities, and international organizations (e.g., Relevant German Federal and State Laws, Freiburg City Council publications, CIVITAS reports, and Indonesian transport policy documents).
2. Peer-reviewed literature and academic publications on sustainable transport systems and neighborhood-scale planning.
3. Previous case studies detailing the planning, implementation, and outcomes of sustainable mobility policies, with an emphasis on Vauban, Freiburg, as a best-practice example.

2.2 Scope and Focus

The study is delimited to examining the reduction of private car usage for short-distance journeys at the neighborhood level. While the broader concept of sustainable mobility encompasses multiple dimensions (e.g., public transit, walking, cycling), this analysis focuses specifically on strategies that discourage routine car use within residential neighborhoods. To illustrate the possibilities and challenges of such interventions, the case of Vauban serves as the primary reference point for exploring how planning, policy instruments, and community engagement can be combined to support modal shifts [2].

The study does not include primary fieldwork or quantitative modeling. Instead, it aims to synthesize existing knowledge into a set of actionable recommendations that may inform policy development and planning practice. As recommended by [10], this method allows the researcher to derive meaning from documentary evidence while situating it within the broader discourse of sustainable urban development.

3. RESULTS AND DISCUSSIONS

Vauban is a pioneering urban district located in the southern part of Freiburg im Breisgau, Germany. Geographically, the district is bounded to the north by Merzhausen, to the east by the Sankt Georgen district, to the west by the Vaubanallee arterial road, and to the south by the Schönberg hills. This strategic location has enabled the district to integrate urban density with access to green spaces and regional mobility networks.

As of 2020, Vauban has an estimated population of approximately 5,500 residents, inhabiting around 2,000 dwelling units [11]. The district is characterized by a relatively young demographic and a high proportion of households with children. Historically, Vauban originated as a French military barracks area, known as “Quartier Vauban,” occupied by French forces after World War II. Following the withdrawal of French troops in the early 1990s, the land was transferred to the German Federal Government and subsequently acquired by the City of Freiburg. In response to acute housing shortages and in alignment with Freiburg’s environmental policy ambitions, municipal authorities embarked on an ambitious plan to transform Vauban into a model of sustainable urban development [12]. The planning process was guided by principles of ecological construction, participatory governance, and social diversity.

Table 1. Estimated Land Use Distribution in Vauban

Land Use Category	Estimated Share
Residential Areas	40%
Green/Open Spaces (parks, playgrounds, gardens)	25%
Streets and Car-Free Paths	15%
Public Facilities (schools, community centers)	10%
Commercial/Services	5%
Peripheral Parking Facilities	3%
Utilities/Other Uses	2%

Source: Adapted from [2], [8], [9]

The estimation of land use distribution in Vauban can be seen in Table 1. The residential area, including both owner-occupied homes and cooperative housing, takes up to 40% of total area. Most of the areas were used for infrastructures or facilities that favor the active mobility, such as car-free paths, parks for community activities, and public facilities that scattered across the distriict and accessible by walk or bike. Meanwhile, parking only takes up to 3% out of total area, means that car owners need to use longer routes and not all paths are accessible by cars.

The district’s development has been strongly influenced by Forum Vauban e.V., a community-based non-profit organization founded in 1994. This forum became a central actor in shaping Vauban’s vision, facilitating extensive citizen participation, and coordinating communication between residents, municipal agencies, and developers. Forum Vauban organized planning workshops, advocated for car-reduced infrastructure, and implemented neighborhood initiatives to support renewable energy and ecological building practices [12]. Vauban’s recognition reached an international audience when, in 1996, it was selected to represent Germany as a best-practice example of participatory urban development at the UN-Habitat Conference in Istanbul.

The district comprises approximately 600 workplaces distributed across small enterprises, local services, and educational facilities [8]. Urban design in Vauban prioritizes walkability and active mobility. All essential destinations—including schools, shops, and workplaces—are located within walking or cycling distance. The spatial layout features high-density, mixed-use development clusters interspersed with social spaces such as playgrounds and community gardens.

3.1 Lesson Learned from Quartier Vauban

1. Policies and design strategies for sustainable mobility

Key principle of Vauban's mobility system is to create inconvenient experience for private motorized vehicles. The daily destinations are accessible within walking and/or biking distance with connected paths for active mobility across the neighborhood. Based on Baden-Wuertemberg State Regulation (LBO BW § 37) residentials or new development are obligated to provide minimum parking around 1-1.5 spaces per dwelling [13]. Many urban planner confronted this regulation as enforcing car usage and increasing the dependency. However, the German Federal Building Code (BauGB § 11) gives flexibility for municipality level in order to secure planning objectives beyond ordinary code regulations [14]. City of Freiburg takes this opportunity to support their idea of creating sustainable city. Developers in Vauban are exempted from LBO BW 37 where they agreed to build and finance collectively the shared garages. This exemption is implemented to achieve parking space-free living scheme (German: *Stellplatzfrei Wohnen*) with legal framework. Residents who own cars must buy the parking space in the district's multi-storey car park, with cost approximately EUR 17,500-20,000 upfront. Meanwhile, the car-free households are exempted with such declaration and only need to pay EUR 255 annually for administrative cost and maintenance fee of collective garages [15]. The flexibility given by the Federal Building Code creates the demand-based parking rather than supply-mandated parkings, which is more effective way to reduce car use without bans or coercive policies. The car-free households are much more benefited economically than the car-owning households.

The peripheral car parking are implemented in Vauban, where the shared garages are located in the edges of the neighborhood instead of next to residents houses. The choice of garage location nudges the residents to walk, bike, or use the public transport for daily trips (grocery shopping, schools or work) as the cars are not immediately accessible. On the other side, this experience separates cars from home and daily life which reduces car dependency. As the cars may only enter the periphery of the neighborhood, there is also regulation about driving speed. Germany in general, has applied traffic law where the entire residential districts should be designated as 30 km/h zones (Tempo-30-Zone, StVO §45), it is applied in Vauban perimeter access roads [16]. Moreover, most internal neighborhood streets in Vauban are legally designated as traffic-calmed area/play streets (German: *Verkehrsberuhigter Bereich*, StVO §42(3)), means that walking and playing have priority than the moving cars. Drivers must drive at walking speed or 5 km/h, which forms a slow-paced car traffic. By enforcing slow speeds, Vauban reduces the spatial and psychological dominance of cars in the neighborhood and instead encourages walking, cycling, and social interaction in shared spaces. This approach aligns with the sustainable mobility paradigm, which shifts focus away from car-centric planning towards accessibility, equity, and environmental sustainability [17]. Additionally, such slow-speed regulations disrupt what [1] describes as the "system of automobility," which typically depends on high-speed connectivity, spatial separation, and the cultural privileging of car ownership. By intentionally reducing the speed and convenience of driving, Vauban challenges this entrenched system and reshapes everyday mobility practices toward more sustainable and collective modes of transport.

Moreover, the usage of public transport is fully supported. With the distance of approximately 3 km from Freiburg city, the public transport provider—RegioMobilCard—offers significant discounts up to 20%, integrated with the carsharing schemes. This has an impact on 56% of car-free households own at least one card, whereas 47% of car-owning households own such pass [15]. Vauban has two public transport modes, which are trams and buses. Tram lines already extended in 2006 and since then 70% of local public transit trips were made by trams. After the extension, the bus line that was once backbone of Vauban mobility, then restructured to act as a feeder and coverage service, which connect smaller areas that not directly covered by tram corridors. Nowadays, tram acts as the main public transport option in Vauban, with frequency every 7-15 minutes, while local buses 30-minute intervals to cover peripheral stops and late-night services [15].

The integration between public transport and car-sharing provides flexible motor vehicle access without ownership. This scheme is supported by the main provider Stadtmobil Südbaden and local non-profit organization, Freiburger Auto-Gemeinschaft. This scheme reveals the opportunity for car-free residents to still have acess for using cars while still maintains the free ownerships. This has resulted in around 40% car-sharing membership, indicating that the usage of cars are not fully objected, but Vauban has successfully re-configured it into a less car-dependent lifestyles.

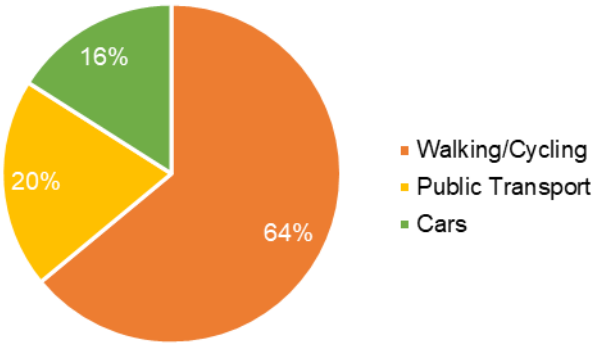

Figure 1. Vauban's Modal Split
Source: Adapted from [18]

The impacts and outcomes from those policies can be seen from the Figure 1 that shows the modal split in Vauban. The Figure 1 describes the mobility behavior of Vauban's residents where most of the trips were made by active mobility (walking and/or cycling). Car ownership rate was less than 150 cars per 1,000 residents, compared to Germany's average of over 500 cars per 1,000 residents [2]. People who own cars and car-free households use their bicycles for 61% and 91% of their trips, respectively [18]. The combination of strong financial disincentive of car ownership and spatial incovinience—or known as push and pull policies—have produced significant and well documented impacts on shifting residents' travel behavior [17]. Meanwhile, [3] also highlights how the driver-car relationship is shaped by ease and immediacy—factors which are intentionally disrupted in Vauban, weakening habitual car use and enabling a reorientation toward active mobility. Moreover, the extension of tram lines support broader evidence that public transport ridership is highly sensitive to improvements in service quality and frequency [19]. While trams and buses work as team, the use of cars is maximized through car-sharing scheme as the last-mile provider.

Beside the on-site results such as reduction in private cars ownership, those policies and design strategies also resulted significantly in environmental and social aspects. Reduced car traffic and higher rates of active and shared mobility have led to significant cuts in CO_2 emissions, air pollutants, and noise levels. A study by [20] estimates that car-reduced developments such as Vauban can halve per capita transport-related greenhouse gas emissions compared to conventional suburban neighborhoods. In addition, separating car storage to the edges of the neighborhood preserves a quiet, low-emission environment in the residential core, contributing to improved microclimatic and public health outcomes [21]. This as well resulted in higher quality of life as Vauban has designated traffic-calmed areas that enforce walking and children playing on streets. This legal framework reclaims the street as public space for play, social interaction, and neighborhood events.

2. Bottom-up decision-making

Vauban's development represents one of the most prominent examples of bottom-up urban planning in Europe. Vauban illustrates how community-driven processes can shape sustainable mobility and urban form. Froum Vauban e.V. was established in 1994 as a non-profit association (eingetragener Verein or e.V.) in Freiburg, Germany, at a time when the city was planning the redevelopment of the former French military barracks area, Vauban Kaserne. Unlike traditional top-down planning processes, Forum Vauban emerged as a grassroots civic platform formed by environmental activists, former squatters, future residents, and urban planners who envisioned a radically different model of neighborhood planning [15].

Initially, many activists had squatted in the abandoned barracks, forming temporary communities that emphasized ecological living, collective decision-making, and resistance to automobile dominance. Recognizing the political opportunity presented by the redevelopment process, these groups transitioned from informal activism into institutionalized advocacy by founding Forum Vauban e.V. The organization's aim was not only to secure space for alternative housing but to embed sustainability, social equity, and participatory planning at the core of the new district's design [9].

Forum Vauban developed a participatory charter and actively collaborated with the City of Freiburg's planning department. It served as a civic intermediary—channeling resident preferences into formal planning negotiations. The group was formally included in the municipal planning process through a cooperation agreement with the city [22], and it received financial support from the City of Freiburg, the Federal Environment Foundation (DBU) and the European Union LIFE programme [18].

Between 1994-2000, Forum Vauban has organized more than 150 events and workshop using participatory approach with local citizens. This method enforce the citizens to co-create the districts. Few key initiatives included the regulations about car-free and car-reduced neighborhood, the integration of

Tram Line 3, supporting housing cooperatives to ensure affordability and social diversity, and promoting sustainable building practices such as low-energy and passive house standards (Forum Vauban e.V., n.d.). Additionally, this forum also managed the coordination among stakeholders including the city, developers, cooperatives, and future residents—effectively functioning as a civil society planning body [23], [24].

Forum Vauban officially ceased its planning role around 2004 as the build-out phase neared completion. However, its legacy continues through the neighborhood association Stadtteilverein Vauban e.V., and many of its principles have been institutionalized in Freiburg's planning approach.

Scholars often cite Forum Vauban as an exemplary case of bottom-up urbanism, where citizen-driven processes directly shaped land use policy, governance structures, and mobility design [15]. The case has become widely referenced in studies of sustainable urban development, participatory governance, and mobility transitions.

Indonesia's combination of high urban density, growing environmental awareness, and the urgency to reduce greenhouse gas emissions provides fertile ground for the adaptation of neighborhood-scale mobility strategies similar to those pioneered in Vauban. For example, compact mixed-use planning, disincentives for private vehicle parking within residential clusters, investments in safe pedestrian and cycling infrastructure, and community engagement can significantly reduce reliance on private motor vehicles. While the socioeconomic, cultural, and governance contexts differ, lessons from Vauban highlight the potential for targeted, place-based interventions to improve urban sustainability outcomes.

3.2 Indonesia Current Situation

Indonesia, the world's fourth most populous country, is experiencing rapid urbanization that has transformed the spatial structure and mobility systems of its cities. According to Statistics Indonesia (BPS), over 56% of the population resides in urban areas—a proportion projected to surpass 70% by 2045 [4]. This demographic shift has been accompanied by substantial growth in motorized vehicle ownership. National vehicle registration data indicate that the number of motorcycles rose from approximately 21 million units in 2000 to over 120 million units by 2020, while private car ownership more than tripled over the same period [4]. This rapid motorization has contributed to widespread challenges in Indonesian cities. Among the most significant are deteriorating air quality, severe traffic congestion, the decline of public transport services, and escalating greenhouse gas emissions.

Indonesian cities often combine high-density settlement cores with sprawling suburban areas characterized by fragmented land uses and limited public space. The built environment in many neighborhoods favors motorcycles and cars, while pedestrian and cycling infrastructure remain inadequate [5]. Even within short distances—less than 1 kilometer—motorbikes are the preferred mode for daily errands, owing to cultural norms, safety perceptions, and lack of continuous sidewalks [6].

Historically, Indonesian transport policies have focused primarily on road expansion and vehicle throughput rather than demand management or mode shift strategies. Initiatives to improve public transport—such as Bus Rapid Transit (BRT) systems—have made progress, but their coverage and integration with non-motorized infrastructure remain limited [5], [25]. Car-oriented development has further accelerated the conversion of agricultural land and permeable surfaces into built-up areas, exacerbating urban flooding and the heat island effect [26].

Unlike Vauban, where bottom-up initiatives such as Forum Vauban played a central role in shaping mobility policies, Indonesian neighborhood planning is still predominantly top-down. Although participatory mechanisms exist in some cities through Musrenbang (community planning forums), these processes often have limited influence over transport investments or land use zoning [27]. As a result, neighborhood-level strategies to encourage sustainable mobility remain underdeveloped, despite clear evidence that they are essential to reversing car dependence and promoting more equitable access to public space.

3.3 Strategies Tailored to Indonesian Sustainable Mobility Practices & Regulations

While the Vauban district of Freiburg presents an ambitious, integrated model for sustainable mobility, directly replicating its strategies in Indonesia requires careful contextual adaptation. Socioeconomic conditions, governance structures, urban form, and institutional capacity in Indonesian cities differ significantly from those in Germany. However, key principles from Vauban—such as demand-based parking policies, peripheral parking, slow-speed zones, active mobility prioritization, public transport integration, and bottom-up participation—remain relevant and potentially transformative when adjusted to the Indonesian context.

1. Parking Management and Demand-Based Provisioning

In contrast to Germany's standardized minimum parking regulations (e.g., LBO BW §37), many Indonesian cities have historically lacked strong regulatory frameworks for parking supply. Where rules

exist, they often reinforce car dependency, especially in middle- to upper-income neighborhoods and commercial districts. Cities like Jakarta, Bandung, and Surabaya have faced rising car ownership without corresponding space management, leading to congestion and spillover parking. Susilo et al. [5] documented how Jakarta's rapid motorization has outpaced infrastructure provision, resulting in chronic road saturation and the encroachment of parked vehicles onto pedestrian space and public rights-of-way. Similarly, studies on Indonesian urban mobility have shown that the absence of demand-side parking management encourages vehicle acquisition by reducing the perceived cost and inconvenience of car ownership, further entrenching car-oriented urban form [6].

Inspired by Vauban's demand-based approach, Indonesian municipalities could shift from supply-oriented to demand-managed parking policies. This would involve (i) removing blanket parking minimums from local zoning codes, especially in areas well-served by public transport, and (ii) introducing paid parking schemes or collective/shared parking structures, potentially managed through housing cooperatives or RT/RW-level community organizations. Pilot projects in new residential developments or TOD (Transit-Oriented Development) zones could demonstrate the feasibility of a "*Stellplatzfrei*" (parking-free) model, supported by legal waivers and incentives for car-free households.

2. Peripheral Parking and Reduced Car Access

The peripheral car parking strategy in Vauban—where private vehicles are stored in district garages away from homes—offers a subtle but effective form of mobility nudging. In Indonesia, a similar concept could be tested in gated communities, kampung revitalization projects, or university housing complexes, where vehicle entry is limited to the outer perimeter, and internal streets prioritize walking and cycling.

This would require infrastructural adjustments and community engagement, particularly to overcome the perceived prestige and convenience of car ownership. However, in dense neighborhoods where road widths are already constrained (such as in Yogyakarta, Malang, or inner Jakarta), designating pedestrianized alleys and calm zones could align with traditional spatial patterns and public support. Low-cost interventions—such as bollards, signage, and greening—could help implement traffic-calmed areas akin to Germany's "*Verkehrsberuhigter Bereich*," especially around schools, markets, and parks.

3. Slow-Speed Zones and Traffic Calming Measures

Indonesia already has legal instruments that can support safer neighborhood mobility, such as the Peraturan Menteri Perhubungan No. 14/2021 on traffic management in residential areas. However, enforcement is weak and implementation uneven. Drawing on Vauban's extensive use of 30 km/h and 5 km/h zones, Indonesian cities can begin designating play streets or kampung zones with maximum 10-20 km/h speeds, coupled with physical traffic calming like speed humps, narrow gateways, and shared space design.

Community-driven implementation is key here. Similar to how Forum Vauban co-created traffic regulations, kelurahan- or RW-level planning forums could be empowered through participatory budgeting to identify zones for play streets, especially where children and elderly residents are vulnerable.

4. Integration of Public Transport and Car-Sharing

Indonesia's cities are undergoing major improvements in public transport infrastructure, such as the BRT systems in Semarang and Yogyakarta, the MRT/LRT in Jakarta, and feeder microtransit systems in multiple regions. However, last-mile connectivity remains a persistent challenge. Research by Susilo et al. [5] highlights that even where trunk transit systems exist, the absence of reliable, safe, and frequent feeder services at the neighborhood level continues to deter modal shift from private vehicles. Poor pedestrian infrastructure around transit stops, limited real-time information, and fragmented network integration between formal and informal transport modes further compound this barrier, particularly in peri-urban areas where low-income residents depend most on affordable connectivity [22].

Taking Vauban's tram-bus integration as inspiration, Indonesian cities should prioritize feeder systems that connect neighborhoods to primary transit corridors, with high frequency and reliability. For instance, deploying angkot reform programs, neighborhood shuttle buses, or e-microtransit that serve as feeders can reduce car dependency in peri-urban and new town developments.

While car-sharing is not yet widespread in Indonesia, motorbike-sharing (e.g., Grab, Gojek) and electric bike rentals could be adapted as flexible modes for occasional motorized travel. Partnerships between local governments and private operators can replicate the Stadtmobil-style schemes, especially in student-heavy areas like Universitas Indonesia or Universitas Gadjah Mada, where demand for flexible, low-cost transport is high.

5. Legal Flexibility and Institutional Support

Vauban's success partly stems from the legal adaptability of the German Federal Building Code (BauGB §11), which enabled Freiburg to deviate from state regulations. In Indonesia, legal flexibility is available through *Peraturan Daerah (Perda)* and RTRW/RTBL (spatial detail plans) that can tailor urban regulations at the local level.

Cities aspiring to implement car-reduced or active mobility neighborhoods must strategically use these local regulatory instruments. For example, RTRW revisions could designate "*Zona Rendah Kendaraan Bermotor*" (Low Motor Vehicle Zones) and embed incentives for developers to support car-free living, such as fast-track permits, FAR bonuses, or tax incentives.

6. Bottom-Up Governance and Community Participation

Perhaps the most compelling lesson from Vauban is the power of community-led planning. In Indonesia, urban planning has often been top-down, but participatory mechanisms exist and can be scaled up: *Musrenbang*, Community Action Plans, and NGO-facilitated urban kampung programs have shown promise.

Local equivalents to Forum Vauban could be nurtured through NGOs, urban labs, or university-community partnerships. Programs like Kotaku (*Kota Tanpa Kumuh*) already demonstrate the potential of community planning in improving infrastructure. Adding a mobility lens—co-created walkability plans, shared parking initiatives, or neighborhood bus route mapping—can integrate mobility justice with ongoing community empowerment.

4. CONCLUSION

The case of Quartier Vauban in Freiburg demonstrates how an integrated approach—combining spatial design, regulatory innovation, economic instruments, and participatory governance—can significantly reduce car dependency and promote sustainable urban mobility. By reallocating space from vehicles to people, implementing demand-based parking policies, and ensuring high-quality alternatives such as walking, cycling, and public transport, Vauban achieved measurable reductions in private car ownership and transport-related emissions. Its success is further underpinned by strong legal flexibility at the municipal level (BauGB §11), the availability of car-sharing schemes, and community-driven planning processes through Forum Vauban e.V., which collectively facilitated a socially inclusive and environmentally responsive neighborhood model.

Although Indonesia's urban context differs substantially from that of Germany—particularly in terms of institutional capacity, income disparities, enforcement mechanisms, and urban morphology—the core principles from Vauban remain adaptable. Strategies such as peripheral parking, speed-reduction zones, demand-based parking provision, and the integration of public transport with informal feeder systems (e.g., angkot or microtransit) can be localized to fit Indonesian conditions. Legal instruments such as local spatial plans (RTRW/RTBL) and participatory frameworks (*Musrenbang*, Community Action Plans) offer existing platforms for policy experimentation. Likewise, neighborhood-scale pilot projects in TOD zones, university campuses, or kampung revitalization programs can serve as test beds for spatial and behavioral interventions that encourage modal shifts without resorting to coercive bans.

Importantly, the success of such strategies in the Indonesian context will depend not only on infrastructure investments or regulatory reform, but also on fostering civic participation and cultivating public trust in the planning process. The Vauban experience illustrates that mobility transitions are most effective when grounded in community aspirations and supported by enabling institutions. Therefore, by embracing a contextualized application of Vauban's principles—emphasizing flexibility, co-creation, and multi-modal integration—Indonesian cities can move toward more sustainable, inclusive, and livable urban futures.

This study acknowledges several limitations that future research should address. The analysis relies exclusively on secondary data, drawing on the Vauban district in Freiburg, Germany, as a primary case study to extract lessons learned, while a review of Indonesian regulations serves to identify existing gaps in the current policy framework. As such, the findings are not directly tested against local conditions, and the transferability of strategies to the Indonesian context remains to be validated empirically.

Nevertheless, this paper contributes to the body of knowledge by establishing a conceptual foundation for mapping best-practice sustainable mobility strategies suited to the Indonesian urban context by bridging international experience with national regulatory realities. Future research is encouraged to build upon this groundwork by collecting primary data from representative neighborhoods in Indonesia, using them as pilot projects to evaluate and refine the most appropriate approaches toward a more sustainable urban mobility system.

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