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Considering a whole-of-community approach to integrating nature in cities, an international case study of Vauban, Germany

Angela C. Reeve^{1*}, Cheryl K. Desha¹, Karlson Hargroves², Doug Hargreaves¹, Peter Newman²

¹ Science and Engineering Faculty, Queensland University of Technology, Brisbane, Queensland

² Curtin University Sustainability Policy (CUSP) Institute, Curtin University, Perth, WA

*Corresponding author. Email: angela.reeve@qut.edu.au

ABSTRACT: Globally, cities face a convergence of complex and rapidly evolving challenges, including climate change, resource shortages, population growth and urbanization, and financial pressures. Biophilic urbanism is an emerging design principle capable of considering the multi-dimensional and interdependent complexities of urban systems and infrastructure, which through the use of natural design features, can meet society's inherent need for contact with nature, and assist efforts to respond to these growing challenges. Considering the imperative for addressing these challenges, this paper proposes that significant lessons can be learned from existing examples of biophilic urbanism, avoiding 're-invention of the wheel' and facilitating accelerated innovation in other areas. Vauban is a 38-hectare brownfield development located 3 kilometers from the centre of Germany's 'ecological capital' of Freiburg city. It was developed using an innovative process with strong community participation and reinterpreted developer roles to produce an example of integrated sustainability. Innovation in transport, energy, housing, development and water treatment has enabled a relatively high-density, mixed-use development that integrates a considerable amount of nature.

This paper discusses Vauban in light of research undertaken over the last two years through the Sustainable Built Environment National Research Centre in Australia, to investigate emerging elements of 'biophilic urbanism' (nature-loving cities), and their potential to be mainstreamed within urban environments. The paper considers the interplay between the policies, community dynamics and innovations in Vauban, within the context of the culture, history and practice of sustainability in Germany, and how these have enabled nature to be integrated into the urban environment of Vauban while achieving other desirable goals for urban areas. It highlights potential applications from Vauban for Australian cities.

KEYWORDS: biophilic urbanism, climate change, community engagement, policy development, Vauban.

1 Introduction

Globally, cities face a convergence of complex and rapidly evolving challenges, including climate change, resource shortages, population growth and urbanization, and financial pressures. Collectively, these challenges are forcing a re-evaluation of the 'business as usual' approach to urban design.

Cities are the epicentres of a nation's economic livelihood, bringing together labour, industry, demand for goods and services, and enabling innovation. Urban populations are rapidly growing worldwide,ⁱ and cities face the task of accommodating the influx of people. The impacts of suburbanization and greenfield development are well documented.ⁱⁱ Hence, governments are increasingly favouring urban infill and increased urban densities. However, there is a need to mitigate the impacts of dense urban environments, which include the

urban heat island effect, increased stormwater runoff and localized flooding, loss of biodiversity and visual amenity, as well as a range of social and psychological impacts.

Biophilic urbanism is emerging as an important urban design principle, which features a range of natural design features that address multiple pressures related to climate change, increasing urban populations, finite resources, and human's inherent need for nature (biophilia). The principle directs the creation of urban environments conducive to life, delivering a range of benefits to stakeholders including building owners, occupiers and the surrounding community.ⁱⁱⁱ As such, biophilic urbanism can contribute to the balancing of density, urban function and liveability. However, a range of barriers prevents its mainstream use.^{iv} In stakeholder engagement workshops held in 2011 as part of the SBEnrc Biophilic Urbanism research project, key

barriers identified to widespread use of biophilic urbanism in Australia included:

- Lack of local evidence and understanding of performance;
- Planning and policy frameworks that don't support inclusion of biophilic urbanism in buildings or neighbourhoods;
- Governance structures that make cross-departmental collaboration difficult;
- Inability to value benefits of biophilic urbanism with traditional economics, and to therefore value these with conventional decision making methods;
- Split incentives for costs and benefits of biophilic urbanism, reducing the attractiveness for private property owners to invest in biophilic elements; and
- Cultural and social inertia to accept or seek new forms of urban design due to a lack of experience with these.

This paper presents the example of the City of Freiburg, Germany, and in particular the inner-city Vauban development, as an example of how a combination of policies enable dense, affordable inner city area with significant green space throughout, and provide insights into how barriers to biophilic urbanism in Australia could be addressed.

Vauban is recognized internationally as being an example of innovative, sustainable urban development. However, much of what has been achieved in Vauban has not been possible elsewhere. Hence, this paper also discusses the drivers and enabling factors that have been important in the development of Vauban, as well as challenges that were overcome, with a view to providing a deeper understanding for how such initiatives might be implemented elsewhere, if they are deemed appropriate given the context with which they were implemented in Freiburg.

2 Freiburg and the Vauban District

Freiburg is known as the 'ecological capital' of Germany, is a hub for innovation, renewable energy and energy efficient design, and has won many national and international awards for environmentally sensitive and sustainable urban design. Vauban is a mixed-used development, 3km from the city centre, built on land formerly occupied by the French military. Planning for the district began in 1992 with extensive citizen engagement. A '*learning while planning*' philosophy provided a context for testing new ideas, and the District was

developed in stages from 1993 up to the final stages being completed today. The 38-hectare site is home to over 5000 residents, 600 jobs, and has the highest density in Freiburg with approx. 130 persons/hectare.



Figure 1: Map of the Vauban district (Source: Lutz, 2012)

3 Policy mix to enable high-density, biophilic urban areas

Competing land use requirements often result in the loss of green space in urban environments,^v especially when the benefits such green space provides cannot be effectively quantified with existing economic valuation techniques.

In Vauban, a combination of a mobility concept that reduces personal car use, and a development model that favours communal space and facilities, have reduced land-use demands and resulted in a high density district with an estimated 20% ground-level green space.^{vi} Vegetation is also integrated into the built environment on roofs, walls and inside buildings, into transport infrastructure (tram tracks), and to replace traditional grey infrastructure (stormwater culverts).

3.1 Mobility policies

The proportion of space in cities typically dedicated to road infrastructure is significant, from an average of 25% in Europe, to 30% in the USA, and as high as 40% in Los Angeles.^{vii} 'Walking cities', however, on average devote only 10% of land to streets and parking.^{viii} Hence, mobility policies are pivotal to balancing density and land use in cities.

The City of Freiburg began actively pedestrianising in the 1970s, supported by a growing environmental ethic amongst the community and a desire to reduce oil dependency in the face of the oil crises during that decade.^{ix} Today, the city has around 30 kilometers of tramlines and 169 kilometers of

bus routes. Over two thirds of the population live within 500 meters of a tram stop, and these come every 7.5 minutes during rush hour. The City introduced measures to ensure these are affordable, with resulting high patronage making this amongst the world's most financially viable public transport systems.^x There are approximately 420 kilometers of cycle paths throughout the city.^{xi} Over 90% of Freiburg residents live on streets where the speed limit is 30 km/hr, with many limited to 7 km/hour.^{xii} Freiburg has an extremely low private car density compared to other major German cities (423 vehicles/1000 persons).^{xiii} These achievements are noted within the context of Freiburg's urban nature – 43% of the borough area is woodland, and 660 hectares of greenspace extend from the outskirts of the city into the city centre – while the City's most recent Land Use Plan significantly reduces land consumption through increasing density.^{xiv}

The Vauban development went beyond these city-wide initiatives. The district Masterplan prohibits parking spaces in residential areas for large parts of the district. As the State of Baden-Württemberg requires that residential properties must all have a car parking space, this required extensive negotiations to reach a suitable compromise. These negotiations were undertaken by the citizen group 'Forum Vauban', as it was the future residents rather than the City of Freiburg that were pushing for the parking-free concept. To accommodate State requirements, communal garages on the periphery of the district are available for residents who choose to own a car, and a parking place must be purchased for approximately €18,500–€22,500 (depending on the garage), being the cost of the land and construction, plus annual property charges.^{xv} 'Car-free' residents pay a one-off charge of around €3,700 to purchase land through the 'Verein für autofreies Wohnen', (Association for Car-Free Living), for the future construction of parking space if in the future they decide to own a car. This land is in the meantime open space used by the community for sport and recreation.^{xvi}

Car reduced living is enabled through a range of practices and planning, including short distances between end uses; mixed-use design - residents can live, work, study, shop and play within the district; easy access to Freiburg city by tram, bus and bicycle within 10-15 minutes; and a car sharing organisation that provides options for occasional car users.

Consequently, 40% of Vauban households don't own a car, and no households have more than one.^{xvii} There is significantly reduced land-use demand in Vauban for road and parking infrastructure. The areas in front and behind residential buildings in Vauban are devoted to private and communal gardens and green space, rather than driveways, garages and roads. In addition, the tramlines in Vauban lie on a belt of grass, noticeably adding to the district's green space (See Figure 2).

3.2 Development processes and covenants

Both the process of designing and developing Vauban, and outcomes from this process, resulted in greater nature being integrated into the district.



Figure 2: Green tram tracks running through Vauban

Processes:

Extended citizen participation through the design and development of Vauban was facilitated by a non-government organization, Forum Vauban. This was begun by volunteers and later received funding that enabled them to create paid positions.^{xviii} Forum Vauban liaised with the City on the District's design and development and managed the publicity campaign, including running over 40 workshops to educate potential future residents about the proposed ideas and benefits that could be expected.^{xix} The

community participation exceeded legal requirements and was an integral component of the plan to test and demonstrate cooperative, participatory urban design to better meet the community needs as well as ecological, social, economic and cultural requirements.^{xx} This built on previous experience in the Rieselfeld development,^{xxi} and had been a feature of urban planning in Freiburg for many years.^{xxii}

Enabling the community to participate in the design and development of the district in which they would live meant that the long term liveability, affordability and sustainability of the district were priorities, rather than more short-term objectives to maximize saleability and profitability that are more dominant in developer-led developments.^{xxiii}

From Vauban's inception, citizens emphasised the importance of integrating green space throughout the district due to the important role they played in the health and wellbeing of residents. The Masterplan incorporated three main green belts, a creek through the southern part of the development, and the preservation of many pre-existing trees, as seen in Figure 3.^{xxiv} Residents were concerned with ensuring the maximum proportion of space was permeable, that the natural water cycle was maintained, and that native vegetation and diverse design allowed for greater biodiversity.^{xxv} Green spaces are multifunctional, providing aesthetic value, shading and giving privacy to the residential buildings, integrating play and learning opportunities for children, integrating wetlands and swales for water capture, treatment and infiltration, and even allowing for some food production (see Figure 4 - **Error! Reference source not found.**Figure 9).^{xxvi}



Figure 3: Preserved mature trees are home to treehouses for the many children in Vauban

There was no cost benefit analysis to support the citizens' contention that such spaces were valuable in the district, and no quantification of the probable performance of nature in the district with respect to managing stormwater, urban temperature, providing food or other benefits. It appears, however, that such an analysis was not necessary. The citizens inherently understood that significant value is provided and fought for the inclusion of the 'biophilic elements' on this basis. Citizens fought for the preservation of some open space in the district as it developed, which would otherwise have been developed to provide greater cost recovery to the City, by working with the City and presenting an argument for the value of maintaining open space to the community.^{xxvii}

The 'learning while planning' concept, and stage-wise development of Vauban over many years, allowed new ideas to be tested in a small section of the District by a handful of willing residents, providing demonstration and learning opportunities for others that informed future stages of development.^{xxviii}



Figure 4: Vegetated swales filter rainwater



Figure 5: Streets are full of children playing, and greened front yards rather than carparks

Baugemeinschaften building projects

Most residential buildings in Vauban were developed by citizen building communities, or 'Baugemeinschaften' (also called Baugruppen). The concept of Baugemeinschaft in the area dates back to the 1920s, however the dominance of centralized planning in the Post-War period limited its contemporary use.^{xxx} The first modern-day Baugemeinschaft development was in Rieselfeld, the success of which led to more extensive Baugemeinschaften in Vauban.

In Baugemeinschaften, future residents design and construct the building together. Residents report that through this process, they develop a relationship with other members that often leads to including communal spaces and facilities that replace private spaces and facilities in each individual apartment. This reduces costs and space requirements and in some cases enhances utility, with apartment buildings having (for example) shared guest rooms, media rooms, function rooms, bicycle facilities, and shared gardens. Secondly, Baugemeinschaft enable greater innovation in building design, as future residents prioritise the long-term performance of the buildings

rather than short-term profits. Households design their apartment to meet their needs, within the bounds of the Vauban Masterplan and Baugemeinschaft agreement, in most cases choosing higher quality materials and design for long-term value. This has resulted in highly energy efficient properties; with the first multi-residence passive houses in Germany were built in Vauban. All houses in Vauban were low-energy, passive-haus, or even plus-energy homes, using 0-30% of the energy of the average house in Germany, which are already efficient by international standards.^{xxx} The District generates 65% of its own electricity requirements through extensive solar panels and an onsite combined heat and power plant (natural gas and waste biomass), which results in an estimated reduction in CO₂ emissions of 60%.^{xxxi} Residents involved in an early passive haus project reflected that they were the kind of people who were eager to undertake such a project and weren't confronted by the inherent risk in being a pioneer in this regard. It was estimated that it then cost 10% more to build a passive house, however in their perspective this was 'common sense', given the long-term energy savings.^{xxxi}

An important component contributing to the success of the Baugemeinschaft model is the City of Freiburg's policy to sell City-owned land for a fixed price, such that tenders compete over the quality of the proposed development and value to the City, rather than over price. The City also has a policy of preferencing Baugemeinschaft rather than developers.^{xxxiii}

The role the Baugemeinschaft model played in enabling a higher proportion of urban nature is less clear. However, the balance between density, functionality and land use appears to be aided by residents creating communal spaces that provide utility with minimal land demand, and by having unbounded (shared) gardens in front of the apartments, creating interconnectivity and a sense of more expansive green space. It is also clear on visual inspection of Vauban that urban nature is inherently valued by residents, as evidenced by nature being integrated onto, into and around buildings.^{xxxiv}



Figure 6: Residents designed greenspaces between their homes, often as play parks



Figure 7: Local businesses are integrated into the District



Figure 8: The Children's Adventure Farm, an initiative by Vauban residents



Figure 9: Residences have shared bike parking facilities

Masterplan covenants

From the early stages of Vauban's development, a range of 'moderate regulations' were in place, as required in Vauban's Masterplan, by the City's marketing guidelines and those that evolved through the consultation process with Forum Vauban. A number of these in particular contributed to the biophilic urbanism in Vauban, including:

- Buildings with flat roofs had to be either fitted with vegetation (i.e. a green roof), or with solar panels (either photovoltaic or solar thermal), with combinations possible.
- Water sensitive design features in and around buildings to capture and infiltrate rainwater (i.e. green roofs, infiltration trenches, green belts, and open space).
- Preservation of existing, mature trees in the District's design.

4 Drivers that enabled this policy mix to emerge

This discussion of drivers and enabling factors that supported the emergence of the urban design principles in Freiburg, and more specifically Vauban, is intended to provide vital background context to this case study, and inform a discussion on the transferability of these principles and practices.

Environmental ethic and community cohesion in Freiburg: Germany was strongly affected by the oil crashes during the 1970s, which catalysed energy efficiency efforts to reduce Germany's oil dependency. 17 nuclear power plants were commissioned throughout Germany, including one near Freiburg. Due to growing public concern about nuclear power, there was a well-supported, bi-partisan protest against this power plant. This united the diverse population of the region, and resulted in a mainstream environmental ethic that is widely believed to have supported on-going initiatives to make Freiburg more sustainable,^{xxxv} and also underpinned the formation of Germany's first Green political party in Freiburg.^{xxxvi} These early catalytic events resulted in several important factors that are thought to have enabled Vauban's development, including:^{xxxvii}

- A strong, bi-partisan environmental ethic, and establishment of businesses related to sustainable energy research and development, reduced-car living, and passive-house design;
- Passionate, empowered and vocal citizens willing to be 'pioneers' and take on the risk of testing the limits of urban sustainability;
- A local government supportive of sustainability and innovation, that was willing to work with citizens;
- Extensive public transport and cycling facilities throughout the city;
- Experience in reduced-car living and innovative sustainable urbanism in the Rieselfeld development and to a degree, throughout Freiburg.

City policies and strategies: Freiburg adopted 4 key principles in the early 1980s in their urban planning which have shaped the form of the City until today. These included.^{xxxviii}

1. A **city of short distances**, where one can walk or cycle to all daily needs to reduce dependence on private cars, and to help build viable communities;
2. To **focus development along public transport routes**, building up density in proximity to existing or new public transport to reduce car dependency;
3. To develop a **diverse, decentralized, socially inclusive city** with viable suburbs. Districts have work, shopping, schooling and leisure integrated into residential areas. Further, areas deliberately avoid

segregation of demographic, socio-economic or cultural groups;

4. **Prevent the future development of big shopping malls** on the outskirts of the city. Such developments make local shops unviable, can 'kill' the suburbs, and force people to drive cars, counteracting progress made by the previous three urban planning strategies.

Land availability: The Vauban site was occupied by the French military after World War II. The land reverted to the German government in 1992, and the City of Freiburg bought this land at a relatively low cost.^{xxxix} By owning the land, the City could plan the development with citizens,^{xi} creating a very different dynamic to commercial developer-led urban developments, and is credited with having enabled many of the innovative aspects of Vauban to emerge.

Existing experience with sustainable development: The earlier development of the Rieselfeld district tested many of the concepts found in Vauban, including reduced-car living, Baugemeinschaft developments, and sustainable housing design. This provided valuable experience and demonstration of these principles, along with Freiburg's 30-year history of pedestrianizing the city, limiting urban sprawl, invigorating life in the suburbs, and increasing the energy efficiency of the building stock.

Barriers to creating this policy mix

There was a range of barriers that needed to be addressed as part of the process of designing and developing Vauban.

Risk taking and breaking new ground: Despite lengthy waiting lists of residents interested in living in Vauban once built, property developers were unwilling to invest in the district once the Masterplan had been developed due to it being an untested concept,^{xi} highlighting how difficult such concepts can be to implement. In Vauban, this barrier was to a large extent overcome by building incrementally on previous experience, and by 'pioneering' citizens being willing to take on much of this risk themselves.^{xiii} The Baugemeinschaft concept also reduced the need for private developers.

Overcoming ingrained beliefs and social norms: In Freiburg, urban planning policies were introduced that directed urban development and transportation in the city towards sustainable, energy efficiency outcomes. These contrasted with the status

quo of other cities and regions in Germany, and some were among the first of their kind. There are inherent economic and political risks associated with implementing new policies and concepts in urban design that can be a significant barrier to such measures. Several key factors that enabled Freiburg to overcome this barrier, including:^{xliii}

Demonstration and time: Acceptance of new ideas is facilitated by demonstration and personal experience, and cannot be forced on people. Governments can assist by enabling individuals who are keen to 'pioneer' such new ideas, such as the early Vauban residents. Many of the concepts trialed in the first stages of Vauban, including higher energy efficiency standards, Baugemeinschaft model, and mobility concept were then adopted throughout Vauban, and later in other cities.

Visible catalysts and challenges: Mainstream change generally requires some crisis as a catalyst, to provide an impetus for people to move away from the status quo. In Freiburg, the proposed nuclear power station, energy crises and Chernobyl disaster highlighted the need for the city to become more energy efficient and sustainable and gave impetus to the people and the City to explore new ideas. These challenges are now viewed as having been beneficial to Freiburg's development, and the City's current dominance in renewable energy research and development.

A champion for new ideas: In Vauban, individual citizen champions (i.e. pioneers) and those within the City Council were responsible for the adoption of more far-reaching initiatives, despite significant barriers.^{xliv}

Incremental change: The adoption of new forms of urban design and lifestyles is often facilitated through the use of intermediary steps towards an end goal, which can take significant time. Vauban's 'learning while planning' and stage-wise development enabled incremental learning and implementation of new ideas.^{xlv}

Confronting lobby groups and vested interests: Many of the urban planning measures introduced in Freiburg (such as restricting urban sprawl and prohibiting the development of large, ex-urban shopping malls) were resisted by development and investment groups. There was furthermore some resistance from citizens, many of whom wanted to have large, US style shopping malls in their City, or to be able to build larger houses on the suburbs of the City.^{xlvi}

The City of Freiburg allowing for a public debate, in which they clearly communicated the rationale for introducing such urban design strategies. They discussed the benefits they would provide, as well as the likely consequences of unfettered 'business-as-usual' development. Of note is that within four to five years, property developers were investing in smaller scale suburban developments. This has perhaps demonstrated that investment will find opportunities and fit within the parameters set by the government, even if there is a period of adjustment.^{xlvii}

Cost recovery: Cost recovery was an important consideration for the City in developing Vauban.^{xlviii} According to members of Forum Vauban, this led to some contention over how certain land should be developed, with the citizens at times pushing to retain open space or green space for public use, and the City preferring to sell the land for development, to enable some cost recovery.^{xlix} Effective communication of alternative proposals for the use of land led to the citizens successfully retaining some areas of open space, which involved communicating the (often intangible) value of such spaces to the community.¹

Meeting state-level legislative requirements: The Baden-Württemberg State planning requirements' had minimum parking requirements for residential areas, posing a barrier to the proposed mobility concept in Vauban. As the push for reduced-car living came from the future residents rather than the city, Forum Vauban undertook extended negotiations with the State and reached a compromise, in which a parking ratio of less than 0.5 spaces per housing unit was allowed, with these spaces located in the peripheral multi-storey car park, and an association established to manage land for the future development of additional car parking, if necessary. A legal framework developed with the City of Freiburg required households to sign a declaration indicating whether or not they owned a car, and if so to purchase a car parking space in the multi-storey garage.

Discussion: What can be learnt from Freiburg's experience

On overcoming lack of local evidence and quantification of performance:

- Grassroots, citizen-led development processes in Vauban are considered responsible for many of the District's innovative concepts, including reduced-car living, extensive use of Baugemeinschaften, and exceeding legal energy efficiency

requirements for buildings, as well as the extensive inclusion of green and open space. Enabling citizens to engage in the development process can introduce a powerful driver for innovation that can somewhat circumvent the need for evidence that such measures may reduce costs or provide a certain degree of benefits.ⁱⁱ

- Enabling pioneers to develop pilot projects as demonstration of innovative ideas, and communicating the outcomes, is an effective way of catalysing their wider use.
- Challenges drive innovation. Increasing the visibility of challenges enables wider understanding and acceptance of the imperative for new ideas and practice. Freiburg City made the challenges associated with a growing population, suburbanization and growing car dependency visible to the people, which provided a background of support and understanding for the need to investigate alternative forms of urban living, including pedestrianisation of inner city areas, investment in public transport, redevelopment of inner-city brownfield areas with high density living, and a need to integrate nature into the built environment.

On addressing planning and policy frameworks:

- Bringing together stakeholders, meaningfully and early on in the development process can ensure there are multiple perspectives on ways to address planning and policy framework barriers.ⁱⁱⁱ In Vauban, a compromise to the parking requirements within state planning legislation was found by providing the citizen group access to official channels to negotiate a solution.
- Enable pilot projects to test small-scale variations to planning laws. By creating a 'demonstration' project of parking-free living in Vauban, such ideas could be tested with willing citizens without needing to immediately address the State-wide planning legislation.
- Consider urban design holistically, to highlight synergies and interactions between aspects of urban design. For instance, in Vauban the mobility concept works due to the district being mixed-use, and in turn supports the City's goals of creating a space for young families (through safer streets and more land available for green/open space for children), higher density living, and to maintain viable suburbs. Similarly, adopting

extensive citizen engagement as a strategy for urban planning, and preferencing the Baugemeinschaft approach, has resulted in greater innovation, enabled demonstration of new urban design concepts, and enhanced urban sustainability.

On valuing externalities and intangible benefits:

- Separately and realistically pricing the costs of car parking in Vauban ensures residents make clear and informed decisions about personal car usage and whether the benefits they receive from this outweigh the costs. Pricing this externality contributes to lower car usage, and lower housing costs for those who chose to be car-free.^{liii}
- Extensive citizen engagement in the development process in Vauban resulted in 'public' benefits being prioritised, even when they couldn't be economically quantified, such as the importance of green space to the health and wellbeing of residents, or the value of 'streets for living'.
- The Freiburg City policy of fixing the price of land sold by the City, such that tenders are assessed on the basis of the overall value they provide to the City, means that some externalities of urban development are considered and 'valued' in the urban development process.

On overcoming split incentives:

- The Baugemeinschaft development model overcame the issue of split incentives in building development, as future residents design and build their own apartment and could prioritise the long-term performance of the building rather than short-term profits. This furthermore allowed for greater innovation and 'risk-taking' in design, trying new ideas that a developer may not, for fear that the concept may not attract buyers.
- The sale of city owned land at a fixed price better aligns property development goals with public interest, as bidders must compete for the land in their tenders by providing value to the City and the public.

Cultural and social inertia

Several important emerging elements that facilitated social acceptance of new ideas in Vauban include:

- Demonstration of new concepts: Vauban was itself a demonstration of higher density living, and the reduced-parking mobility concept. Ideas tested in the first stages were more

readily adopted in following stages, and in other cities in Germany.

- Effective communication of outcomes: Workshops run by Forum Vauban helped educate future residents about the benefits of the proposed design, and the outcomes of the early stages of development.^{liv} By contrast, sensationalist coverage of Vauban in the popular media with often presents this as an 'environmentally extreme' lifestyle has marginalized the notion, and at times failed to capture the holistic benefits the Vauban model provides, potentially limiting its broader application.^{lv}
- Don't force the change, but celebrate the benefits it brings: Many residents living in Vauban advocate a softer path, in which the urban design concepts are not forced on others, but the benefits are widely celebrated. Some consider that the conversation is too frequently dominated by a discussion of 'how do people live with reduced access to cars', rather than highlighting how children have more freedom to move around the district, that they have more greenspace and fewer roads, and that such a high proportion of residents cycle, walk or take public transport to work. The cost savings of car-free living, or even parking-free living, are often obscured by an interest in the cost of purchasing a car-parking spot, despite equivalent costs being integrated into the cost of at-home parking in other areas.^{lvi}
- Support and enable pioneers: Those involved in Vauban's development suggest that there are always people willing to create such projects, and require only that the government provides the context and permission to do so.^{lvii}

4 Conclusions and recommendations

The case study of Freiburg, and in particular the Vauban development, provides insights into both processes and principles in urban design that can balance density with liveability, enhance urban sustainability, and enable innovation and the application of new ideas. More specifically, guidance as to how to integrate nature into a dense built environment can be found from an inspection of the Vauban district.

Key learnings from this case study, with respect to Australian efforts to increase biophilic urbanism, include that a multi-policy focus can enable synergies between policy goals and support the adoption of new forms of

urban design; that meaningful, extensive and early citizen engagement in the design process can potentially overcome a lack of local evidence and economic quantification of benefits; the Baugemeinschaft model of property development reduces split incentives and can lead to space efficient, lower cost design that enables more surrounding green space; and that the adoption of new ideas can be best facilitated by governments by supporting pioneering citizens to demonstrate these ideas, and effectively communicating the benefits this brings more widely.

The 40-year history of urban greening, energy efficiency, environmental activism and innovation in Freiburg no doubt underpins the success of Vauban's development, however learnings from this study may help reduce timeframes to achieve similar outcomes elsewhere. Certainly, the example of Freiburg and Vauban demonstrates how high-density living, with reduced personal car usage and increased citizen involvement can provide wide ranging benefits that are heartily supported by those who live there.

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