



CASE STUDY

Vauban

FREIBURG, GERMANY

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VAUBAN SITE FACTS

Developers: Multiple, mainly small building cooperatives

Architect: Kohlhoff & Kohlhoff (masterplan)

Construction Began: 1998

Year Completed: 2010

Population: 5,000

Total area: 41 ha

Density: 122 persons / ha

Net Housing Density: 95 / ha

Housing Units: 2,000

Jobs On-site: 600

Distance from City Center: 3 km

Parking Spaces/Residence: <0.5

Cars: 160 per 1,000 residents

NMT Mode Share: 64%

Transit Mode Share: 19%

Households with Carsharing Membership: 39%

BACKGROUND

Vauban is one of the most celebrated “model sustainable districts,” comprising 2,000 low-energy homes in an attractive location in the foothills of the Black Forest in Freiburg, south-west Germany. It is a car-reduced brownfield redevelopment with parking-free residential streets: car ownership and use are half that seen in a comparable reference district.

A bottom-up approach to the planning of Vauban was taken from the outset, with groups of potential residents (including those who lobbied for the adopted street design) designing their own homes on allocated plots of land alongside established developers. This has resulted in an architecturally diverse and colorful district with a strong sense of community (Photo 1). With its relatively high density, high standards of thermal insulation¹ and the use of solar energy, renewable woodchip district heating, generous green space provision and communal gardens, Vauban has become a magnet for urban designers and students of architecture.

Vauban, like Stellwerk 60 in Cologne, limits and separates parking from the majority of housing units, but car access to residential streets is permitted for picking up and dropping off (Figure 1).

¹ 65 kWh/m² maximum, with 100 “passive houses” requiring only 15 kWh/m².

PLANNING PROCESS

In 1992 the City of Freiburg held a masterplanning competition for a new mixed-use eco-suburb on 70 ha of previously-developed land on the western edge of the city. This became Rieselfeld, a brownfield redevelopment project with 3–5 story energy-efficient buildings, on-site services and jobs, no through traffic, traffic-calmed streets and a new tram line, which opened in 1997. The same model was to be applied to Vauban, a 41 ha site vacated by the French army in 1992. However, a group of local environmental campaigners formed the association Forum Vauban in an attempt to introduce more radical design measures into the masterplan, explicitly to deter car use and create safe streets where children could play safely. This led to the design of Vauban’s characteristic U-shaped streets off a main thoroughfare, with no on-street parking in front of homes in the first and second phases of the development.

A key principle of the Forum Vauban masterplan was that car use should be less convenient than the alternatives. But planners were prevented from completely restricting parking because the Baden Württemberg Land law requires every home to have access to a parking space. Forum Vauban, negotiated a compromise resulting in a parking ratio of less than 0.5 per housing unit, with most parking located in parking garages on the edge of the district. Pricing for the spaces was based on land value and the cost of construction. A legal framework to satisfy the City was drawn up, in which residents of

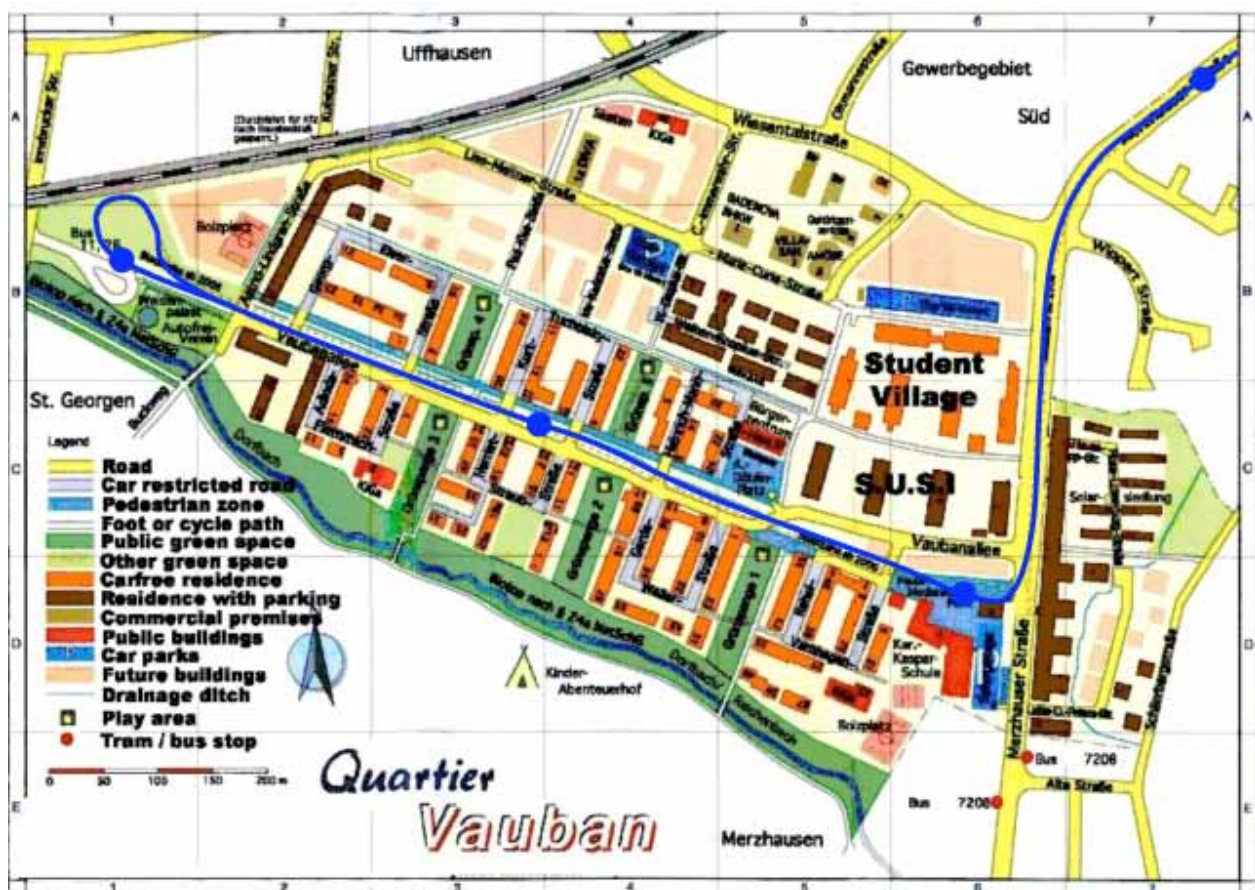


Figure 1: Site plan. Parking-free blocks are in orange and tram route 3 is indicated by a solid blue line. Car-owning residents of the parking-free blocks must park in one of the peripheral garages.

parking-free streets have to purchase a parking space in one of two peripheral parking garages, initially costing 16,000 EUR plus a monthly service charge. If residents wish to avoid paying this fee, they must prove they will not own a car by signing a legal declaration to that effect. However, in order to comply with State laws, the development was still required to set aside land to provide for expansion of parking facilities if future demand requires it. Residents had to help fund this, to the tune of 3,500 EUR. An Association of Carfree Living was created to administer this system. To this day the City of Freiburg does not publicly support the parking-free streets model, serving as a reminder that such radical initiatives are only likely to be considered if grassroots campaigns to demand them are mounted by the electorate.

The architects Kohlhoff & Kohlhoff of Stuttgart blended the ideas of Forum Vauban into the final masterplan shown in Figure 1. A lengthy waiting list of potential residents for the parking-free streets formed rapidly after publication of the final masterplan, but risk-averse developers were unwilling to invest in such an untested concept, despite the cost savings associated with not building expensive underground parking. Forum Vauban was tasked by the City to help coordinate groups of interested architects, residents and financiers into building cooperatives (“Baugruppen” in German), each being sold small plots of land on which to build housing consistent with the densities and minimum energy standards set out in the masterplan and Freiburg’s planning regulations. Uptake was enthusiastic, with this model of development accounting for most of the buildings constructed in the first two phases of development, which commenced in 1998 and was completed by 2004.

Although most of the original military buildings were demolished, three were incorporated into the new Vauban: “Haus 37” became a pub and offices, accommodating Forum Vauban and the Association for Car-free Living; a second block formed part of the student village; and a third became part of the S.U.S.I. low-cost, communal living (co-housing) project. Around 10% of all homes are social housing (rented to low-income residents at below market rates), with the remainder almost entirely owner-occupied. One part of the first construction phase was provided with bundled underground parking (grid ref. B5 in Figure 1), and third phase blocks at the western end of the site (marked in brown on the map) also include underground and some on-street parking. Construction was completed in 2010, later than anticipated owing to the global economic downturn. Although Forum Vauban has been dissolved, a thriving residents’ association known as Stadtteil Vauban continues to promote the area and organise events such as a summer festival.

KEY POLICY AND DESIGN MEASURES

Vauban limits car use through parking-free residential streets, spatially and fiscally separated parking and filtered permeability to prevent through traffic. Attractive alternatives include: frequent rail-based transit system and extensive, high quality non-motorized transport infrastructure.

Urban Design

Street design

Vauban is fully accessible to private motorized traffic approaching from the east, but parking is not permitted on the U-shaped streets

FREIBURG TRANSPORTATION POLICY

Freiburg’s achievements in sustainable transport since the 1960s include the exclusion of cars from the historic city core; an air quality environmental zone since 2010; reduced city centre car parking with fees of up to 2.20 EUR per hour; extensions of the tram system to Rieselfeld and Vauban; a doubling of local “S-Bahn” train frequencies; re-building of the main rail station to include a new transit interchange and 1,000-space bike storage facility; city-wide 30 km/h or lower speed limits; and “naked junctions” that force drivers to negotiate them at low speed.

Freiburgers have elected a Green Mayor since 2002, suggesting strong local eco-awareness and popular support for “green” transportation policies (Photo 2).

serving the blocks shown in orange in Figure 1. These roads are around 4 m in width (including drainage channels) and are signed “Stellplatzfrei” play streets, meaning “no parking places” (Photo 2). Vehicles must be driven at walking pace, giving priority to other road users, and may stop only for the purposes of picking up and dropping off. The same rules apply to streets around the residential blocks shown in brown in Figure 1, which are provided with on-site underground parking. In the absence of parked cars, these roads are used as social space, especially by children, many of whom can be seen playing unattended.

A boulevard for pedestrians and cyclists runs along the north side of Vaubanallee, with a further network of non-motorized traffic routes on the northern side of the development. Fixed posts prevent unauthorized access by car users.

Direct access to the neighboring district of St. Georgen from the western end of Vaubanallee is only possible by non-motorized modes, preventing through traffic and thus a major source of noise, air pollution and danger (Photo 3).

Land Use

Residential buildings in Vauban are of four or five stories, with a net density² of approximately 95 units per hectare.

Several large green spaces separate the residential blocks, providing recreation areas for the many young families in Vauban and contributing to urban cooling.³ On the other side of each block are communal (non-fenced) gardens (Photo 4).⁴ Additional greenery and walking trails adjoin the stream forming the southern boundary of the site, providing yet another draw for families and minimizing the need to travel out of the district in search of pleasant recreation areas (Photo 5).

A supermarket, neighborhood grocery store, two cafés, pub-restaurant, fast-food take-away, bakery, offices, doctor’s surgery,

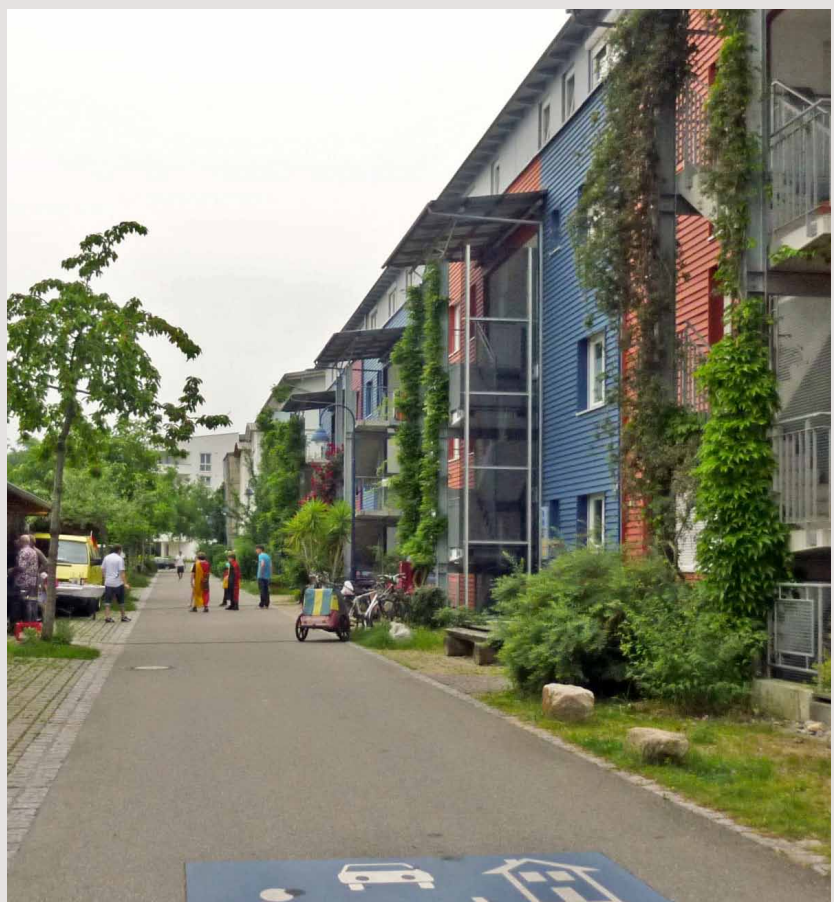
² Inclusive of green and other open space

³ The opposite of the urban heat island effect caused by heat-radiating hard surfaces

⁴ A local law entitles all Freiburgers to rent small (off-site) allotment plots for a low fee



1
Distinctive
architecture and
car-free streets
in Vauban



2

A “play street” where the primary use is walking and playing. Motor vehicles are permitted but must travel at walking speed.

3

Cars are discouraged from many streets, and additional greenway paths make walking and cycling even more direct and convenient.



4
Inner courtyards
and communal
gardens



5
Public space
and bicycle
paths



6

Freighburgh's tram system was extended to Vauban in 2006. All households are within 400 m of a tram stop.



7 Tram tracks on Vaubanallee

Trams run on unpaved surfaces to help reduce noise and mitigate stormwater runoff.



8

Tram and bus stop at the western entrance to Vauban, showing access restrictions, “bike and ride” parking and direct interchange between bus and tram.

pharmacy and primary school are all located along the main spine of the development. In addition, an organic supermarket, cosmetics store and discount supermarket are all located on Merzhauser Straße. A public square in front of the pub is used for a weekly farmers' market and community events.

Parking

The overall residential parking space to unit ratio is less than 0.5, provided with underground and street parking in three parts of the development, and a total of 470 spaces in two peripheral parking garages. Residents of the "parking-free" blocks (orange in Figure 1) must either sign a legal contract with a specially created Car-free Living Association, agreeing not to own a car, or purchase a space in one of the two garages on the edge of the district. These offer a total of 470 spaces, each of which currently costs 18,500 EUR (Solargarage) or 22,500 EUR (Glasgarage) (Linck, 2010: pers. comm.), with a further monthly maintenance charge of 70 EUR. Almost all residents of the "parking-free" blocks live closer to a tram stop than one of the car parks, helping to influence modal choice in car-owning households, especially for short trips. This demand management effect is reinforced through inner city car parking fees of up to 2.20 EUR per hour.

Public parking for non-residents is available in the form of 220 metered spaces on Vaubanallee and in the garages. Enforcement of parking and vehicle ownership restrictions is the responsibility of the Car-free Living Association, and thus far has been limited to taking legal action against two residents known to own a car despite claiming otherwise.

Parking infractions are not evenly distributed across Vauban, perhaps reflecting varying levels of community pressure on neighbors to abide by the rules. Unfortunately the problem is particularly noticeable in some blocks, where significant numbers of residents park in front of their homes. The absence of police or local authority enforcement is thought to be a source of frustration for those who moved to Vauban for the benefit of an essentially car-free immediate environment.

Public Transportation

Transit routes to Vauban are summarized in Table 1 below. An extension of Freiburg's tram system to Vauban opened in 2006, connecting the district with the heart of the city and the rail station in 14 and 18 minutes respectively (Photo 6). No home is more than 400 m from a stop and all trams offer step-free access. Since 2009 the municipal transit operator has purchased "green energy" to power the tram system, and many vehicles use regenerative braking to return energy to the overhead wires for use by other trams. Approximately hourly night buses operate at weekends, and a longer-distance bus route to the rural Hexental area runs at least at least every hour seven days a week. Land has been set aside for a local rail station (grid A2 in Figure 1), but a lack of capacity means this must wait for the completion of track doubling on the main line to Switzerland.

Trams run on a grassed central reservation along Vaubanallee (Photo 7): this contributes to noise reduction and decreases the amount of impervious surfaces and run-off, it is also aesthetically pleasing. A shelter, timetable, map and real-time electronic departure information are provided at all tram stops throughout Freiburg.

Table 1: Transit routes to and from Vauban

Route	Stops served	Mon – Sat daytime frequency (mins)	Mon – Sat evening frequency (mins)	Sun frequency (mins)
Tram 3 to city center and rail station	Three stops along Vaubanallee	7.5 (10 Sat. p.m.)	15	15
Bus 11 to rail station, conference center, large IKEA store	Innsbrucker Straße (at western end of Vauban)	30 (irregular Sat p.m.)	No service	30

VAG Freiburg

Table 2: Vauban compared to the reference district Rieselfeld

	Vauban	Rieselfeld
Population	5,000	9,000
Area (ha)	41	70
Population density (persons/ha)	122	129
Jobs per resident	0.12	0.09
Cars per 1000 residents	160	299
Car parking spaces/residential unit	< 0.5	1.2
Transit journey time to city center (mins)	14	19
<i>Mode share for all trips</i>		
Car	16%	30%
Public transit	19% *	25%
Bicycle/walking	64%	45%

EC, 2010;
Nobis, 2003;
Stadt Freiburg
Statistics, 2010

* prior to opening of the tram extension to Vauban

Tickets are available from convenience stores, in-vehicle ticket machines (coins and some debit cards only) and from tram drivers.

Freiburg has developed a reputation for innovative, low-cost ticketing since the introduction of transferable monthly passes in 1984, which led to a doubling of transit patronage in the decade that followed (*Fitzroy and Smith, 1998*). Fares include:

- City single ticket, valid for 1 hour: 2.10 EUR;
- 24-hour city ticket: 5.30 EUR (1 adult and up to 4 children), or 9 EUR for up to 5 adults;
- Transferable monthly season ticket for the Breisgau region: 47.00 (or 41.10 EUR per month as part of an annual subscription).

A further benefit for RegioKarte holders is free travel for a second adult on Sundays. These fares are low in absolute terms, and compare very favorably with the monthly Vauban car park service charge of 70 EUR. In addition, residents in the first parking-free block to be constructed were given a free annual RegioKarte and national rail discount pass upon moving in. Transit services and fares are coordinated by the Regio-Verkehrsverbund Freiburg (RVF) agency, which has a comprehensive website with timetables, fares, maps and a sales portal for single-trip and one-day cell phone e-tickets. “Mobility guarantees” are offered by the municipal transit operator and RVF, offering free taxi rides in the event of missed connections and delays.

Pedestrian and Cycling Infrastructure

The district has been designed to make access by non-motorized modes safe and pleasant, with a dedicated network of streets free of motorized traffic (described above). Every home has at least one bike parking space, often in secure cellars accessed by ramps. A community bicycle repair store offering free labor is located within the district.

Both the city center and rail station are reachable in about 12 minutes by bicycle, with good on-road and sidewalk cycle lane provision (Photo 8). A leafy, lightly-trafficked lane through the city vineyard is a popular alternative route during the hours of daylight.

Carsharing

Twelve carsharing vehicles are available across Vauban, five of which are located in the solar parking garage. The not-for-profit Car-Sharing Südbaden Freiburg organization offers a total of 80 cars across the city. Annual membership fees are 350 EUR for an individual, or 600 EUR per household; usage fees vary by length of rental, distance travelled and vehicle class, with no hourly fee for overnight use (when transit service is limited).

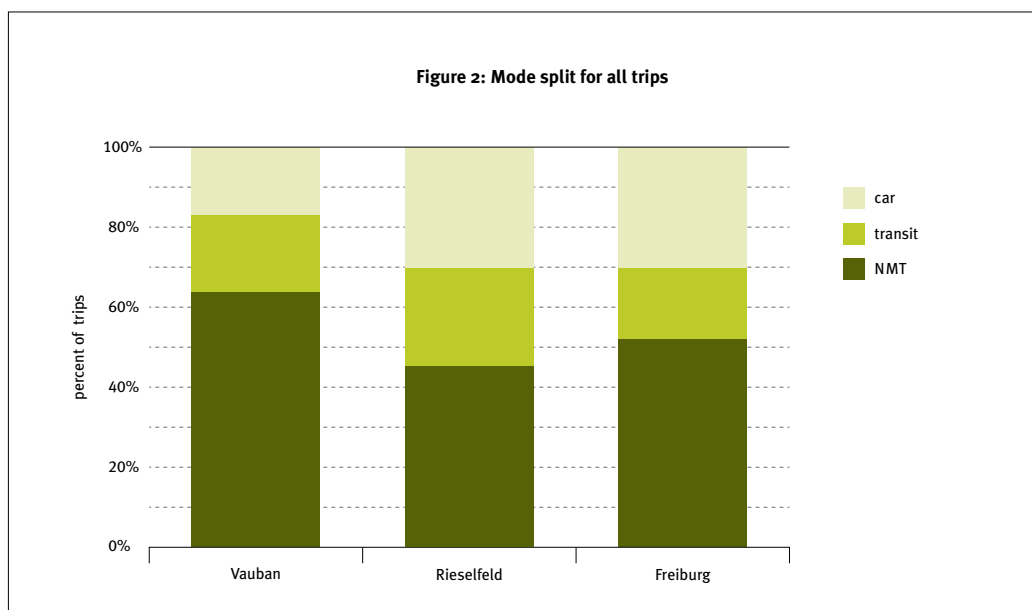
A combined transit and carsharing pass known as the RegioMobilCard offers significant discounts on a range of mobility services: for an additional 10 EUR per month on an annual RegioKarte subscription, this pass offers:

- Carsharing membership for 200 EUR per person, and a 20% reduction on carsharing usage fees;
- A 20% discount on bicycle parking and cycle hire from the “Mobile” bicycle center at the rail station;
- 20% off pre-booked taxis from Taxi Freiburg;

QUANTITATIVE ANALYSIS

This section mainly draws on survey data from May 2002 (*Nobis, 2003*), post completion of the parking-free blocks but prior to the opening of the extension of tram route 3 into Vauban. Nobis compared Vauban with Rieselfeld, a larger but demographically similar development located 3.5 km from the city center.

A comparison of the two sites (Table 2) is particularly interesting given the conception of Vauban as “Rieselfeld II,” i.e. with a range of local services, “play streets” and infrastructure for non-motorized transport users, but retaining free on-street parking or underground spaces bundled into the cost of residential units. In contrast to the Vauban situation, the tram system was extended to Rieselfeld in advance of redevelopment: today both routes operate at the same frequencies.



Modal Split

Car use in Vauban is around 50% of that recorded in the reference district and the city of Freiburg, with NMT accounting for almost two thirds of all trips (Figure 2).

Cycling rates stand out as the key difference in travel behavior among Vauban residents (Figure 3).⁵ Across the city as a whole, the bicycle accounted for 34% of commuter trips in 2002, compared with 61% and 91% for Vauban's car-owning and car-free households respectively. A majority of residents in both groups prefer to do daily grocery shopping within Vauban, reflecting the excellent provision of local facilities.

Turning to bulk shopping, one of the most difficult trip types to shift away from the private car, a car is used for only 6% of trips by members of car-free households. In contrast, those with access to a household car make 73% of these trips by car.

Data for the main mode used for leisure trips are shown in Figure 4 (Freiburg data are from 1999). Individuals without access to a household car make an impressive 83% of such trips by non-motorized means, with significantly greater bicycle use compared to car-owning Vauban residents and all households in Freiburg.

Only 2% of leisure trips made by residents from car-free households are by car, clearly demonstrating that car ownership is the primary determinant of car use. The data are not broken down by transit pass ownership, but these and the comprehensive local network are likely to play a significant role in supporting car-free residents' mobility in the region and beyond.

Among car owners, 41% use a bicycle more frequently than before moving to Vauban, but transit use is low, or at least it was prior to the introduction of tram services in 2006. The findings with respect to transit use should be treated with caution, since they applied to a bus service that neither entered the development nor the city center tram and pedestrian zone, leaving passengers with short walks at both ends of the journey. Since then, it is likely that some NMT trips

have been switched to the tram among both car-owning and car-free residents, especially in winter.

Vehicle Ownership and Carsharing

Considering only the parking-free blocks, approximately 40% of households do not own a car according to the 2002 survey. Figure 5 is based on Stadt Freiburg data from January 2010 unless stated otherwise.

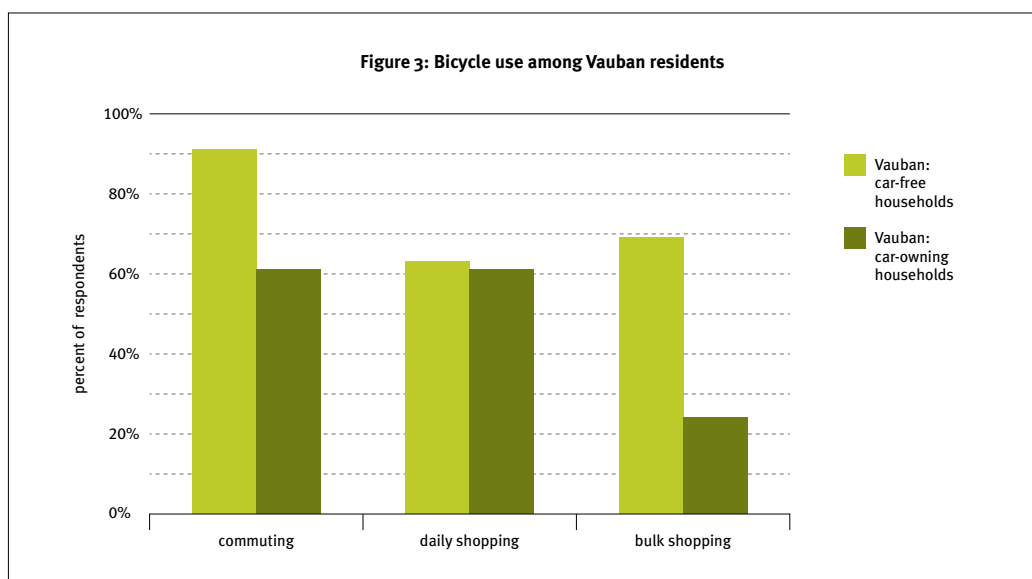
Although Vauban has a greater proportion of low-income residents and students, this is offset by having twice as many households with children, a demographic group expected to be car-reliant, compared with Freiburg. Rieselfeld has succeeded in reducing car ownership to the level of Freiburg's inner districts (300 per 1,000 population), but Vauban has almost halved this.

In 2002, 39% of Vauban households were registered with a car-sharing organization, broken down into 59% of individuals in car-free households and 11% of those in car-owning households. At the time, only 0.1% of German drivers were carsharing members. In addition, 70% of respondents without a car use carsharing more often than they did before moving to Vauban.

There is a question of causality: do residents give up their car as a result of Vauban's parking concept, or has the decision to live car-free been made long before moving in? In answer to this, the Nobbys research revealed that 81% of the inhabitants of car-free households previously owned a car: 57% gave up their car just before moving to Vauban. Interestingly, 65% of residents moved to Vauban from elsewhere in Freiburg (*Stadt Freiburg Vauban Website*). These statistics suggest that more than half of those without a car were persuaded to do so by the unique combination of carrots and sticks offered by the district.

In summary, the inhabitants of Vauban are enthusiastic walkers and cyclists, but car-owning residents tend to default to the car for awkward trips, such as those involving heavy loads, and are more likely to jump in the car for longer leisure trips beyond the range of non-motorized modes.

⁵ Nationally, the bicycle accounted for 2.6% of distance travelled for all trip purposes in 2004.



Transit Use

56% of car-free households in the parking-free area own at least one RegioKarte transit pass for the region, compared with 47% of car-owning households on parking-free streets and 32% of car-owning households in the conventional area. In addition, 72% of car-free Vauban residents and 49% of car-owning residents own a national rail discount card⁶, as opposed to the national figure of 10% (Nobis, 2003). These findings (prior to the opening of the tram extension into Vauban) can be interpreted as an indication of the importance of local transit for day to day mobility, and rail as a substitute for the car for medium to longer-distance journeys.

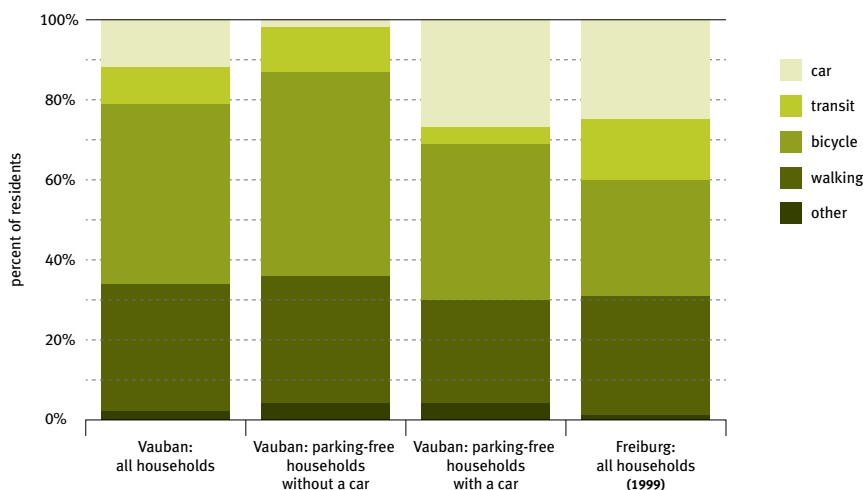
⁶ The national BahnCard, which at that time cost 120 EUR per year and gave holders a 50% discount on all second class tickets.

Residents' Views on Vauban

In 2002, 81% of residents from car-free households stated they found organizing their life without their own car “easy” or “very easy.” This finding can be attributed to the high quality NMT infrastructure, the convenience of bicycle use compared with walking to one of the parking garages, the provision of local services, proximity to the city center, good regional transit links and the availability of a carsharing service.

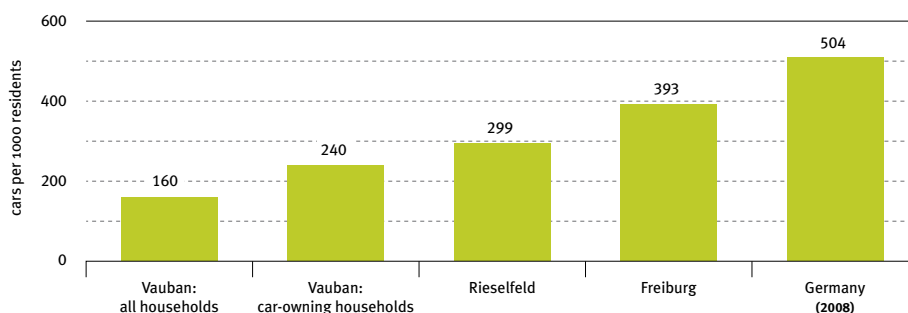
However, 67% of car-owning residents in parking-free streets reported being dissatisfied with being unable to park outside their home. Given that almost 60% of parking-free households have a car, this implies that approximately 40% of these residents considered Vauban’s advantages to outweigh this inconvenience, but a significant proportion would like to have “the best of both worlds,” helping to explain the parking infractions.

Figure 4: Mode split for leisure trips



Nobis, 2003;
R+T, 1999

Figure 5: Vauban Car ownership as compared to surrounding area



EC, 2010;
Nobis, 2003;
Stadt Freiburg
Statistics, 2010

LESSONS LEARNED

Vauban is a success story, with greatly reduced car ownership and bicycle substitution of routine car trips as tangible benefits of the policy and design strategies. Key to this is decoupled parking, meaning both car ownership and habitual use are no longer default scenarios: 40% of parking-free households do not have a car, and 41% of car-owners use a bicycle more than they did before moving. The second vital component is the ease with which people can go about their lives without a car, made possible through the provision of local services and jobs, proximity to the city center, extensive NMT infrastructure and good, low-cost regional transit services. In these circumstances developments such as Vauban can attract people not pre-disposed to an altruistic car-free lifestyle: 57% of residents in car-free households gave up their car when they moved to Vauban. High quality transit should be in place from the outset: a criticism is that the tram extension had not opened by the time most residents had moved in, a factor which could have contributed to greater car ownership and the desire of developers to build later blocks with bundled parking.

Transferability of the economically and spatially decoupled parking model into other new developments is possible, although this is unlikely to be accepted in the absence of carrots of the quality seen in Vauban and the wider Breisgau region. Masterplanning competitions have been successful in Vauban and Stellwerk 60, working to sustainability guidelines developed by local and regional planning

authorities. Both developments have demonstrated that legal barriers in the form of minimum parking standards can be overcome: it would help further if these were abolished or could be determined at the local development plan level. The sale of small plots of publicly-owned land to several different associations of developers, architects and potential residents ("Baugruppen") is a model that could be replicated elsewhere, helping to mitigate the unpopularity of and lack of a sense of community in unappealing, anonymous estates of identical homes.

The dissatisfaction among car-owning residents could be ameliorated through personalized travel planning, including advice on how to navigate the transit system, incorporate walking and cycling into daily routines (including for shopping), and how to plan leisure trips without a car. Greater marketing for the RegioMobilCard could be worthwhile, building on the awareness-raising effect of the free annual RegioKarte issued to residents of parking-free households upon moving in.

There is a significant and growing problem of illegal parking in the parking-free streets, which until now has been largely self-policed by residents applying pressure on their neighbors. Formal warnings should be issued to offenders in the first instance, to avoid possible future tensions between residents. Legal action may be required against the small subset of car-owning residents who claim to live car-free and therefore evade parking fees. ■

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Image credits

Figure 1: Stadtteil Vauban (adapted).
Photos 1, 3–8: Simon Field, ITDP Europe
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