Cutting Back the Car
Lessons on Reducing Suburban Automobile Dependence from the US & Germany

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By

Matthias Neill

Advisor: Dr. Weiping Wu | Reader: Dr. Nick Klein
Abstract

This thesis attempts to answer the research question: “How have suburbs reduced car dependence?” It looks specifically at two suburbs, one in the US and one in Germany, that have had success in reducing automobile dependence and creating new paradigms of suburban development and transportation planning. These case studies, the Rosslyn-Ballston Corridor in Virginia and Rieselfeld and Vauban in Germany, are different but provide valuable lessons on how suburbs can reduce automobile dependence. Information on the case studies and their strategies to reduce car dependence was gathered primarily through secondary sources and through interviews with experts. Research looks at municipal planning systems in both case locations, and summarizes broad lessons that experts have identified as important to the reduction of car-dependence in both locations. Findings indicate that the Rosslyn-Ballston corridor has reduced car dependence by coordinating transportation and land use planning, incentivizing a shift away from driving, and by securing community consensus in favor of densification and transit provision. Planners have made Rieselfeld and Vauban less car dependent by focusing on environmental sustainability and planning for low-car lifestyles from both suburbs inception. Ultimately this thesis finds that a range of strategies can work to reduce car dependence in suburbs but that the success of both case locations in reducing car dependence is context dependent.
Acknowledgements

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I owe a debt of gratitude to everyone in Washington, Freiburg, and elsewhere who was willing to be interviewed for this work. Although their identities are withheld in accordance with research policy, this thesis would not be possible without their knowledge and I truly appreciate their time and input.

Lastly, I would like to thank my family and friends for all their help in this process. I relied on them for motivation, constructive criticism, and inspiration and would not have gained as much from writing this thesis without them.
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1. Introduction

Places are often described according to their built and transportation characteristics. A city or neighborhood can be described as dense or sprawled, congested or accessible, commercial or residential, active or inactive depending how development has taken place and how people travel. One condition in particular can have a substantial impact on the built environment and the way people experience it. That condition is automobile-dependence.

What is Automobile Dependence?

Automobile dependence is a condition that has arisen in many cities around the world whereby travelers have few or no alternatives to the car as a means of transportation. Whereas in multimodal cities travelers can choose between public transport, walking, biking, or driving, in automobile dependent places they must drive to reach most destinations. Automobile dependency is not a firmly defined concept and there is no metric by which it is uniformly measured. Some scholars like Newman and Kenworthy (1999) have attempted to measure it using data on vehicle-miles-travelled (VMT) per capita, car ownership per household, transport modal split, or energy consumption metrics. Assessments of levels of automobile dependence tend to incorporate a range of these indicators to provide insight into the significance of cars in an area’s transportation system. Automobile dependence is not the same as automobile use. Car dependence refers to the need to drive rather than the choice to do so. Automobile use may be high even in places that are less car dependent, or it may be relatively low in places
with no alternatives. Economic and social factors can influence car use but car dependence is more directly linked to transportation and land use planning.

What then makes for automobile dependent places? Typically, car dependence entails high levels of car ownership and usage, low levels of alternative transport provision and usage, and land use patterns that perpetuate the situation. Cars are likely to be prioritized over other modes in transport planning. Road designs for example, may promote high speeds while public transport, pedestrian, and bike infrastructure may be inadequate. Levels of car dependence vary between cities. Those developed prior to the rise of private cars in the early 20th century tend to be less automobile dependent while areas developed since World War Two tend to be more so. Car dependence also varies within cities. More densely developed central districts tend to be less car dependent while lower-density outlying areas can be car dependent even in cities with good public transport systems. Almost every city has areas in which car dependence is higher or lower according to local development patterns and transportation options.

Automobile dependence has been driven in part by suburbanization and the associated urban planning and design policies that promote low-density development and remove impediments to driving. Policies that support suburban car dependence include the expansion of motorways, minimum parking requirements, single-use low-density zoning, and low fuel taxes. By making driving easier and cheaper these actions in turn encourage more of it, in a cycle that can turn walkable or transit-oriented communities into places designed almost entirely for cars. Automobile dependence is most pronounced however in areas developed for car use, such as outer suburbs. Though car dependence is by no means limited to it, it is in North America that pro-car policies have been most substantially implemented. Across much of the continent, car
dependence has become a way of life, so much so that much urban development is automobile oriented by default. The mutually reinforcing relationship between car dependence and suburbanization has been particularly pronounced in US suburbs but has also impacted suburban development patterns elsewhere, including in Europe. Although it is typically local in nature, suburban automobile dependence is becoming a global issue. Automobile ownership remains an aspiration for many and as cities across the world grow, many are experiencing the negative effects of car dependence.

**Why is automobile dependence an important research topic?**

Automobile dependence is an important issue because it forces car usage, which is detrimental in many ways. The combination of automobile dependence and sprawl is particularly harmful to the natural environment. Automobile usage contributes to about ten percent of global greenhouse gas emissions and encourages development that consumes large amounts of land (Allianz, 2016). Land consumption is in turn environmentally detrimental because it drives degradation of natural spaces and habitat loss. By reducing the need to walk or bike, care use also minimizes the amount of exercise people get and contributes to obesity and related public health issues. Auto-related air pollution and the danger of accidents to both drivers and non-drivers, further negatively impact public health and safety (Litman, 2012). Automobile dependent places are also less resilient to transport network disruptions and routinely suffer the negative economic consequences of congestion. Ultimately automobile dependence is an important issue because it limits individuals’ abilities to opt out of these cycles. In car dependent places, the lack of good alternatives means that even those who are aware of the negative impacts of car use must drive.
Understanding automobile dependence, particularly in suburbs where it is often more pronounced, is important if it is to be meaningfully reduced. The benefits of reducing car dependence, for people and the planet, are clear and many planners and policy makers understand these. Changing travel behavior is difficult though, and is especially challenging in suburbs where the built environment is often designed to facilitate car usage over other modes of transport. Information on how suburbs have reduced car dependence therefore, is important to understanding what can work in places working to reduce car dependence in future.

**Addressing automobile dependence is challenging**

Despite growing awareness of these negative consequences of automobile dependence, planners and policy makers have found it difficult to address the issue. Strategies to reduce car use involve providing or improving alternative mobility options, and incentivizing development that is less car oriented and more oriented towards all forms of mobility. These strategies can be especially difficult to implement in suburbs, whether in existing ones or those yet to be built. Providing public transport is often financially impractical in areas with very low housing densities and poor walkability, and encouraging denser development is challenging where land is cheap and suburban planning is the norm. In this context, efforts to encourage automobile alternatives or promote transit oriented development in suburbs are often ineffective.

Suburban car dependence can however be reduced. Existing car dependent suburbs can be ‘retrofitted’ to facilitate alternative land use patterns and transportation options. New development can be planned to ensure that the car-oriented development practices of the past
are replicated less in future. There are examples of suburbs in North America and Europe where planning has helped to either retrofit existing car-dependent suburbs or encourage new suburbs be less car-dependent. These places provide insight as to how efforts to reduce suburban automobile dependence can work and are the focus of this thesis.
2. Literature Review

The literature on automobile dependence sits within a larger body of work on urban geography, development patterns, transport planning, and urban sustainability. Academic thought relating to these issues, at least in the Anglophone world, has changed since the 1970’s, by which time many planners had begun to identify and understand the problems of widespread automobile usage. Prior to this period, many held a positive view of the car and its role in urban development and had focused their efforts on improving automobile systems and reorienting cities around them.

This research is draws from work that has taken place since this change in understanding. Now, much of the existing literature on automobile dependence, but also on automobile related planning issues more generally, is to varying extents advocative. Many scholars have identified the potential benefits of the reduction of automobile dependence, while relatively few make arguments in favor of pro-auto planning approaches. Newman, Litman, and Kenworthy (1996 & 1999) have written extensively about the negative consequences of automobile dependence and frequently discuss how cities and regions can reduce dependency. Of course, literature on automobile dependence is by its very nature likely to view cars as problematic and this potential bias should be acknowledged. However, there appears to be a consensus among transport and planning experts that car use has negative social, environmental, and economic consequences.

This review examines literature pertaining to automobile dependence. It explores academic efforts to understand the history and relationships of suburbanization and automobile
dependence, and how they became widespread phenomena. This review also discusses arguments made in relation to reducing automobile dependence and explores how scholars have approached the issue of understanding the challenges of automobile dependency.

**Historical Context of Literature on Suburbanization and Automobile Dependence**

Suburbanization and car dependence were partly driven by an anti-urban school of thought in response to the perceived ills of the industrial city. From the beginning of the 20th century to the late 1960s, ideas like Ebenezer Howard’s Garden City, Le Corbusier’s auto-centric Ville Radieuse, and Frank Lloyd Wright’s Broadacre City, sought to reduce urban densities and allow for more open space. These ideas were viewed as solutions to the problems of urbanization such as crowding, pollution, and disease (Don, 2010). Planners and scholars, at least in certain places, only started to become aware of the negative consequences of suburbanization and automobile dependence when they became more widespread in the 1960s. Jane Jacobs’ (1961) seminal work *The Death and Life of Great American Cities* might be considered the driver of early anti-automobile scholarship. Her work refocused attention on the benefits of planning for a human scale and critiqued the absolute belief in the car, and negative opinions of density held by many American planners at the time. Jacob’s work coincided with the genesis of the modern environmentalist movement, which has profoundly impacted the understanding of suburbanization. Rachel Carson’s *Silent Spring* (1962) helped grow the environmental movement at the same time. Some scholars also began to criticize the outcomes of car centric planning for socio-economic reasons. In *City of Quartz*, Mike Davis (1990) further builds on Jacobs’ rebuke of the modernist and post-modernist embrace of the auto-centric planning by
critiquing the outcomes of post-modernity in Los Angeles, particularly marginalization and the degradation of social groups and environmental spaces. While he does not frame his arguments as an attack on suburbanization per se, Davis’ work has attuned planners and scholars to the many problems of post-modern urbanism and its low-density, car-oriented built form. Sheller and Urry (2000) meanwhile, explored the wider societal impact of automobile dependence and suggests that it has “reshaped citizenship and the public sphere” more than any other form of mobility. These works are part of the broader embrace of sustainability and social-equity in academic discourses that have occurred alongside the growth of ostensibly sustainable planning concepts like Smart Growth and New Urbanism.

Alongside this growing body of literature focusing on the impacts of suburbanization and car-oriented urbanism, many authors have looked to understand the underlying process behind these phenomena. Foster (2003) characterizes the post war growth in American car dependence as a result of pent up consumerist demand, government subsidization of road building and home ownership, and a cultural rejection of cities in favor of suburbs. Seiler (2008) examines the cultural history of cars in America and suggests that the growth in American car ownership and usage was partly a result of utilitarian planning that saw the car as a tool for modernization, and partly as a response to the perceived threat of Communism in which the car became an ideological tool embodying American individualism. Cox (2015), who expresses support for pro-car planning, observes that many of the same trends have driven suburbanization in Europe, albeit more slowly and from a later starting point. He attributes America’s greater rate of suburbanization to more rapid population growth and wealth accumulation after World War Two but claims that since the 1970’s Europe has been
suburbanizing significantly as its population has grown wealthier. Jones (2008) also finds that the World Wars held Europe back economically but helped the US grow wealthy and thereby facilitated the earlier rise of the car in the US than in Europe.

In the late 1990’s and early 2000’s scholars began to specifically discuss the topic of car dependence. Litman (2002) defines automobile dependence as “high levels of per capita automobile travel and... reduced transport alternatives” and outlines its financial costs to individuals and health, productivity, and infrastructural costs to society. Newman, Kenworthy, and Laube, some of the most prolific authors on work pertaining to car-dependence, discuss car dependence in national or global contexts. They attribute the growth of car-dependence less to shifts in the wealth of individuals and more to land use policies. Newman and Kenworthy (2000) in particular have refuted the idea that suburbanization and car ownership are a result of wealth by highlighting higher property values in non-car-dependent city centers and discussing the role of government financed road building and subdivision planning practices in driving suburbanization. Other scholars like Stokes (2002) and Farringdon et al. (2001) have examined issues of car dependence more locally. Farringdon et al. notably distinguish car dependence, the need to use a car, from car reliance, the continued use of a car when alternatives are available.

While the literature on the impacts and origins of suburbanization and car dependence has grown, scholars observe that planning practice has been slow, particularly in the US, to reorient itself away from the automobile. Themes of sustainability took hold earlier in some European planning contexts, especially in northern European cities. Buehler (2014) notes that planners in Europe began to slowly refocus their efforts on automobile alternatives in the 1960s while
American counterparts largely continue to plan for the automobile. However, American literature is becoming vociferous in its critique of suburbanization and automobile dependence. Chakrabarti (2013) illustrates vividly the problems of continued American suburbanization and argues that built environment professionals need to do more to dismantle the systems of government subsidization that have promoted low density development patterns. He, along with other contemporary authors, asserts that automobile dependence and suburbanization have become unnecessarily synonymous with the ‘American Dream’ and further argues that mentalities and cultural perceptions of suburbanization and the car can and should be changed.

Reducing Automobile Dependence

While many scholars have discussed or analyzed the causes and effects of suburbanization and car use, relatively few have taken an in-depth approach to discussing ways to reduce automobile dependence. Some authors stand out in this respect: Calthorpe, Newman, Kenworthy, Pucher, and Buehler. Newman and Kenworthy (1989 & 1999) were among the earliest to identify the specific negative impacts of automobile dependence on cities. Their work comparing and analyzing cities with high and low levels of automobile dependency has helped identify approaches that have worked to reduce or restrict automobile dependency. They point to the provision of automobile alternatives and integrated land use and transportation planning as effective ways to reduce car dependence and frequently reference cities that have done this, mostly in Europe, as examples of urban and economic growth that is disentangled from car usage. Also in the early 1990’s Calthorpe and other New Urbanists began to popularize the concept of transit oriented development as an alternative car-based planning (Calthorpe, 2017). Buehler (2014), Pucher (2016), and others have more recently built on this
work by conducting a range of comparative analyses of North American and European transport and urban development policies. They have generally found that automobile dependence remains higher in North America than in Europe due to local policies that promote low-density development, greater restrictions on car-usage in Europe, and better promotion of alternative means of transport in Europe. Manville et al.’s (2017) recent investigation into a decline in American driving in the 2000’s suggests that despite growing investment in non-automobile forms of mobility, the conditions driving car dependence remain an issue in the US. Americans have recently driven less not because their modal preferences or built environments changed, but because of economic hardship. In this context, some scholars are currently engaged in a debate over the extent to which density or pricing influence automobile dependence. Stevens (2016) argues that “compact development features do not appear to have much influence on driving”. Handy (2016) counters that dense development may have a relatively limited impact on automobile dependence but automobile dependence cannot be reduced without density. Ewing and Cervero (2017) also argue that compact development does reduce automobile dependence and suggest that Stevens has over reached in his conclusion. Manville (2017) meanwhile, argues that automobile dependence is impacted more by the pricing of roads and parking than by density. This element of the literature is in development, as many of these scholars continue to conduct research and produce written work on the impacts of automobile dependence and strategies to mitigate them.
3. Methodology

The aim of this thesis is to provide insight into planning strategies that have been successful in lowering car dependence in suburban areas. This thesis is investigative and case-based, and draws conclusions from planning practice in different contexts.

Case Selection

The research process began by identifying case study suburbs where car dependence is lower than in others. Identifying case suburbs involved literature-based research and communication with colleagues and planning professors. Specifically, colleagues and professors were asked to share their knowledge of suburbs where car dependence is lower. Potential case study locations in North American and Europe were identified and considered (Appendix A):

After consideration of the research potential of these case studies, the Roslyn-Ballston corridor and the suburbs of Freiburg, Germany were selected for further research. Information availability played a role in the selection of these two cases. Both are popular in planning research and discussion relating to issues of suburban transport, land use planning, and sustainability and have been written about more than many of the other identified potential cases. The cases were also selected because they are widely held to be some of the best examples of reduced suburban car dependence in their respective countries and as such, offer more potential lessons on the issue.

Research into these case locations is intended to provide a better understanding of how suburban automobile dependence is addressed in North American and European contexts.
These two cases provide insight into how reductions in suburban car dependence can occur in cities of varying size. The Washington region has a population of roughly 4.5 million and is sprawled over 1,400 square miles (3,600 square kilometers) with a population density of 1,045 per square mile (418 per square kilometer) (US Census Bureau, 2015). Freiburg is a small, compact city with 250,000 residents and 60 square mile (150 square kilometer) footprint and a population density of 3,750 per square mile (1,500 per square kilometer) (UN, 2015 & Statistisches Bundesamt, 2016). Because suburban car dependence is an issue in both large and small cities, these two cases can provide valuable information on how it can be reduced at very different suburban scales and densities.

**Data Collection**

Research consisted of gathering secondary and primary data on planning strategies implemented in both places, with respect to car dependence. Initial data collection focused on understand the planning systems in both Freiburg and Arlington. Research for this phase consisted primarily of reading government issued planning documents, municipal planning websites, and academic literature. The main planning documents of Arlington and Freiburg, the municipalities in which the case suburbs are located, were some of the most important sources in this research phase. These sources were examined for information on how each location plans development and specifically, how they have planned the case suburbs. Special attention was paid to sources on land use and transportation planning strategies.

Data collection also sought to shed light on current levels of car dependence in both locations. Because there is no agreed-upon measure of car dependence, research sought to gather a
range of information to provide a general understanding of the issue in both case locations. Data on levels of car ownership, car usage, and usage of other forms of transport were gathered from government issued planning documents, reports, and academic literature.

Primary data in this thesis consists of expert accounts of car dependence has been reduced in the Rosslyn-Ballston Corridor area, and Rieselfeld and Vauban. In order to gather this data experts, in this case planning practitioners and academics with knowledge on either case location, were interviewed and asked questions on how each location has reduced car dependence. The aim of interviewing experts was to gain a deeper understanding of the successes of both locations in reducing suburban car dependence than academic literature or other secondary sources can provide.

Potential interviewees were identified either through reading or through conversations with transport planners and academics. The search for interviewees led me to interview nine individuals, whose identities are coded to preserve their privacy. These individuals are listed and described in Appendix B.

The interview process began with an outreach email, which described this thesis and asked interviewees if they would be willing to participate. Interviews were then arranged depending on the availability of interviewees. Four of these interviews, all in the Washington DC region, were conducted in person. One interview with an expert on the region was also conducted via telephone. Due to travel difficulties, interviews with German experts were not conducted in-person. Two interviews with German experts were conducted over the phone and two were conducted with a written set of questions emailed to the interviewees. All interviews were
conducted in English, except for Interview 8 which was conducted in German. All oral interviews were recorded with permission, and all interviews were summarized in writing.

Interviews sought to gather information on how each of the suburbs reduced car dependence. Interviews primarily consisted of case-specific questions about the planning strategies with which the Roslyn-Ballston corridor or Rieselfeld and Vauban respectively have achieved success in reducing car dependence. Question focused on the nature and importance of land use and transport policies, the role of public and private sector actors, community engagement tactics, and the wider planning philosophies of the case suburbs, all in relation to the reduction of car dependence. Many case-specific questions were tailored to each individual interviewee to focus on their area of expertise. Examples of the full range of questions asked in these interviews can be seen in Appendix C.

Interviewees were also asked about broader issues surrounding the issue of suburban car dependence. These general questions were not geographically targeted and left the interviewee room to reflect on suburban car dependence at the regional, national, or global level. Non-case specific questions were intended to reveal how interviewees think about suburban automobile dependence and to understand what, if any, general lessons the two cases might provide. Interviewees were not all asked the same questions but the focus and content of all interviews was similar and focused on how the case suburbs reduced car dependence.

Here, it is important to note that this research is qualitative, rather than quantitative. Though data on metrics relating to car usage is important in understanding suburban automobile dependence, this thesis focuses on understanding planning strategies and decisions that have
helped reduce it. In part because these strategies and decisions are complicated and diverse, and in part because there is no universally-agreed upon way to measure car-dependency, this research aims to understand the issue primarily through engagement with experts.

**Presentation of Findings**

Research findings are presented separately for each case. A discussion of relevant planning systems and structures is presented first, followed by findings on levels of local car dependence. These are followed by a longer presentation of interview findings, which are presented according to recurring themes. These themes came up in some way in a majority of interviews, and stood out as key findings. They were identified in preliminary reviews of interview notes and recordings for recurring topics. Once a thematic finding was identified, the author spent more time reviewing interviews for information relating to that theme. Five recurring themes are presented as the findings of interviews on the Rosslyn-Ballston Corridor, and seven are presented as the findings on Rieselfeld and Vauban. There is some overlap between these two findings sections, but because this research effort is not intended to be a direct case comparison, they are presented independently from one another.
4. Case Studies

The two suburbs selected as case studies for this thesis are very different from one another in terms of size and context. The Rosslyn-Ballston corridor is part of a large metropolitan area while Rieselfeld and Vauban are part of a medium-sized town. These differences are important in understanding their successes in reducing car dependence.

4.1 The Rosslyn-Ballston Corridor

Figure 1. – Rosslyn Ballston Corridor Area Map

1 Source: Author
The Rosslyn-Ballston Corridor is an area in Arlington County, Virginia, across the Potomac River to the west of Washington D.C (Figure 1). It is roughly four kilometers long and is characterized by dense modern development located around five underground stations on the orange and silver lines of the Washington Metro, a heavy rail system serving the region (Figure 2). The Rosslyn-Ballston Corridor is so called because it stretches from Rosslyn station in the northeast along Wilson Boulevard to Ballston station in the southwest. Figure 1 provides an overview of the area generally referred to as the corridor but there is no formal delineation of the corridor area. Arlington planning documents often refer to the corridor as the agglomeration of five ‘station areas’. This thesis defines the corridor as the census tracts which encompass these five stations. Today, these are census tracts 1015, 1016.2, 1016.3, 1017.1, 1017.2, 1018.1, and 1018.2, (Appendix D).

Figure 2. – Washington D.C. Metro Map

Source: https://www.wmata.com/schedules/maps/upload/system_map_color.pdf
Within this defined area of roughly 1.6 square miles (4.4 square kilometers), the corridor is home to approximately 30,000 people (Table 1). Arlington county itself is roughly 67 square kilometers (26 square miles) in area, is home to 220,000 people, and is part of the inner ring of Washington suburbs (US Census Bureau, 2015). It grew rapidly during and after World War Two as the region’s population swelled (Arlington, 2017). Arlington experienced particularly substantial office development as federal government employment grew and the carrying capacity of the office market in Washington was strained. By the late 1960s however, the Rosslyn-Ballston corridor were in decline as newer outer ring suburbs began to develop and attract businesses and residents away. What is today the Rosslyn-Ballston corridor was then a low-density commercial area of small retail stores, car-repair businesses, and parking lots (Figure 3) (Arlington County, 2010). Simultaneously, the region began to plan the Washington Metro. Arlington county officials came to a consensus that the corridor could benefit economically from the new metro. They lobbied regional planners to route the planned metro extension to Arlington beneath Wilson Boulevard, as opposed to along the median of Highway 66 as was originally planned. They were successful, and in 1977 the metro began service to five new underground stations along the corridor (Arlington, 2017).

<table>
<thead>
<tr>
<th>Area</th>
<th>Population</th>
<th>Population Density</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.45 sq. miles</td>
<td>30,438</td>
<td>27,294.8 per sq. mile</td>
</tr>
</tbody>
</table>

Table 1. – Rosslyn-Ballston Corridor Area Summary Statistics (2015)³

³ Source: 2015 American Community Survey (5 Year Estimates)
Since the opening of the metro extension, Arlington County has used planning to focus dense, mixed-use development along the corridor. Today the corridor exemplifies transit-oriented development and is less car dependent than adjacent suburban areas. Building density is moderate to high, surface parking lots are rare, and the area provides more transportation options than typical North American suburbs (Figures 4). The corridor is now a regional employment centers with an economy centered on government and services. The corridor’s development has helped make Arlington, which has a median household income of $105,000, quite wealthy (US Census Bureau, 2015). Despite growth the corridor remains suburban or quasi-urban in built character (Figure 5).

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4 Source: https://arlingtonva.s3.amazonaws.com/wp-content/uploads/sites/31/2016/05/RosslynBallstonCorridor.jpg
Figure 4. – Rosslyn-Ballston Corridor 2016

Figure 5. – Rosslyn-Ballston Corridor – Clarendon Station Area Streetscape

5 Source: https://arlingtonva.s3.us-east-1.amazonaws.com/wp-content/uploads/sites/31/2016/05/RosslynBallstonCorridor.jpg

6 Source: Author
Freiburg is a mid-sized city in the south west of Germany, close to the French and Swiss borders. It is situated on the western slopes of the Black Forest Mountains just east of the Rhein River Valley and is characterized by its medieval city center and more recently developed outer areas. Freiburg was founded in 1120 and developed slowly until World War 2, when it was heavily damaged by allied bombing (Stadt Freiburg, 2017). The city grew rapidly during the 20th Century and like most German cities became somewhat more car-oriented during this
period (Interview 9). In the 1970’s however, a culture of environmentalism began to form and planning became more focused on environmental sustainability. Today, the city covers 214 square kilometers, is home to roughly 230,000 people and has an economy centered on services, education, and tourism (Daseking et al, 2012. Vaessen, 2007). Freiburg is relatively wealthy, with a GDP 11 percent above the European average (Daseking, 2013).

Rieselfeld and Vauban are suburbs of Freiburg (Figure 6). Both are new-build districts, developed in the last 20 years, and are known for their transit-oriented and environmentally sustainable designs (Figures 7 – 10). Rieselfeld is situated on the western edge of Freiburg, four kilometers (2.5 miles) from the center on the site of a former sewage treatment field. Vauban is two and a half kilometers (1.5 miles) from the center of the city, and is built around a former military base. With an area of two and a half square miles (four square kilometers) and 11,000 inhabitants, Rieselfeld is the larger of the two. Vauban is less than half a square kilometer in area and is home to around 6,000 residents (Field, 2010. Broauddus, 2011) (Table 2).

<table>
<thead>
<tr>
<th>Area</th>
<th>Population</th>
<th>Population Density</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rieselfeld</td>
<td>2.5 sq. miles</td>
<td>11,000</td>
</tr>
<tr>
<td>Vauban</td>
<td>0.2 sq. miles</td>
<td>6,000</td>
</tr>
</tbody>
</table>

Table 2. – Rosslyn-Ballston Corridor Area Summary Statistics (2015)\(^8\)

\(^8\) Source: (Field, 2010 & Broauddus, 2011)
Figure 7. – Rieselfeld⁹

Figure 8. – Rieselfeld Streetscape¹⁰

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⁹ Source: https://upload.wikimedia.org/wikipedia/commons/4/4d/20160211-Freiburg-Rieselfeld-Aerial.jpg

¹⁰ Source: http://1.bp.blogspot.com/-KUxMAETVNmM/UfKRV-u5hkI/AAAAAAAAFuA/0vwMTFIsy68/s1600/44873285.jpg
Figure 9. – Vauban

Figure 10. – Vauban Streetscape

11 Source: http://www.freiburg.de/pb/site/Freiburg/get/documents_E-1562355727/freiburg/daten/bauen/vauban/Luftbilder_Download/Luftbild_2009.jpg

12 Source: http://www.thereallifeproject.com/wp-content/uploads/2013/06/freiburg_bike_courier-6-1024x574.jpg
Rieselfeld and Vauban were both planned in the early 1990s in response to intense housing demand. The city owned the land of both areas and exercised strict development control. It focused on creating self-contained districts where a majority of residents would be within close proximity to public transport (Hall, 2014). Community engagement and environmental sustainability goals, particularly reducing energy consumption, featured prominently in the planning process for both areas (Interview 6).

Today Rieselfeld and Vauban residents drive less, walk and bicycle more, and consume less energy overall than other Freiburg residents (Daseking et al., 2012). Their development has coincided with broader shifts in the transportation and urban development of Freiburg, which has become more multimodal since the 1970s. In a nation with high levels of car ownership and relatively wealthy citizens, Rieselfeld and Vauban stand out as examples of alternative suburbia, where car-dependence is low but where many of the features of suburban living have been maintained.
5. Lessons from the Rosslyn-Ballston Corridor

The Rosslyn-Ballston Corridor’s transformation into a more transit-oriented and walkable suburb has taken place in a time and place where most other suburbs have remained car dependent. Arlington’s planning system and policies have played a significant role in bringing about this transformation.

5.1 Understanding the Planning System

Planning in Arlington

The development of the Rosslyn-Ballston corridor has taken place within a unique urban governance context. Unusually for an American suburb, Arlington is not a municipality but a county, which as result of a 1922 Supreme Court decision cannot have incorporated towns within its boundaries (Arlington, 2016). It is governed by a five-member County Board with an annually rotating chair, rather than a mayor (Arlington, 2017). The County Board is responsible for most local policy making, including land use and zoning, local taxes, and fiscal policy. It appoints the County Manager, who implements local policies and manages public service operations (Arlington, 2017). In addition to the County Manager, the County Board is advised by about 50 citizen advisory commissions including a Planning Commission and Transportation Commission (Arlington, 2017).
Alongside the County’s political apparatus, the Department of Community Planning, Housing, and Development (CPHD) regulates and plans the built environment. CPHD is made of six divisions: planning, housing, neighborhood services, zoning, inspection, and business operations. Each of these divisions is staffed by professional planners who report to the County Manager (Interview 4). As the author of long range plans, CPHD has played an important role in shaping the Rosslyn-Ballston corridor’s development. It has long incorporated Smart Growth principles, which emphasize mixed-use, compact, and walkable development, into its general planning framework. These principles guide long-range plan making as well as development review and permitting processes.

**Planning for the Rosslyn-Ballston Corridor**

The Rosslyn-Ballston Corridor has been a central focus of planning efforts in Arlington for 40 years and many planning policies have been designed to promote its development. The concept for a transit-oriented Rosslyn-Ballston corridor emerged in the late 1960’s, after the decision to route the metro beneath Wilson Boulevard. Land-use planning efforts to achieve that concept were developed over the course of 12 years from 1972 to 1984 and incorporated significant community input (Arlington, 2016). These planning efforts included:

- **RB’72** – a study of potential land use patterns (1974)
- **Long Range County Improvement Program** (1975)
- **Rosslyn Ballston Corridor Recommended General Land Use Plan** (1977)
- **Rosslyn Sector Plan** (1977)
- **Ballston Sector Plan** (1980)
• Court House Sector Plan (1981)
• Virginia Square Sector Plan (1983)
• Clarendon Sector Plan (1984)

Planning is now guided by the Comprehensive Plan, which is updated every 5 years (Arlington, 2017). The comprehensive plan is comprised of multiple elements, including a general land use plan, transport plan, and nine others. Planning efforts for the corridor can largely be broken down into land use or transportation strategies (Table 3).

Table 3. – Arlington County Planning Structure\textsuperscript{13}

\textsuperscript{13} Source: Author
General Land Use Plan

Land use planning along the corridor is primarily shaped by the County’s General Land Use Plan (GLUP). The GLUP concentrates higher density development along the corridor and preserves low density housing outside of it. It is a pro-growth planning policy that focuses on managing new development to provide new jobs and housing while conforming to the county’s planning goals. The policies of the GLUP are implemented primarily through zoning and capital improvement programs. They are also implemented to a lesser extent through historic preservation districts and subdivision ordinances, which regulate the provision of public facilities (Arlington, 2017).

Zoning

Arlington’s zoning ordinance is like many American zoning codes in that it regulates land use and built form by designating areas where certain building types are permitted. It contains almost 50 land use classifications which fall into residential, commercial/industrial, public-space, office-apartment-hotel, or mixed-use categories (Arlington, 2016). These classifications vary most in terms of permitted density. Lower-density classifications regulate density in terms of units per acre but the medium and higher density regulations use floor area ratios (FAR). On one end of the spectrum, an R-20 residential classification permits one to ten units per acre while on the other, a C-O-A designation permits up to 6.0 FAR. Most areas along the Rosslyn-Ballston corridor are designated for development of 3.0 FAR or more (Arlington, 2016).

Development proposals that do not conform to zoning regulation may be permitted through various special exemptions. Site Plan procedures are the most important exemption and allow
for the County Board to vary zoning regulations on development proposals to achieve specific planning goals (Arlington, 2016). Site Plan procedures have been used for larger developments along the Rosslyn-Ballston corridor. They allow development in excess of zoned density in exchange for community benefits such as open space, affordable housing, or infrastructure provision (Arlington, 2016).

**Sector Plans**

In addition to the GLUP and its associated zoning regulations, sector plans “guide the vision and future development of Metro Station Areas” along the corridor (Arlington, 2017). Sector Plans are essentially detailed development guidelines for these areas, and identify planning priorities and goals for a 20-year planning horizon (Arlington, 2017). They are written explicitly to guide both the community and private-sector development. For local community members, they outline a development vision. For developers, they describe policy aims against which proposals in the area will be evaluated (Interview 4). Such policies typically focus on land use, transportation, built form, urban design, and public space. The Rosslyn sector plan for example, recommends creating a distinctive skyline with ‘peaks and valleys’ (Arlington, 2015). The Clarendon sector plan on the other hand, focuses on creating an ‘urban village’ through active frontage requirements and recommends preservation of specific historic buildings (Arlington, 2006).

**Master Transportation Plan**

Along the Rosslyn-Ballston corridor, transportation planning is governed by Arlington’s Master Transportation Plan (MTP), a document which sits alongside the General Land Use Plan in the
county’s comprehensive plan. The MTP guides transportation planning for a 20-year horizon and is comprised of six component plans focusing on:

- Bicycling
- Demand and system management
- Parking and curb space management
- Pedestrians
- Streets
- Transit

The MTP is emblematic of Arlington’s progressive approach to transport planning for an American suburb. Rather than simply seeking to improve throughput or capacity as is more typical in suburban areas it seeks to create an equitable transport system that “gives priority to the movement of people rather than only vehicles” (Arlington, 2011). The MTP is structured around the following goals and policies (Table 4):

<table>
<thead>
<tr>
<th>Goals</th>
<th>General Policies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Provide high quality transportation services</td>
<td>Integrate transport with land use</td>
</tr>
<tr>
<td>Move more people without traffic</td>
<td>Support complete streets</td>
</tr>
<tr>
<td>Promote safety</td>
<td>Manage travel demand</td>
</tr>
<tr>
<td>Manage effectively and efficiently</td>
<td></td>
</tr>
<tr>
<td>Advance environmental sustainability</td>
<td></td>
</tr>
</tbody>
</table>

Table 4. – Arlington County Master Transportation Plan Goals & Policies

14 Source: (Arlington, 2011)
The MTP seeks to create a mutually reinforcing relationship whereby development is transit-oriented and transit is development-oriented. The development of the Rosslyn-Ballston corridor has been particularly shaped by its focus on transport and land use integration. This has driven efforts to improve the pedestrian realm so that travelers can more easily use both the public transport system and transit oriented developments around it. It has also resulted in policies to encourage mixed land uses so that a variety of destination types are accessible along the corridor.

The MTP’s complete streets policy, which aims to make existing auto-oriented streets serve a wider variety of users, has further impacted the Rosslyn-Ballston Corridor. An extensive bike-lane network has been centered on the corridor and numerous ‘road diets’, reallocations of road space away from automobiles, have been implemented along Wilson Boulevard (Interview 4). As part of the Complete Street’s policy, Arlington has shifted from measuring street performance using the traditional auto-oriented Level of Service (LOS) model to a multimodal Quality of Service (QOS) system (Arlington. 2011). Arlington is better equipped than nearby suburbs to re-plan streets in these ways because it, rather than the Virginia Department of Transport, owns and has authority over them (Interview 1).

The MTP’s transportation demand management (TDM) program controls the transport impact of new development along the corridor. TDM strategies are intended to reduce driving demand or change driving behavior to improve transport efficiency, and aim to reduce the portion of county residents driving to work to 50 percent by 2030 (Arlington, 2011). TDM strategies include road access management, high-occupancy vehicle lanes, targeted traffic enforcement, and road redesigns (Arlington Mobility Lab, 2017). Notably though, Arlington’s TDM program
does not heavily regulate parking along the corridor and has not eliminated parking minimums (Di Caro, 2013). Arlington’s TDM policy is noteworthy because it requires new developments to prepare TDM plans as part of the local approval process and to incorporate these plans into their development.

## 5.2 Car Dependency along the Rosslyn-Ballston Corridor

The Rosslyn-Ballston corridor has been transformed from an auto-oriented suburb into a less car dependent place that challenges the notion of what an American suburb is. Now almost 90 percent built-out, the corridor is walkable, bikeable, and well-served by public transport (Interview 4). Development is more compact and less car-oriented, and the area contains elements of both suburban and urban places. The corridor stands in sharp contrast to many other American suburbs where driving is the only mode of transport and development is less dense and more car-oriented.

Data suggests that planning strategies have made the corridor less automobile dependent. In 1970 when Arlington was beginning to plan for transit-oriented redevelopment of the corridor, 60.5 percent of corridor-area residents drove alone to work, and only 26.5 percent commuted by public transport, which at the time consisted of buses (Table 5) (US Census Bureau, 1970 & 2009). In 2009, 46.5 percent drove alone to work, while 35 percent commuted by public transport. The portion of commuters walking to work has remained the same at roughly 10 percent. This data is drawn from four census tracts that most closely approximate the corridor area but does include areas further away that are likely more car-dependent. Furthermore, this
data, which does not account for all trips, provides only a snapshot of travel behavior along the Rosslyn-Ballston corridor but is indicative of a decline in local car-dependence.

Table 5. – Rosslyn-Ballston Corridor Area Commute Modal Split (1970-2009)\textsuperscript{15}

\textsuperscript{15} Source: US Census Bureau
Car ownership data for Arlington and the corridor-area also provides evidence of low car-dependence. Car ownership in Arlington and the corridor area is relatively high, at 88 and 83 percent of households respectively, but is lower than the national average of 91 percent and the level of adjacent Fairfax county, 96 percent (Arlington, 2010). There is a more notable difference in terms of second car ownership. In Fairfax County, 66 percent of households own two cars, in Arlington 40 percent do, and along the Rosslyn-Ballston corridor only 25 percent do (Arlington, 2010). Here it is important to note that data on car-ownership at the household level may indicate variations in household size or wealth and is not inherently correlated with car-dependence. More specific data, such as car-ownership among individual adults normalized to wealth, is not available.

Travel behavior is another important indicator of reduced car dependence along the Rosslyn-Ballston corridor. 35 percent of corridor residents commute using public transport and 10 percent walk or bike to work (US Census Bureau, 2009). In some residential developments along the corridor, 40 to 60 percent of residents do not drive on a daily basis (Buehler et al., 2014). This contrasts with the US as a whole, where 76 percent of commuters drive alone, 5 percent take public transport, and 3.5 percent walk or bike (McKenzie & Rapino, 2011).

The change in automobile traffic relative to increased development indicates a decline in auto-dependence. From 1970 to 2016 over 17.1 million square feet of office space was constructed along the corridor, along with 2.4 million square feet of retail and 25,000 residential units. During the same period, traffic counts along Wilson Boulevard declined by 25 percent while traffic on other nearby roads declined by between six and 14 percent (Di Caro, 2013 & Alves, 2017). Concurrently, public transport ridership in Arlington increased by 35 percent (Alves,
2017). This indicates that many of the new trips generated by increased development of the corridor were absorbed by auto-alternatives.

5.3 How Car Dependence was Reduced along the Rosslyn-Ballston Corridor

1. Planning strategies were framed according to local concerns

Arlington planners appear not to have substantially discussed automobile dependence as an issue itself. They do not measure it and make little mention of it in their policy documents (Interview 4). Rather, they have focused more on negative externalities of automobile use such as congestion, emissions, or safety concerns. Interviewees suggest that framing planning efforts according to these negative externalities has been an important factor in the Rosslyn-Ballston corridor’s reduction of car dependence because most Americans like cars. Interviewee 2 argues that in the US, “the automobile has become socially constructed as a paradigm of freedom and liberty” and that to plan “against cars” is difficult in this context. Planners working to transform the Rosslyn-Ballston corridor initially framed their efforts not as an attack on cars but as supporting economic development, arguing that a rapid transit system and would spur new development and reinvigorate the declining corridor (Interview 1). Today, many of Arlington’s planning policies that reduce car dependence as framed as efforts to improve the pedestrian environment and improve public spaces. Interviewee 1 notes that “[planners] are not trying to deny people the use of their cars. It’s about providing options”. He also describes the
importance of ‘carrots’ like economic development or improved safety that frame policies either as mitigating the harmful effects of cars, or as policies that are beneficial for entirely separate reasons.

Framing matters, as alluded to by interviewees 3, 4, and 5. All point to the relative insignificance of car dependence to most people, with one describing transportation as “a means to an end” rather than an issue itself (Interview 3). “95 percent of Arlingtonians” demonstrate little care about car dependence but do care about issues like economic development, safety, congestion, or pollution (Interview 5). Planners are most successful at pushing planning strategies, particularly those that change how people travel, when they frame them according to some of these more relevant public concerns (Interview 5). By doing so, Arlington planners were able to secure public consensus for transformative planning strategies that contributed to reduced car dependence. This consensus has largely been maintained because successive municipal leaders have “created the space for those that are scared [about planning impacts] to say their peace and make their points” (Interview 4). Interviewee 4 cautions that without sustained community support for plans, the corridor could have been “the worst of both worlds” with unhappy drivers and ill-served pedestrians.

The genesis of planning efforts to reshape the Rosslyn-Ballston corridor was largely local. According to Interviewee 1, there was community consensus behind the general idea of a less car dependent corridor from “the beginning”. The community, which was already inspired by passionate anti-highway sentiment, was firm in lobbying for the location of metro beneath Wilson Boulevard rather than in the median of Highway 66 (Arlington County, 2010). Arlington’s planning efforts have continued to involve substantial community engagement, so
much so that local planners now refer to the county’s successful community engagement practices as ‘The Arlington Way’ (Interview 4). Interviewee 3 suggests that this consensus between politicians and communities on planning issues is more prevalent in the Washington region than in other city regions partly because municipalities in the Washington region share the goal of oriented new regional growth to make the most of existing infrastructure.

2. Long term comprehensive planning for transport and land use created a less car-oriented built environment

The success of the Rosslyn-Ballston corridor speaks to the importance of long-term planning. Interviewees note that the biggest initial factor in reducing car dependence in the corridor area was the development of the Metro. Without a concerted effort in the 1960s to plan for the long term by locating the metro extension beneath the corridor and avoiding the ‘second best’ highway median route alignment, the Rosslyn-Ballston corridor would likely never have become the dense transit-oriented suburb it is (Interview 2). One need only look further west to Fairfax County where metro stations are located in highway medians to see the relative lack of new development and continued suburban automobile dependence that could have been if the metro had not been located as appropriately (Interview 4).

Forward-thinking land use planning also paved the way for a less car-dependent corridor area. Guided by the principles of managed growth in its comprehensive plan, Arlington rezoned the area around metro stations for more dense development at the same time the metro was being developed (Interview 2). The county created a ‘bull’s eye’ zoning system that concentrated mixed-use and moderately high-density development around metro stations (Figure 11)
(Interview 1 & Buehler et al., 2014). Rezoning for the long term meant that the Arlington allowed for density levels that were in excess of what was demanded by the market at the time but which gradually became necessary. It also comprehensively planned each station area along the corridor in great detail through sector plans before development began in earnest such that land use planning was proactive rather than reactive. Being “ahead of the game” in this way ensured that Arlington was able to achieve controlled transit oriented development around metro stations that matched its broader vision for the corridor as an economic and residential center, and reduced the need for residents and workers to drive from the outset of redevelopment (Interview 4).

![Figure 11. – Arlington’s Early ‘Bull’s Eye’ Zoning Concept](https://arlingtonva.s3.amazonaws.com/wp-content/uploads/sites/31/2014/04/bullseye.jpg)

To change travel behavior, land use and transport planning must be coordinated in pursuit of the same end goal. Rapid transit systems have less of an impact on travel behavior in places

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where land use is not conducive to their use, as demonstrated at the aforementioned Fairfax County metro stations, and dense areas can remain car-dependent if non-automobile transport options are not effectively provided, as demonstrated to an extent by Tysonn’s Corner (Interview 4). The reduction of car dependence along the Rosslyn-Ballston corridor has been substantial in part because land use and transportation planning strategies have been effectively integrated so that the presence of metro is supported by dense development and a high-quality pedestrian realm. As Interviewee 4 views it, “the combination of density, accessibility, and alternative mobility” is the real reason for the corridor’s success both in terms of place making and reducing car dependence.

The decline in car dependence along the corridor has been supported by a comprehensive transportation system. Interviewees agree that a rapid transit line alone is not as effective in reducing suburban car dependence as a more complete transportation system that provides supplementary public transport and allows for walking and bicycling. Interviewee 1 emphasizes the importance of “putting a solid transportation system in place and then expanding it as much as possible by providing multiple elements”. Interviewee 3 values bus systems in addition to rail transit. Interviewee 4 speaks of the importance of providing high quality infrastructure for pedestrians and cyclists further away from the corridor to facilitate more car-free trips beyond the walkable range of metro stations. Arlington has done this by providing a comprehensive transport system based around the Rosslyn-Ballston corridor, which now incorporates 19 local bus routes, 29 bike share stations, a car-share system, and numerous bike lanes (Arlington Transit, 2017, WMATA, 2017, Capital Bikeshare, 2017). Interviewee 2 notes that comprehensive transportation systems are important in tackling suburban car dependence.
not just in Arlington but more broadly, suggesting that in the right conditions, walking and cycling can be effective alternatives to the automobiles in suburbs, even those less dense than the Rosslyn-Ballston corridor. Interviewees expressed enthusiasm for ride-sharing networks as another tool to make suburban transport systems more comprehensive. Comprehensive transportation systems are especially crucial to reducing car dependence because they better serve the large number of non-commute trips that hub-and-spoke rapid transit networks cannot (Interview 3).

3. **Zoning encourages non car-oriented development**

Arlington’s vision for the Rosslyn-Ballston corridor as a transit-oriented suburb was realized due to effective zoning policies. The county shaped development to be transit and pedestrian oriented using zoning that:

- Provided for density around metro stations
- Allowed for mixed use development
- Incentivized developers to provide community benefits in exchange for more development rights

Interviewees stress the importance of this package of zoning strategies and suggest that the corridor-area would be more car dependent if all three were elements were not coordinated. Interviewee 4 summarizes this attitude in observing that “if you just pile density at or near a metro station and expect transit-oriented livability, that won’t work”. Interviewees 1 and 4 highlight the benefits of doing more than just zoning for density by comparing the Rosslyn-Ballston corridor to Tyson’s Corner, a more distant Washington suburb, which has densified
around metro stations but in their view has not done enough to incentivize development that is transit and pedestrian oriented and as such is unlikely substantially reduce car dependence. Because Arlington owns very little land along the corridor, its zoning system is essentially the best planners can do with the power they have (Interview 2). In this context, developers play an important role in determining how development plays out and to what extent it is car dependent. In the case of the Rosslyn-Ballston corridor, Interviewee 1 recounts that developers were initially opposed to the more complex zoning system but have since become supportive, particularly of its incentive elements. Corridor-area zoning is actually less restrictive for developers than typical suburban zoning because it allows developers to negotiate parking requirements, density, and use restrictions which can reduce costs or increase profit potentials (Interview 1 & Interview 2). In turn, zoning provides the community with benefits such as street scape improvements, or simply money for public works, which can reduce car dependence. Interviewee 2 summarizes the importance of incentive zoning in achieving the planning vision for the corridor by observing that “you don’t zone for what the developers want. You zone for a bit less and then make them negotiate for more”. In contrast, standard suburban zoning regulations generally mandate parking requirements, building use, and low-densities, all of which are restrictions on developers that do not yield public benefits (Interview 2). Interviewee 2 asserts that “developers actually don’t have more freedom in [traditional] suburbs because of strict zoning requirements” and describes local developers as being “sick and tired of not being able to do more mixed use (and thereby less car-dependent) development because of zoning” outside Arlington.
Plans for the corridor capitalized on density by incentivizing mixed-use pedestrian oriented development (Interview 3). Because only 25 to 30 percent of trips in the Washington region are for commute purposes, which are the trip-type most easily served by metro, reducing car dependence necessitates attention to the other 70 percent of trips (Interview 3). Although supportive data is not readily available, Interviewee 3 indicates that zoning to create a walkable environment with mixed-use destinations in close proximity has reduced the amount of non-commute trips carried out by car in the corridor area. Interviewees 1 and 4 also emphasize the importance of Arlington’s zoning code in improving pedestrian and bicycle friendliness to supplement the provision of public transport and denser suburban development. Simple measures delivered by zoning such as curb extensions or enhancing sidewalk continuity are, in their view, some of the most effective ways to reduce car-dependence. Essentially, “coming up out of the metro to a real place” is more important than “saying you can walk to [TOD destination]” (Interview 4).

4. Information on mobility options is provided

Information provision has also played a role in changing transportation behaviors in the corridor area. As part of its transportation demand (TDM) Plan, Arlington engages in several marketing and outreach efforts to encourage people to make use of auto-alternative forms of transport. Arlington’s TDM plan is administered by Arlington County Commuter Services (ACCS), a bureau of the county’s Transportation Division. ACCS manages several programs which provide information on transportation options in the county. Among these are ‘Commute Stores’, commuter benefit programs, educational groups, and employee transportation surveys. Commute stores are physical stores which sell public transport passes and provide information
on travel options. Two of four such stores are located on the Rosslyn-Ballston corridor and serve over 200,000 people annually (Arlington, 2017). The commuter benefit program works with employers to identify appropriate tax-incentivized transit benefits, and to conduct surveys of employee transportation patterns in order to better understand the travel behaviors of different companies and offices. Educational groups include BikeArlington, WalkArlington, and ‘Arlington’s Car-Free-Diet’. These groups provide information on the environmental and health benefits of walking or cycling, for example through the provision of CO2 savings calculators. ACCS also organizes awareness campaigns and events to advertise non-automobile forms of transport in the county and along the corridor. In addition to these public-sector driven outreach the Site Plan element of the zoning code mandates that all new developments provide information kiosks on clear display to all residents that advertise all transportation options available to them (Interview 4).

Such information provision strategies are well-liked by interviewee 4, who notes that to change opinions on car use “you have to give space for these kinds of conversations to happen”. It is unclear though to what extent information provision has influenced car dependence. It is likely that such measures are important supplementary actions in reducing car dependence but that the land use and transportation policies have played a greater role in reducing car dependence.

5. **Arlington has built community consensus for planning policies**

Arlington is famous for the ‘the Arlington Way’, which emphasizes thorough engagement so that as many stakeholders as possible have a chance to participate in planning decisions (Alpert, 2011 & Interview 4). Many attribute the success of the corridor to this planning
structure, which incorporates citizen advice from small citizen associations and larger bodies like the Planning Commission, and allow citizens to be heard at public meetings and through individual channels of communication (Figure 12) (Interview 4). Plans that transformed the corridor such as the comprehensive plan, GLUP, MTP, or sector plans were all developed with this type of community input. Community engagement has been important to the transformation of transportation and land use along the corridor because it helped establish consensus for the basic idea of a transit oriented suburb. The historical narrative of the development of the corridor is rife with accounts of the broad community consensus in support of this idea (Interview 1).

![Figure 12. – Arlington Planning Commission public meeting (2017)](image)

Despite receiving praise in planning circles, the transformation of the Rosslyn-Ballston corridor remains an exception to the rule of auto-oriented North American suburbs. Interviewee 1 suggests that ‘retrofitting’ suburbs similarly is difficult because in most of them, residents “are happy with the way things are”. Automobile oriented ways of life have become normal and

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17 Source: Author
people generally do not complain about the nature of transportation systems or patterns of suburban development unless something is perceived as wrong (Interview 1). Interviewees acknowledge this and point out that while there are negative externalities to suburban development, suburbs are not inherently bad places. The premise of this thesis, that the transformation of the Rosslyn-Ballston corridor into a less car-dependent place is good, is predicated on a subjective notion of what a good suburb is. From environmental or public health perspectives, car oriented suburbs are easy to portray negatively and transit-oriented suburbs like the Rosslyn-Ballston corridor are success stories. Viewed from the perspective of those who value open space or larger homes, the reverse may be the case. Interviewee 2 attributes the continued omnipresence of traditional car-oriented suburbs to the aforementioned link between the ‘American Dream’ and suburban home and car ownership. In this context, efforts to substantially change suburbs, or any existing community, to the extent that the Rosslyn-Ballston corridor has changed are “going to be viewed as [planners] trying to tell people how to live” (Interviewee 2). Interviewee 2 contends though that auto-oriented suburbs, which grew partly as a result of mortgage and highway subsidization, are actually more of a symptom of government overreach. This may be true, but the idea that car-dependent suburbanization is negative has yet to substantially alter suburban development patterns. The success of the Rosslyn-Ballston corridor in reducing car dependence is therefore a reminder that planning can achieve transformation change most effectively in places where there is political will and where communities are receptive (Interview 4 & Interview 5).
Findings Summary

Arlington has reduced car dependence in the Rosslyn-Ballston corridor area by creating a built environment that provides alternatives to driving. It has relied on long-term planning documents that integrate transport and land use planning to transform the corridor area into a transit-oriented place where the conditions are right for reduced car dependence. In particular, the story of the Rosslyn-Ballston corridor demonstrates the importance of building support for new planning concepts. In order to successfully promote the corridor’s redevelopment around public transport and the pedestrian realm, Arlington planners framed their proposals according to concerns about local economic development and worked to build community consensus.
6. Lessons from Rieselfeld & Vauban

6.1 Understanding the Planning System

Planning in Freiburg

Urban planning in Freiburg, like that of many cities in Germany, is a vertically integrated process in which municipalities work closely with higher levels of government. The federal government produces guidelines for regional and spatial planning and ensures consistency across all levels of spatial planning. State governments create planning regulations in line with these federal policies and typically cooperate closely in doing so. State governments also identify planning objectives at the state level, pass regional planning acts, and oversee state planning laws. Beneath them regions, a jurisdiction that does not exist in the US, create regional spatial plans. Municipalities prepare their own land use plans which must be in line with the associated regional and state plan. At the bottom of this hierarchy, individual development projects are subject to approval by local municipal planning authorities (Schmidt & Buehler, 2007). This organizational system aims to ensure consistency in planning efforts, and allows for local control as long as collaborative goals are addressed. The process of reciprocal influence by multiple levels of government is known as the ‘counter current principle’ and is part of the reason that German planning has a high degree of consensus (Schmidt & Buehler, 2007).

Freiburg’s municipal planning authority operates within this context (Table 6). It is responsible for preparing visioning documents for the city area, as well as legally binding land use plans, in
concurrence with the regional, state, and federal planning guidelines. The planning authority reports to the mayor and city council, which unusually for Germany has been dominated by the Green Party for more than a decade (Daseking, 2013). The current planning vision for the city is the ‘Land Use Plan 2020’ or FNP (Flaechennutzungsplan 2020), which focuses development in the city center rather than on the periphery (Stadt Freiburg, 2014). It is supplemented by Development Plans for specific districts. These Development Plans are somewhat similar to American zoning in that they outline permissible uses and building typologies (Freiburg, 2017).

Within this planning structure, Freiburg has implemented a range of transformative planning policies that have contributed to low car-dependence. Immediately after the war, when much of the city was destroyed, planners elected to rebuild the city around its medieval street network and thereby preserve a walkable city center. In the 1970s, Freiburg fully pedestrianized large portions of the city center, and began to promote the construction of modern housing in the inner city to reverse suburban flight (Eberlein & Daseking, 2011). From the 1980’s onwards, the city more aggressively pursued environmental sustainability and community engagement in planning. In doing so it developed the two case-suburbs discussed in this thesis, expanded its public transport network, reduce car speed limits, generally to less than 18 miles per hour (30 kilometers per hour) in residential areas, and halted the expansion of suburban retail malls (Field, 2014). Today, planning efforts focus on sustainably accommodating population growth and promoting economic development around high-tech and education industries.
Table 6. – Freiburg Planning Structure\(^\text{18}\)

\(^{18}\) Source: Author
Planning for Rieselfeld and Vauban

Rieselfeld and Vauban were conceived as environmentally friendly ‘districts’ (local planners do not refer to them as suburbs) in the 1990s in response to intense housing demand and citizen environmentalism (Siegl, 2009). Accordingly, both Rieselfeld and Vauban were designed to be sustainable in their construction and operation, and in terms of the lifestyles they would facilitate. In response to concerns over energy production, the planning and design concepts for both areas focused heavily on reducing energy consumption.

Rieselfeld

Rieselfeld was planned and developed before Vauban and is somewhat different in both physical character and in terms of the planning priorities which was shaped it. Prior 1990, the Rieselfeld site was a sewage drainage field owned by the City of Freiburg (Interview 7). Throughout the 1980’s, it became clear that the facility was approaching the end of its useful life. Concurrently, Freiburg faced a housing shortage and had exhausted its supply of residentially zoned land. To provide new housing the city’s planning authority decided to promote the development of the Rieselfeld site, and hosted a planning competition for it from 1991 to 1992 (Siegl, 2009). The winning entry, from the firm Planning Group South West in collaboration with several local architects, focused on creating a self-contained neighborhood where most daily needs could be met on foot. The plan also incorporated flexible urban design guidelines, mixed-use and industrial space targets, designed green space, a tram extension, and a sustainable building code (Siegl, 2009). It planned for medium densities with floor-area ratios (FAR) of at least 1.0 on all lots, and for extra density around the central axis served by the tram
extension. This tram line formed the centerpiece of Rieselfeld plan, which was designed to be a ‘transit-first’ development (Broaouddus, 2011). The extension included three stops in the suburb, spaced at roughly half a kilometer from one another so that most residents are within a ten-minute walk. While Rieselfeld has been made highly transit-oriented, plans did not substantially inhibit car use. On-street parking is free but is not provided on main streets, and most buildings include underground parking, the result of a one-space-to-unit parking requirement (Broaouddus, 2011).

In 1992, Freiburg adopted the planning concept for Rieselfeld and began to sell off land parcels to various developers. Developers were limited to producing only 40 housing units each and were coordinated by Projektgruppe Rieselfeld, a development agency created by the city to oversee the development (Eltis, 2007). Construction of the tram extension and first buildings began in 1993 and the entire site was completed and occupied by 2000. Today, Rieselfeld contains 4,200 housing units, 11,000 residents, and 1,000 jobs on 193 acres of land (Broaouddus, 2011 & Daseking, 2012). Its housing density is roughly 22 units per acre, which would translate into 14,000 units per square mile.

**Vauban**

At the end of the Cold War in 1992 the French military vacated the Vauban barracks site to the south of Freiburg, and the land became federal property. Freiburg’s mayor and planning authority viewed the area, like Rieselfeld, as an opportunity to provide housing in a way that incorporated community concerns about the environment and social equity. To achieve greater control over the site's development, the City forced the federal government to sell the site to it
by refusing to grant planning permission for any new proposal (Eberlein & Daseking, 2011). It again held a planning and design competition to solicit ideas for the site. The city consulted locals and potential future residents for several months before making a decision on the plan. During this period, a group of local environmental activists formed Forum Vauban in an attempt to interject more radical environmentalist thinking, such as a complete ban on cars, into the design strategy. Kohlhoff & Kohlhoff, a Stuttgart-based architecture firm, won the competition and incorporated some ideas of Forum Vauban into the final master plan (Field, 2010). The plan sought to reuse existing military buildings for housing in addition to new-build housing, create a new street grid, provide public spaces, and extend the tram system through the suburb. Transportation concerns played a greater role in planning for Vauban than for Rieselfeld. Initially the Vauban plan aimed to eliminate car traffic in the new district. State laws, which mandated 0.5 parking spaces per dwelling, prevented this however, and the plan ultimately allocated parking in garages at the edge of the district (Interview 2). Instead of focusing on eliminating automobile traffic, the plan for Vauban prioritized bicycling and walking. The plan also sought to be transit-oriented by locating moderately dense development around a central tram axis, to accommodate a mixture of uses and provide community spaces.

Freiburg adopted the plan for Vauban in 1994 and construction of the first elements of the plan began in 1998 with the demolition of much of the old military base. The tram system was extended to the site in 2006 and the entire district was complete by 2008. Vauban is smaller than Rieselfeld and contains only 2,000 housing units, 5,000 residents, and 600 jobs on 84 acres of land. Its housing density is approximately 24 units per acre, or 15,300 units per square mile (Broaddus, 2011).
Eco Suburb Planning Principles

Although Rieselfeld and Vauban are different in some respects, they are similar examples of Freiburg’s eco-suburb concept. Freiburg’s approach to planning an eco-suburb incorporates several guiding principles which are evident in both cases. Foremost among these principles is environmental sustainability. To planners and activists in Freiburg, this has primarily meant a focus on reducing energy consumption in both transport and buildings. Eco-suburbs encourage auto-alternatives forms of transport, for example through street design that loops side streets towards central transit axes rather than arterial roads. They also incorporate building codes that mandate high efficiency standards for energy consumption, energy sourcing, and water usage (Broauddus, 2011 & Von Bradsky et al., 2008). Freiburg’s two-faceted approach to energy usage in planning is important because it means that the idea of an eco-suburb is more comprehensively focused on the environment than a typical transit-oriented development.

Freiburg’s eco suburb vision also incorporates a focus on creating communities. Planning and development processes aim to establish or support an existing community so that new suburbs are socially cohesive upon completion. The eco-suburb concept aims to make new suburbs family-friendly places by providing spaces for children to play and for the public to interact. It also aims to provide a range of housing options for renters and buyers at mixed income levels (Daseking, 2012 & Broauddus, 2011).
6.2 Car Dependency in Rieselfeld & Vauban

Rieselfeld and Vauban are areas of low car dependence in a city that is already less car dependent. Freiburg is walkable, bike-friendly, and transit oriented. A comprehensive public transport network, supported by a five-line, 32 kilometer tram network, provides access to most of the city (Eltis, 2007) (Figure 13). Cycle routes extend from the center to the outer suburbs and over 5,000 bike parking spaces are provided in the city center (Hall, 2014). New development is concentrated in the inner areas of the city and around public transport.

Figure 13. – Freiburg Tram Network Map

As a result of these planning strategies, Freiburgers drive less than they did in the 1970’s. In 1982, when Freiburg had already embarked on the path towards reduced car dependency, 39 percent of trips were by car, 35 percent by foot, 15 percent by bike and 11 percent by public transport. In 2016, only 21 percent of trips were by car. Notably, walking and public transport trips declined somewhat, to 29 percent and 34 percent respectively, as biking increased substantially to 34 percent (Table 7) (Interview 6). Today, Freiburg’s total share of non-car trips, 68 percent, is ten times higher than the average for North American cities and even 30 percent higher than for German cities. Automobile ownership in the city has not increased since 1990 (Hall, 2014).

Table 7. – Freiburg Modal Split (1982-2016)\(^{20}\)

\(^{20}\) Source: Data provided by interviewee 6
Information on travel behavior in Rieselfeld and Vauban indicates low levels of car dependence within both areas. In Rieselfeld, 45 percent of trips are by bicycle or foot, 25 percent are by public transport, and 30 percent by car (Field, 2010). Vauban is even less car dependent. There, 64 percent of trips are by bike or foot, 19 percent are by public transport, and only 16 percent are by car (Field, 2010) (Table 8). According to a local expert, Vauban is, at least in experience of many residents, now “virtually car free” (Interview 6).

![Bar chart showing Rieselfeld and Vauban Modal Split (2010)]

Table 8. – Rieselfeld and Vauban Modal Split (2010)

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21 Source: (Field, 2010)
Car ownership in both suburbs also indicates reduced car dependence. In Rieselfeld there are 290 vehicles per 1,000 residents, while in Vauban there are only 170 vehicles per 1,000 residents. Converting these figures into household level data, to allow for comparison to Arlington, indicates that 76 percent of Rieselfeld households own a car while only 43 percent of Vauban residents do (Broauddus, 2011). These low levels of car ownership are noteworthy because Freiburg, and both case suburbs, are relatively affluent. Urban GDP per capita is above the European and German averages and the city has experienced sustained economic growth for several decades (Daseking, 2012).

Over the last 30 years Freiburg has changed from a city at “at the cusp of becoming car dependent” to a global leader in sustainable transportation and development (Interview 9). The same is true for its suburbs. Even for Germany, where suburban areas tend to be less sprawled than in North America, Rieselfeld and Vauban are examples of how planning can reduce car dependence in suburbs.
6.3 How Car Dependence was Reduced in Rieselfeld & Vauban

1. Early decisions created the conditions for reduced car-dependence

Freiburg’s suburbs have succeeded in reducing car dependency because numerous decisions, before and during their planning, were directly intended to do so. Put another way, the early decisions were important. Many cities and suburbs became car dependent because planning decisions and market forces pushed them in that direction. Relaxed regulation on urban expansion, demand for larger houses and lots, or a reduction in public finance for bike or public transport service for example, can make a place more car dependent. In Freiburg, not only were many such decisions that enable automobile dependence never made, many policies were put into place that minimized the need to drive. For example, the decision in the 1960’s to retain the city’s tram network was instrumental in maintaining transportation alternatives at a time when many cities were removing them. Retaining the tram network was important as a later catalyst for suburban transit oriented development, as Interviewee 7 suggests that trams are uniquely more attractive for development than buses or commuter rail. In addition to maintaining a driving alternatives, planners in Freiburg made early decisions that prevented sprawl, and associated car oriented development patterns. They designated areas of the city’s periphery for development and areas for open space in an effort to preserve nearby agricultural and natural land (Interview 6). Interviewee 6 describes the 1980’s decision to prohibit new suburban retail malls as an important early decision that minimized the amount of ‘drive-only’ places in suburbs. Designating growth areas and controlling retail development in these ways early on helped ensure that new suburban development was not auto-oriented by default.
In planning for Rieselfeld and Vauban, the early decision to provide public transport has minimized car dependence. Rieselfeld in particular was connected to the tram network via a new tram extension in the early 1990’s before the first residents moved in (Figure 14). This eliminated the need for many of them to rely on automobiles, at least for most commutes, from the outset of their lives there. Interviewees 8 describe the tram extension in Rieselfeld as “an important central design feature” that helped anchor the development. Likewise, in Vauban a bus route was provided prior to construction and was converted into a tram route soon after the completion of the development such that car reliance was never a significant issue for residents (Interview 7). In addition to ensuring that car alternatives were available from the outset in Rieselfeld and Vauban, planners also made early decisions to discourage driving such as reducing the amount of on-street parking, lowering speed limits, and narrowing roads (Interview 9 & Hall, 2014). Early decisions for Rieselfeld and Vauban that promoted auto-alternatives and discouraged driving are a testament to the preemptive power of planning.
2. Planning principles encouraged reduced car dependence

Freiburg’s guiding principles and goals that lead to reduced car dependence have been thoroughly integrated into planning practice. The planning authority has 12 broad planning principles but two of them, the principle of being a ‘city of short distances’ and the principle of ‘public transport and density’ are frequently mentioned in relation to issue of suburban car dependence (Daseking, 2012).

Interviewees frequently cited the goal of being a ‘city of short distances’ as a key reason that the two suburbs are less car-dependent (Interview 6 & Interview 8). Vauban and Rieselfeld were planned with this principle in mind and as such, feature mixed-use centers which cater to most daily requirements within a ten-minute walk of all district residents. Interviewee 6 notes that planning for both areas also focused on creating a ‘decentralized but integrated city’, in which people can do most things within their own district but are easily able to access other

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22 Source: http://www.fws-freiburg-rieselfeld.de/images/rieselfeld.jpg
areas. Adherence to the short distance principle influenced the actual size of both suburbs. Rieselfeld, at 78 hectares (0.3 square miles), and Vauban, at 41 hectares (0.16 square miles) (Field, 2010) are both relatively small but are the right size for TOD. For comparison, the 0.4 Kilometer (0.25 Mile) radius commonly referenced as the appropriate walking distance from a public transport station within which development should be concentrated results in a circle of roughly 0.2 square miles in area.

The principle of ‘public transport and density’ is a key factor in the suburbs’ low levels of car dependence. Freiburg has an extensive public transport network which generally receives priority over cars in planning and operational procedures. The city’s planning authority and public transport provider RVF work closely to ensure that development is transit oriented and RVF views itself as a competitor to the car even in suburban areas (Interview 7). With respect to density, Freiburg treats TOD principles as a norm, rather than as a localized exception and incorporated this mindset in planning Rieselfeld and Vauban. Interviewee 7 notes that it is in the transport authority’s own interest to ensure that it serves relatively dense areas and that planners understanding of this need has guided suburban planning. In Rieselfeld and Vauban, this mutual interest in transit oriented development motivated the provision of public transport before major development.

That planning for ‘short distance neighborhoods’ where public transport and land use are integrated has led to “a natural reduction in car dependence is easy to understand” (Interviewees 8). Freiburg’s success in planning Rieselfeld and Vauban according its principles demonstrates the city’s commitment to strategic planning (Interview 6).
3. Plans were framed according to local concerns

Many of the planning principles that have made Rieselfeld and Vauban less car dependent were successfully implemented in part because planners framed them according to local concerns. Rather than promoting the planning of the two suburbs as opportunities for economic development or less car-dependent suburban living, planners portrayed them as environmentally responsible solutions to Freiburg’s housing crisis (Interview 7). Freiburg’s population has more than doubled since World War Two and the 1990’s saw the city’s housing supply come under pressure as the number of students in the city increased and its economy grew. Framing plans for Rieselfeld and Vauban as solutions to this housing shortage, and as responses to demands for environmentally sustainable development was so popular that planners were essentially “pushing at an open door” in developing the two suburbs (Interview 7). Furthermore, framing them in this way allowed for the development of slightly higher than normal suburban densities, which is why Rieselfeld and Vauban incorporate more apartments than nearby Freiburg suburbs. Planners also framed specific planning strategies intended to reduce car usage and dependence, such as strict speed limits, as measures to enhance pedestrian safety, particularly for children (Interview 9 & Broaudson, 2010). Ultimately, the success of Rieselfeld and Vauban has been a result of many factors but effective framing was, according to interviewees, an important and necessary element of their planning.

4. Citizen involvement drove and supported plans

Extensive community involvement has been one of the defining planning strategies of Rieselfeld and Vauban, and the wider city. The current general land use plan for example, was
developed with input from 19 citizen working groups (Hall, 2014). Citizens were engaged in planning for the two suburbs from the outset, and in the case of Vauban were also drivers of the development. Master planning competitions were used to design Rieselfeld and Vauban and citizens were invited to comment on submissions as individuals and as part of working groups (Hall, 2014). Citizen feedback factored into the selection of the winning plans for both areas, and the winning entrants worked with locals to incorporate their input into the submitted masterplans (Interview 8). The same strategy of soliciting plans through competition and then allowing members of the public to help select a winner was also used for important buildings in both suburbs such as schools and community centers (Hall, 2014). Involving citizens in the planning process of Rieselfeld and Vauban was part of an effort “not just to build streets and erect buildings, but to prepare future citizens [for these neighborhoods]” (Interview 8). The land development process for both areas, which is discussed in a later section, also made locals clear winners and thereby reduced the risk associated with each development (Interview 6).

Interviewee 6 highlights the extent to which Freiburg engages citizens, observing that “city leaders have to be committed to long-term plans but always with the support and engagement of people” and suggests that an engaged populace is important in any effort to make cities more sustainable.

Community engagement has been important with respect to reducing car dependence in both suburbs because it helped ensure that efforts to plan for lower car dependence had popular support and were implemented smoothly. Had the city not had the support of citizens in the planning process, it might have faced more substantial opposition from Freiburg’s strong activist community. Interviewee 7 suggests that in fact, neither Rieselfeld nor Vauban would
have even been conceived of as ‘eco-suburbs’ were it not for an engaged environmentalist community. In the case of Vauban, the activist group Forum Vauban was “the motor of the ecological or other improvements” that have come to make the suburb stand out (Interview 9).

Leadership in was important in implementing the plans for Rieselfeld and Vauban. Although Freiburg was in some ways responding to a public desire for sustainable urbanism, its leaders were not “blindly following” the community (Interview 7). They involved the community in outlining, planning, and building a vision but also trusted their own expertise (Interview 7). Leaders also made strategic use of community sentiment, and have described their approach to planning as more strategic than regulatory (Interview 6). The strategy of implementing popular projects first, such as speed limit reductions on side streets, demonstrates this.

While Freiburg’s engaged population may be somewhat unique, Freiburg’s mayors and planning authorities have consistently viewed participation as a vehicle to achieving planning goals rather than a hindrance that needs to be overcome (Interview 7). Interviewees 8 stress that complex developments like Rieselfeld and Vauban “must have a motivated city administration and motivated citizens” backing them. Creating a framework to allow for effective participation in the planning for the two suburbs has thus allowed planners to pursue strategies to reduce car dependence that might otherwise have encountered.

5. Planning incentivized non car-oriented travel behavior and land use patterns

Automobile dependence is minimized by providing alternatives to driving and by reducing the need to drive. Transport and land use planning “absolutely must go hand in hand” to create places where multiple modes of transport are available and land use patterns are not car
oriented (Interview 9). In this respect plans for Rieselfeld and Vauban have done well. Both suburbs are places where car dependence is lower thanks to the presence of car alternatives and land use patterns that do not prioritize driving over other forms of mobility (Interview 8). Tram routes form the backbones of both suburbs and more intensive mixed use development is located close to tram stops. Pedestrian and bike infrastructure connects residents to the center of each district and to the wider city. Road design allows for efficient pedestrian, bike, and car access to the center of each suburb by providing straight routes. Road layouts also restrict vehicular through traffic by minimizing the number of road entrances; each district has only two (Broauddus, 2010). Land use planning has also been used to enhance the pedestrian environment by dividing both sites into numerous small plots with public rights-of-way permeating through semi-public courtyards, as opposed to large plots with limited pedestrian access.

In addition to coordination of transport and land use planning, Freiburg’s five principles of smart transportation planning are a key reason that Rieselfeld and Vauban are less car-oriented. These principles are (Bindra et al., 2006 & Hall, 2014 & Interview 6):

- Extend public transport to development
- Restrain vehicle traffic
- Channel motor traffic away from pedestrians and cyclists
- Manage parking
- Promote cycling

According to interviewee 6, integrating transportation and land use planning should involve more than just planning for higher density development around public transport infrastructure. Effectively achieving less car-oriented travel behavior in such environments requires a focus on providing ‘carrots and sticks’ to discourage automobile use and encourage alternative forms of
mobility. These five principles of smart transport planning are such incentives and disincentives. While providing good alternative forms of mobility and allowing for moderately higher densities around public transport, Rieselfeld and Vauban are less car dependent than other suburbs because driving disincentives have been put into place (Interview 6). In Rieselfeld for example, there is no parking on main streets while in Vauban, there is almost no parking at all in the entire district, save for a few garages located on the periphery in which a space costs upwards of $25,000 (Hall, 2014 & Interview 9). Interviewee 9 points to the location of parking away from residences as perhaps the most important step Vauban has taken to reduce car dependence, and suggests that when residents have to walk to their cars, many decide “[they] might as well take the tram”. In both districts, trams are given priority over cars in terms of street space and at signals. To ‘restrain’ vehicle traffic driving speed limits are also quite low, generally at 30 kilometers (20 miles) per hour (Figure 15) (Broauddus, 2010).

![Vauban Street with 30 km/h speed limit](http://cyclingchristchurch.co.nz/wp-content/uploads/2015/08/vauban-freiburg-9.jpg)

**Figure 15. – Vauban Street with 30 km/h speed limit**

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Planners have also worked to make auto-alternatives competitive in other ways. The regional RVF, which operates all buses, trams, and commuter rail services, subsidizes travel passes so that public transport is relatively affordable. A monthly public transport pass costs around 50 Euros, about one and a half times the price of filling up an average vehicle, and allow unlimited access to all modes of public transport (Hall, 2014 & ADAC, 2017). This contrasts with the Washington region where public transport passes are segmented by mode and a monthly Metro-only pass costs 237 dollars, about eight times the price of filling up an average vehicle (WMATA, 2017 & Gasbuddy LLC, 2017). Forum Vauban has further sought to directly incentivize auto-alternatives among Vauban residents by providing ‘mobility packages’ which include public transport passes and membership of a local car sharing scheme (Broauddus, 2010 & Interview 9). Interviewee 7 highlights such measures as examples of how planning for Rieselfeld, Vauban, and Freiburg has sought to “reduce the primacy of the automobile”.

It is important to note that despite efforts to incentivize automobile alternatives and non-car-oriented land use patterns, planners have not actively sought to fully prevent driving in either suburb. Car ownership remains important in German culture, even in relatively environmentalist areas such as Freiburg. Even in Vauban, 40 to 50 percent of households own a car (Interview 7). Therefore, the use of incentive planning strategies has been important. Rather than forcing residents not to drive, and thereby potentially upsetting many, planning strategies have sought to persuade them to do so less. Interviewees 8 describe this approach as “working at [reducing car dependence] from many sides at the same time”. Planning to reduce car dependence in both suburbs has however, benefitted from a public that does not perceive efforts to disincentivize driving as an attack on their way of life. Freiburg’s planning authority
has a significant amount of control over transport and land use policy in part because the public accepts that it should (Interview 2). The main goal, at least from a transportation and land use perspective, in planning Rieselfeld and Vauban was, as Interviewee 6 describes, to minimize car use in “places that could have easily become car dependent” (Interview 6).

6. Land ownership and development strategies facilitated implementation of plans

Freiburg’s planning authority could exercise significant control over the planning and design of Rieselfeld and Vauban because the municipality owned the land on which they were built. In the case of Rieselfeld, the site had been owned by the city for decades. In the case of Vauban, the site was transferred from the French military to the German federal government. However, under the leadership of Ralph Boehme, the city’s socialist mayor during the 1990’s, the city aggressively pursued land ownership for the purpose of developing an eco-suburb on the site. The city essentially embargoed Vauban by refusing to grant permission for any scheme the Federal government proposed for the site and negotiated with it to sell the land to the city instead (Interview 7). Ownership of both sites allowed the city to pursue its vision for suburbs developed according to its aforementioned planning principles by soliciting master plans and controlling the development process. It is doubtful that the two suburbs would have been developed as they have been, had the city not exercised as much control (Interview 7).

Within this context of public land ownership, the development process for both Rieselfeld and Vauban was unique. The city spent almost nothing to develop the two suburbs and relied instead on private investment to make its plans reality. Instead of relying on larger private
developers though, the city sold off small parcels of land, generally 2,000 to 2,200 square feet (190 to 210 square meters), to smaller developers, building cooperatives, and individuals (Interview 7 & Hall, 2014). Such building cooperatives are called *Baugruppen* and were composed of groups of citizen groups who partnered with architects to build their own accommodation. Groups were essentially allowed to build what they wanted, as long as they conformed to basic design guidelines (Interview 6). Their participation was ensured in part because local lenders, who had seen the concept work in Freiburg before, were willing to finance small developers when more conventional lenders would not (Interview 7).

In pursuing this strategy of piecemeal smaller-scale development, the city also limited the area individual developers could build on. This was done to ensure architectural diversity by preventing a single developer from controlling the entire site (Interview 6). Planners also felt larger developers had “an inferior view of the public good” and “work only to maximize profits” (Interview 8). The strategy had a significant impact on development of both suburbs. Vauban for example, was constructed through 175 different projects, only 30 percent of which were built by major developers (Hall, 2014). With respect to reducing car dependence, this focus on smaller scale development and design diversity has strengthened the pedestrian realm. Smaller developers have proven to be more interested in creating pedestrian friendly street frontages, if only for their own enjoyment, and thereby made walking a more viable transportation option (Daseking, 2012 & Interview 6).

Key to the success of this development approach was the fact that the city extended public services to the sites in advance of development (Interview 7). Smaller developers were more able to participate in the development because they did not have to finance the entire site’s
preparation. Here again, land ownership was important. The city financed the necessary infrastructure spending by borrowing cheaply from local banks through investment trusts, and then used the proceeds of land sales to repay these loans (Hall, 2014). Interviewee 7 is skeptical of the idea that this approach could work without public ownership of land. A private owner would not have the patience to wait for small cooperatives to assemble the necessary financing and slowly develop individual parcels of land. A scenario involving private land ownership would also have seen less of a focus on reduce car dependency, because private developers are still somewhat skeptical of the idea of low-car suburban living (Interview 7 & Interview 9).

7. **Continuity in planning and leadership**

Freiburg stood by its strategy of reducing car dependence in Rieselfeld and Vauban, and across the city, over a long period of time. The planning strategies discussed in this thesis, including strict controls on land use, driving disincentives, and the piecemeal approach to development were not universally popular. Although there was early support for both suburbs, residents of older suburbs were somewhat resistant to the idea of less car-oriented life styles encroaching into what they perceived as their space (Interview 6). Major developers were also skeptical of the eco-suburb concept and later resented what they saw as obstructionist tactics by the city in the way it managed development of the Rieselfeld and Vauban, (Interview 6 & Daseking, 2012). By sticking to its planning principles, and being transparent in the way it planned, the city was able to get some smaller developers to support and participate in their development by demonstrating that “the playing field was level” (Interview 6).
Continuity in leadership was also important in implementing both plans. Freiburg only had two mayors and one planning director over the 30-year period in which it developed Rieselfeld and Vauban (Hall, 2014 & Interview 6). This continuity has meant that planning strategies have not changed substantially. While the city is flexible and alters planning goals over time, continuity in leadership and planning strategies meant that the city pursued long term goals like providing more public transport and improving walkability rather than short term planning ‘fads’ (Interview 6). Interviewee 6 sums up this planning approach in noting that “we didn’t do big things” in planning Rieselfeld and Vauban but rather stuck to a few core planning principles and were patient in achieving them.

**Findings Summary**

Freiburg has purposefully planned Rieselfeld and Vauban as suburbs where car dependence is reduced. Early master planning efforts focused on creating walkable and bikeable environments where new development was oriented around public transport. Freiburg used masterplans to guide development and was able to exert substantial control over development outcomes because it owned the land on which Rieselfeld and Vauban have been built. The city relied on small scale developers to develop both suburbs, which helped enhance the construction of the public realm. Additionally, both suburbs are made less car dependent because of strategies that disincentivize driving and incentivize alternative land use and transportation patterns. The success of Rieselfeld and Vauban as low car-dependence suburbs has been made possible by sustained leadership and community buy-in, which planners helped to achieve by framing plans according to local environmental and housing concerns.
8. Conclusion

Findings

The Rosslyn-Ballston Corridor and Rieselfeld and Vauban case studies demonstrate that in the right conditions and with effective planning approaches, suburbs can become less car-dependent. Although the case studies are different, both in terms of context and how they were planned, there are commonalities between their successes in changing travel behavior. These commonalities are discussed here as the lessons of the two case studies. While they do not provide a full answer to the research question, they do provide clues as to how suburbs can reduce car dependence.

Planning strategies that reduced car dependence in both case studies were not portrayed as efforts to reduce car dependence. They were framed according to local concerns such as economic growth, housing, or environmental sustainability. This helped ensure maintain public support for new planning approaches that changed the way people travel.

Planners in Arlington and Freiburg worked to integrate transport and land use planning. Plans for both suburbs increased density around public transport, created walkable public realms, and scaled development appropriately for non-automobile forms of mobility. Planners also pursued long-term strategies that delivered gradual reductions in car dependence, rather than more intrusive interventions intended reduce car dependence in the short term. Plans for both case suburbs were strategic, not ‘magic bullets’.
Rail transportation systems have been important elements of reduced car dependence for both case studies. Rail transit acts as a central element of the suburbs but is supplemented to varying extents by good pedestrian and bike infrastructure, as well as good road infrastructure and bus networks. Facilitating true multi-modal mobility has allowed the Rosslyn-Ballston corridor and Rieselfeld and Vauban to achieve substantial reductions in car dependence because complete transport systems are better equipped than rail transit alone to serve a wide variety of mobility needs.

In both cases, planning strategies have incentivized a shift in travel behavior away from driving. Auto-alternatives are advertised or subsidized, for example through reduced-price public transport tickets, while driving is made less easy by reducing ease of parking, reallocating road space, and reducing speed limits. Notably however, neither case location has relied heavily on pricing to discourage driving. The focus in both has been on reducing the dominance of the automobile in transport planning.

The case cities have pursued development strategies that enhance the public realm. Through regulation and land management strategies, planners in both locations have created walkable areas where pedestrians can access mixed-use development that caters to a variety of their needs. Enhancing the public realm has been important in taking advantage of transit-supporting densities, which alone are not enough to substantially reduce car dependence.

Community participation in planning has been integral to the success of planning strategies that reduced car dependence. Engaging the public and allowing members to have input on planning established support for what were in some ways transformative policies. Both case studies suggest however, that planning for less car dependent built environments requires large scale
government action and therefore communities that support government and believe it the capacity of planning to affect positive change. Suburban car dependence is easily reduced in communities that are ready for it. Additionally, reducing car dependence in suburbs takes time and leaders who are willing to wait. Planning goals in both cases have been adhered to for at least 20 years and governments have been patient in waiting for results.

These findings, while case specific, provide some general lessons for planners elsewhere that might seek to reduce suburban car dependence. Notably, these findings do not point to pricing as a necessary element of reducing suburban car dependence. Pricing schemes that discourage driving may be effective but it appears that suburban car dependence can be reduced, at least somewhat, without substantial pricing interventions. Rather, these findings suggest that built environment changes can reduce car dependence. Additionally, this research suggests that new-build suburbs can be more effective than suburban retrofits in terms of reducing car-dependence. Suburbs that are trying to reduce car dependence through retrofitting, like Tysonn’s Corner in Virginia, may need to be prepared to make substantial and sustained planning interventions even to achieve modest reductions in car dependence.

Research into the Rosslyn-Ballston Corridor, Rieselfeld, and Vauban suggests that suburbs can reduce car dependence through a variety of planning strategies that create the right conditions for other forms of mobility, shift travel behaviors, and establish the right socio-political climate for sustained planning efforts. Further research into additional suburbs and planning approaches would provide a more complete answer to the research question. Car usage in suburbs will continue for the foreseeable future but the results of this thesis indicate that car dependence can be reduced in different contexts using a variety of planning strategies.
Research Limitations

The results of this thesis are limited in that they provide a relatively case-specific answer to a broad research question. To better answer the research question, information on how a wide range of suburbs around the world have reduced car dependence would be required. Findings on how the Rosslyn-Ballston Corridor and Freiburg suburbs have reduced car dependence are noteworthy but cannot be held to be universally applicable. Their successes are likely context dependent, and what has worked in these locations may not work elsewhere. This thesis’s focus on the two case studies attempts to provide more detailed information on them, and to provide insight into how suburban car dependence has been reduced in Europe and North America where suburbanization has been taking place longest. This case-specific focus however, reduces the wider applicability of findings. Findings would likely be different if more cases, particularly those in different development contexts, were examined. Gathering a large amount of information on many case studies however, was beyond the scope of this thesis.

The findings presented here are further limited because they are derived from a relatively small number of interviews. The nine interviewees were informative but without further substantiation of their ideas from a greater number of sources, it is difficult to ascertain how accurate and important their inputs are. The researcher’s status as an outsider in both case study contexts inhibited the ease of communication and access to additional potential interview subjects.

Research indicates that reducing suburban car dependence is a complicated task involving numerous planning strategies. Here, it is important to acknowledge that it is difficult to gauge
the extent to which any planning strategies have reduced car dependence in the case study locations. In both places demographic changes, economic conditions, and other external factors may have impacted car dependence. This thesis though, relies on the general understanding in the planning communities that these suburbs are somewhat anomalous in terms of car dependence because of planning policies. Additionally, the qualitative nature of the research process further complicates findings, as it is difficult to come to firm conclusions based on an assemblage subjective testimony.

Car dependence is a poorly defined topic. The ambiguity of its definition, and how it can be measured limit the strength of this research effort. Car dependence means different things to different people and because this research process relies heavily on individuals’ ideas, findings are likely shaped by their interpretation of the topic. A research effort that explored suburban car usage, or another better-defined issue of suburbanization might come to different conclusions.

**Areas for Further Study**

Further study into many of the issues outlined in this thesis would provide additional information in response to the research question. A more thorough investigation of the basic concepts of car dependence and suburbanization could help better define these issues and provide more concrete ways to measure both. Research into additional case studies could provide a more robust and less case-specific answer to the research question. In particular, a focus on retrofitted suburbs could provide information that is particularly relevant for existing suburbs. Ultimately, more research into how suburbs around the world have reduced car
dependence would be beneficial in gaining some insight into how planning can effectively reduce suburban car dependence and mitigate the negative impacts of suburban car usage.
## Appendices

### Appendix A – Case Studies Considered for Research

### North American Case Studies Considered for Research

<table>
<thead>
<tr>
<th>Suburb</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rosslyn-Ballston corridor, Virginia</td>
<td>The Rosslyn-Ballston Corridor is a strip of dense mixed-use development centered around 5 metro stations in Arlington, Virginia outside of Washington DC. Arlington itself is suburban in nature but the corridor is regarded as a successful large-scale transit oriented development. The Rosslyn-Ballston corridor is an example of infill TOD that came about in existing suburban areas after the development of rail transit.</td>
</tr>
<tr>
<td>Bethesda, Maryland</td>
<td>Another example of transit oriented development in the Washington area, Bethesda has also concentrated dense development around its metro station. Bethesda is more distant than the Rosslyn-Ballston Corridor from the city center, and is more isolated as a transit-oriented area in the midst of a larger suburban area.</td>
</tr>
<tr>
<td>Radburn, New Jersey</td>
<td>An American model of the British concept of the garden suburb, Radburn was built to be a ‘town for the motor age’ but was built around a train station and incorporated a separated pedestrian route network. Over the 20th Century, Radburn has been surrounded by less-planned suburbanization and is now part of the wider suburban sprawl of northern New Jersey.</td>
</tr>
</tbody>
</table>
## European Case Studies Considered for Research

<table>
<thead>
<tr>
<th>Suburb</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rieselfeld &amp; Vauban in Freiburg, Germany</td>
<td>Rieselfeld is a new-build suburb on the outskirts of the small city of Freiburg in southwest Germany. Vauban is a mixture of adaptive re-use and new build suburbanization. Both are known as ‘eco suburbs’ and were intentionally master planned to be highly sustainable in terms of energy use and transportation. In both suburbs, tram lines were extended and made a focal point of development.</td>
</tr>
<tr>
<td>Seestadt in Vienna, Austria</td>
<td>Seestadt is a new-build suburb northeast of Vienna. It is being built on a brown field site around a metro rail extension and will be comprised largely of apartment buildings. It is planned to be largely pedestrian and transit oriented with minimal provisions for automobiles. When complete, it will be one of the largest new urban developments in Europe, housing over 20,000 people (Reidinger, 2013).</td>
</tr>
<tr>
<td>Garden cities outside London, UK</td>
<td>London’s ‘garden cities’ are suburban towns that were developed in the early 20th century as alternatives to the congestion and pollution of London. Garden cities like Welwyn and Letchworth are comprised of detached and row houses and were initially oriented around commuter rail stations. They were some of the first developments to resemble modern suburbia, and were planned around ideals, such as private green space and lower residential densities, that remain an element of modern suburbanization.</td>
</tr>
<tr>
<td>Copenhagen’s green finger suburbs, Denmark</td>
<td>Copenhagen’s suburban development has largely followed the 1947 ‘green finger plan’ whereby suburban expansion has taken place along designated corridors around commuter railways and large swathes of green space have been preserved (Cahasan &amp; Farina-Clark, 2005). Suburbs such as Virum or Lyngby are typically comprised of detached houses, row houses, and apartments.</td>
</tr>
</tbody>
</table>
## Appendix B – Interviews Conducted

<table>
<thead>
<tr>
<th>Interviewee</th>
<th>Description</th>
<th>Interview Date</th>
<th>Interview Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Former senior official in the Arlington planning department</td>
<td>February 13&lt;sup&gt;th&lt;/sup&gt;, 2017</td>
<td>In-person</td>
</tr>
<tr>
<td>2</td>
<td>Academic working in the Washington region with knowledge on America and German planning</td>
<td>February 13&lt;sup&gt;th&lt;/sup&gt;, 2017</td>
<td>In-person</td>
</tr>
<tr>
<td>3</td>
<td>Senior official at the Metropolitan Washington Council of Governments</td>
<td>February 14&lt;sup&gt;th&lt;/sup&gt;, 2017</td>
<td>In-person</td>
</tr>
<tr>
<td>4</td>
<td>Senior member of the Arlington County Planning commission</td>
<td>February 13&lt;sup&gt;th&lt;/sup&gt;, 2017</td>
<td>In-person</td>
</tr>
<tr>
<td>5</td>
<td>Retired academic with experience researching transportation and development issues in the US and Germany</td>
<td>February 10&lt;sup&gt;th&lt;/sup&gt;, 2017</td>
<td>Telephone</td>
</tr>
<tr>
<td>6</td>
<td>Former senior official of the Freiburg urban planning authority</td>
<td>March 1&lt;sup&gt;st&lt;/sup&gt;, 2017</td>
<td>Telephone</td>
</tr>
<tr>
<td>7</td>
<td>Academic with knowledge of the Freiburg eco-suburbs and of transportation and urban planning more broadly</td>
<td>March 8&lt;sup&gt;th&lt;/sup&gt;, 2017</td>
<td>Telephone</td>
</tr>
<tr>
<td>8</td>
<td>Senior figure at a German urban planning firm</td>
<td>March 17&lt;sup&gt;th&lt;/sup&gt;, 2017</td>
<td>Email</td>
</tr>
<tr>
<td>9</td>
<td>Community representative from Vauban planning advocacy group</td>
<td>March 18&lt;sup&gt;th&lt;/sup&gt;, 2017</td>
<td>Email</td>
</tr>
</tbody>
</table>
Appendix C – Sample Interview Questions

Sample 1

General Automobile Dependence Questions

- What has been the historic approach to suburban planning and suburban transport planning in the US and Germany?
- How do planners in both places think about automobile dependence? Is it an issue?

Case Specific Questions

- Did either of them implement policies intended to directly reduce suburban automobile dependence?
- What role have land use polices played?
- What role have federal/state/local governments played?
- What role have transit agencies played?
- What role have developers played?
- How important is transit relative to other non-car alternatives?
- How have people reacted?

- How were proposed planning changes/policies related to cars framed?
- Do these places measure the impact of policies in terms of automobile dependence?
- What policies have proven to be effective or ineffective in reducing suburban automobile dependence?
- What lessons have been learned?

Personal Opinion Questions

1. What do you think is the most effective strategy to reduce suburban automobile dependence?
2. What obstacles do you feel inhibit the successful implementation of anti-automobile policies?
3. What do you think needs to happen to reduce automobile dependence further on a national or global scale?
4. What is your outlook for future efforts to reduce suburban automobile dependence?
Sample 2

**General Automobile Dependence Questions**

1. How do planners in Freiburg and Germany generally think about auto dependence?
2. Was automobile dependence ever a concern for Freiburg?

**Case Specific Questions**

1. It seems like many people played a role in creating Vauban. Whose idea was it initially? Freiburg city government, Kohlhoff & Kohlhoff, Forum Vauban?
2. How was the community engaged before the development began?
3. In terms of reducing car usage, what was the reaction of the community?
4. In your opinion, what has been more important to reducing car usage: driving disincentives or the presence of good alternatives to driving?
5. What was the most effective policy for reducing car dependence?
6. How important has the price and availability of parking been to reducing car usage?
7. What key lessons have been learned?
8. What has changed about Vauban since the initial development?
Appendix D – Rosslyn-Ballston Corridor Census Tracts

Source: www.socialexplorer.com
https://www.adac.de/infotestra/tanken-kraftstoffe-und-antrieb/kraftstoffpreise/suchergebnisse.aspx?search=Y9F6cRxtedVVi710RF7Zx6Uq.4IkJGq10e93xOR.lbrWudDBqJNvUudvqdfqDjTg9tGFZU9NrzeqehGqqltLrCu05xHeE.0Tqn4lrjTTqsp1ZZl8grW50xBeElsgpBzgZ7Seqd0g9w9Nrfaf836c9nuVR7tVZIFkW8ZZ.Ge4tDVR7BeElFfkW8Zv31U9FOUqf6g9w9OSxBeElsgpBzgZ7Seqd0g93PfatEU9F6lCrC8XqF6Uq.4IptzfRh1fSt1gRxHfvtVg9n6.


Arlington County. 2010. Arlington’s Smart Growth Story.
https://www.youtube.com/watch?v=uFHs1_P4qTU.


Bindra, Sumit, Dave Giel, and Tommy Tran. 2006. “Smart Transportation Planning in Freiburg, Germany.” University of Connecticut.


https://secure.capitalbikeshare.com/map/.

Carlton, Ian. 2007. “Histories of Transit-Oriented Development: Perspectives on the
Development of the TOD Concept - Real Estate and Transit, Urban and Social Movements,


Books.


Daseking, Wulf. 2013. “30 Years of Planning Continuity in Freiburg, Germany.” BSHF.
https://www.bshf.org/world-habitat-awards/winners-and-finalists/30-years-of-planning-
continuity-in-freiburg-germany/.

Verso.


http://wamu.org/story/13/03/26/how_arlington_is_avoiding_dcs_traffic_nightmare/.


Eberlein, Sven. 2011a. “Universal Principles for Creating a Sustainable City.” Planetizen: The
Independent Resource for People Passionate about Planning and Related Fields.

———. 2011b. “Freiburg, Germany: City of the Future. Part II: How to Build an Eco-Suburb from
future-part-ii-how-to-build-an-eco-suburb-from-scratch/.


Answer is Yes”. Journal of the American Planning Association 83 (1) 19-25.
http://www.tandfonline.com/doi/full/10.1080/01944363.2016.1245112


Gutshall, Erik. 2017. Interview with Erik GutshallIn person.


———. 2015a. “American FactFinder - Results.” https://factfinder.census.gov/faces/Table services/jsf/pages/productview.xhtml?pid=ACS_15_5YR_B01003&prodType=Table.


