

Sustainable Transport in Germany and the US: A comparison of the Washington, DC and Stuttgart Regions

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1. Introduction

Federal, state, and local governments in Germany and the U.S. strive to make passenger transport more sustainable. In this paper, we first compare the Washington, DC and Stuttgart regions to demonstrate differences and similarities of the German and US systems of land-use and transport planning. To illustrate local planning for more sustainable transport we compare planning in Arlington County in the DC Metro region and Scharnhäuser Park in the Stuttgart region—both localities are best practice examples for sustainable planning. We conclude that in spite of significant differences in motorization, travel behavior, sustainability, and planning systems, local governments in both countries rely on similar strategies to increase the sustainability of their transport systems.

1.1 Travel Behavior and Sustainability of the Transport System in Germany and the US

Germany and the U.S. are among the most motorized countries in the world. However, in 2010, Americans owned 30 percent more cars and light trucks per capita as Germans (766 versus 585). Americans also drove for a much higher share of daily trips (83% vs. 58%) than Germans. By contrast, Germans were 4 times more likely to ride public transport (8.5% vs. 1.9%), 2.5 times more likely to walk (23.7% vs. 10.5%), and 10 times more likely to cycle (10.0% vs. 1.0%). A higher share of trips by automobile in the U.S. is related to greater annual driving distances for Americans than Germans (21,500km vs. 11,000km).

Table 1 compares indicators for the sustainability of the transport systems in Germany and the U.S., covering three commonly cited dimensions of sustainability: equity, environment, and economy. Driving for fewer trips and shorter distances contributes to more sustainable transport in Germany. Overall travel, and especially walking and cycling, are safer in Germany than the U.S. Moreover, higher levels of walking and cycling in Germany contribute to more physical activity and lower obesity levels in Germany than the U.S. Compared to Germany, households and the public sector in the US spend more on transport. Moreover, governments in the U.S. spend more on roadways than they collect in taxes and fees from roadway users. In Germany, roadway users pay more in fees and taxes than governments spend on roadways. Public transport operation is more financially efficient in Germany. Finally, Germany's transport system is also more sustainable from an environmental perspective when comparing transport energy use and CO₂ emissions.

Selected Sustainability Indicators

		USA	Germany
Safety and Health	Traffic Fatalities per 100,000 Population	11,1	5,1
	Traffic Fatalities per 1 Billion Vehicle Kilometers	7,1	5,9
	Cyclist Fatalities per 100 Million Kilometers Cycled	5,5	1,6
	Pedestrian Fatalities per 100 Million Kilometers Walked	9,7	1,9
	Percent Population Considered Obese (BMI>30; self-reported data)	23,9	12,1
Cost	Share of Household Expenditures for Transport	17,0%	14,6%
	Annual Household Expenditures for Transport	\$7.677	\$5.117
	Ratio of Roadway User Fees & Taxes vs. Roadway Expenditures by all Levels of Government	0,58	2,22
	Government Subsidy as Share of Public Transport Operating Budgets	59%	25%
Environment	Annual Ground Passenger Transport Energy Use per Person (in million BTU)	54,6	18,0
	Transport Sector Share of CO ₂ Emissions	32%	19%
	Kg of CO ₂ Equivalent Emissions per Capita from Ground Passenger Transport	3.800	1.200
	Grams of CO ₂ Equivalent Emissions per Passenger Km	210	110

Table 1: Sustainability Indicators for German and U.S. Transport Systems (Source: APTA 2011, David et al. 2008, Buehler and Pucher 2011, Buehler et al. 2009, EPA 2012, IEA 2012, IRTAD 2012, USDOE 2012, Pucher and Buehler 2010, UBA 2010, 2012, USDOL 2010, VDV 2011)

2. Transport in the Washington and Stuttgart regions: differences and similarities

In this paper the Washington, DC region (DC metro region) and the Stuttgart region serve as examples for similarities and differences between Germany and the US in land-use planning, transport systems, coordination of transport and land-use planning, and sustainable transport. Although there are differences in land area, population size, administrative structure, and economy, both regions share many similarities that render a comparison meaningful (see Table 2): Both are among the wealthiest regions of their country with strong economies and labor markets. Both regions showed relative economic stability during the recent economic crisis and experienced strong population in-migrating, resulting in a more diverse population. Washington, DC has a larger government sector and more industries associated with government, while Stuttgart has a stronger manufacturing and industrial engineering base. The population in the Stuttgart region is characterized mainly by industry, attracting a highly skilled workforce, while the government functions of the Washington, DC region result in a high share of transient populations, moving to and from the area with each federal election cycle.

Travel behavior in the central city of each region is similar: public transport accounts for 22% of all trips in Washington, DC and 24% of all trips in Stuttgart. Similarly, walking and cycling (29 and 32%) and the car (51 and 44%) account for comparable shares of trips in both cities (MWCOG 2010, Broeg and Erl 2012). Travel behavior displays large differences for the region as a whole and for the suburban areas in particular: In 2008/2009, driving accounted for 80.6% of all trips in the DC metro region, compared to 56.6% in the Stuttgart region.

The differences in percentage of trips by mode of transport between core jurisdiction and suburban areas are much larger in the DC metro region than the Stuttgart region (see Figure 1). In the DC metro region, the automobile accounted for more than 90% of all trips in suburban Fauquier, Prince William, Prince Georges, Anne Arundel, Charles, and Fairfax counties (MWCOG 2010). By contrast, the two most car-dependent suburban jurisdictions in the Stuttgart region -Nürtingen and Geislingen- had car mode shares of 70 and 75% (VRS 2011). Walking and cycling only accounted for about 6% and public transport for less than 2% of trips in most suburban jurisdictions in the DC metro region. Even in the most car-oriented jurisdictions of the Stuttgart region, walking and cycling account for more than 22

percent of trips and public transport's mode share is above 3%.

	Stuttgart Region	Washington Region
Size [sqm]	1,411	3,967
Population [million]	2.67	5.58
Population Core City	~ 600,000	~ 600,000
GDP [\$/inhabitant]	45,000	71,000
Car ownership [per 1,000 inhabitants]	544	744
Cars/household	1.1	1.8
Trips/day	3.5	3.9
Median trip distance [km]	5.0	5.6
Distances per day [km]	40	44
Daily travel time [min]	75	80
Average trip speed [km/h]	27	28
Share of trips by car of all trips (region) [%]	56.6	80.6
Share of trips by public transport of all trips (core only) [%]	24	22
Share of trips by public transport of all trips (periphery only) [%]	70-75 (Note: data are for the most car-dependent jurisdictions: Nürtingen and Geislingen)	> 90 (Note: data are for the most car-dependent counties: Fauquier, Prince William, Prince Georges, Anne Arundel, and Fairfax)
Unleaded Gasoline Prices per Gallon 2010 [\$]	7.0	3.0
Gasoline Taxes [\$]	4.84	0.53

Table 2: Socioeconomic, Demographic, and Travel Data for the Washington and Stuttgart Region (Source: U.S. Census Bureau 2010, Statistisches Landesamt Baden-Württemberg 2012, MWCOG 2010, TPB 2010, Zumkeller 2011 IEA 2012)

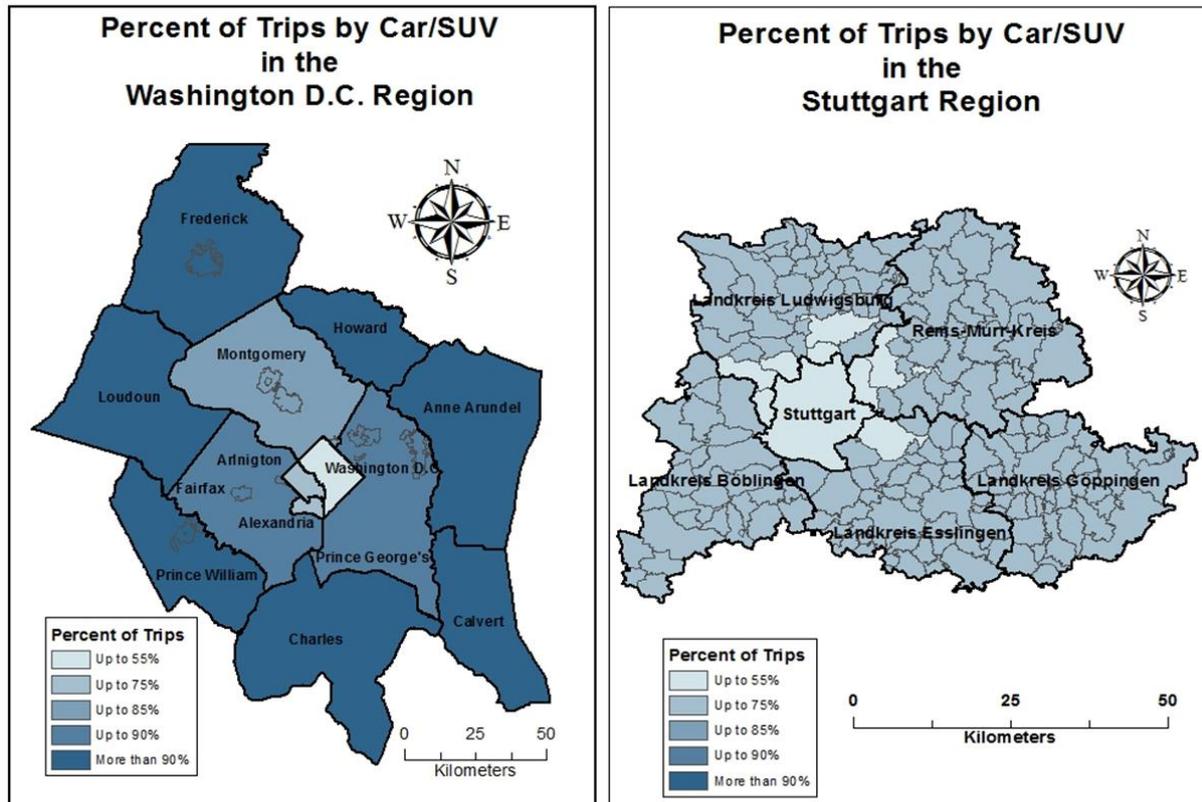


Figure 1: Shares of Trips by Automobile in Jurisdictions of the Washington, DC and Stuttgart Regions, 2008 (Source: Broeg and Erl 2012, MWC0G 2010, TPB 2010, VRS 2011)

3. Coordinating transport and land-use planning

Although the two central cities of Washington, DC and Stuttgart have similar travel mode splits, the overall regions show strong differences caused by the car-dependent suburbs of the Washington, DC Region. Differences in travel behavior can be explained by socio-economics, demographics, culture, and diverging transport and land-use policy and planning systems in Germany and the US. Due to space limitations, the following discussion focuses on transport and land-use planning systems. Detailed discussions about other factors can be found in our other publications (Buehler and Jung 2013).

3.1 Land-use planning

Differences in planning systems

In Germany, federal, state, regional, and local governments interact in a bottom-up and top-down land-use planning process, coordinating their spatial plans in an interactive way (BMVBS 2000). Municipalities in Germany have the exclusive planning right and draw up detailed land-use plans and decide the specific allowable uses of land. Local plans in Germany, however, are restricted by regional and state plans and must be in compliance with federal land-use, transport, and environmental laws (Kunzmann 2001). Federal involvement in spatial planning is limited to defining the legal framework for planning, ensuring consistency of planning techniques, and -in collaboration with the states- setting broad strategic goals for spatial development such as sustainability (Wiegandt 2004).

The regional level plays an important role in defining areas for Transport Orientated Development (TOD). The Stuttgart regional plan distinguishes between 'growth poles' that will capture most of the future settlement growth (Siedlungsbereiche) and areas with lower growth levels (Eigentwicklung). Areas designated for slower growth are typically not connected to public transport lines, while housing development is concentrated in the 'growth

poles' with public transport access. The goal is to reduce land used for settlements and to curb sprawl in the Stuttgart region.

In contrast to Germany, in the US there is no system of land-use planning that connects federal, state, regional, and local levels of government. US local governments play the predominant role in land-use planning and regulation. The US federal government does not engage in land-use planning and, in contrast to Germany's Federal Spatial Planning Act (Bundesraumordnungsgesetz) or Federal Building Code (Baugesetzbuch), there is no federal legislation prescribing the overall land-use planning process at lower levels of government. Federal programs in the US influence spatial development and land-use decisions on the local level, through federal transport policy and finance, environmental regulation, housing and economic development, military spending, and the management of nationally owned lands (Kayden 2001). However, there is no integrating framework and as a result, most land-use planning in the U.S. is fragmented, uncoordinated, and almost always in the domain of local government jurisdictions (Schmidt and Buehler 2007).

In contrast to the fragmented system in the US, coordination and negotiation of different levels of planning authorities in Germany facilitates coordination with regional transport planning. For example, development can be more easily concentrated along public transport routes to provide high capacity public transport connecting to the centers of the region. The Stuttgart Regional Plan allots higher growth rates to communities with rail public transport than for those without. In the DC metro region individual municipalities decide how to connect their land-use to the metrorail system. For example, Arlington County built high density mixed use around its metro rail stops, while Fairfax County chose to build park and ride parking lots next to its metro stops.

Differences in land-use planning on municipal level

In both countries, the municipal level has the main responsibility for regulating land-use and in both countries similar planning documents guide land-use planning. In Germany the main instruments for land-use planning are the Land-Use-Plan (*Flächennutzungsplan*) and Local Building and Construction Plan (*Bebauungsplan*). The Land-Use Plan is a preparatory plan laying out the general outline of existing and future land-use by type (general types of use include housing, mixed use, industrial and commercial, special purpose). Furthermore, the Land-Use plan defines the so-called "inner zone" (*Innenbereich*) and "outer zone" (*Außenbereich*) of a municipality. In the outer zone, no construction is allowed, besides those types of typical uses for outer zones, such as agriculture or energy production. The Local Building and Construction Plan consists of legally binding urban development ordinances. In the Local Building and Construction Plan, the specific categories of land-uses, defined by the Land Utilization Ordinance, are constituted for small areas. Although both documents traditionally separate land-uses (Albers 1992), all categories have some flexibility to allow other uses (see below).

At the municipal level in the US, the most common type of land-use plan is called a comprehensive or master plan, which typically consists of maps and text. However, zoning, and not land-use planning, is the main tool of land-use control in the U.S. (Hirt 2012). With a few exceptions, virtually all local governments have passed zoning ordinances that limit the use of land in the entire jurisdiction. In both countries, industrial and residential uses are deemed incompatible. However, in contrast to Germany, with a few exceptions, U.S. zoning has emphasized the separation of all types of land-uses. For example, in Germany residential zones can include doctor's offices, apartment buildings, businesses, small shops, and restaurants. As a result, many German "residential" areas would be considered 'mixed-use' in the U.S. Additionally, compared to the U.S., German municipalities apply their zoning to smaller land areas - sometimes as small as a block. U.S. municipalities typically apply their zoning to larger areas of land. This results in longer trip distances that often make walking and cycling impractical.

As in Germany, local planning in the U.S. is influenced by the need to achieve

development patterns that best support the local budget. However, compared to German municipalities who mainly compete for business taxes, U.S. local governments focus more on local property taxes to fund local expenditures, such as police, water and sewer, or court services (Orfield 2002).

Strict separation of land uses, exclusion of apartment buildings, doctor's offices, corner stores, and small businesses from single family residential zones, and larger areas of single-use zoning result in longer trip distances in the U.S. Long trip distances and the separation of trip origins and destinations necessitate more trips by car in the U.S. because different activities (e.g., shopping, work, leisure) are more dispersed. Germany's practice of zoning for smaller land areas and the more flexible zoning code has helped to reduce trip distances and car dependence - even when planners did not explicitly coordinate transport and land use.

3.2 Transportation planning

German state and federal governments jointly developed the Federal Transportation Plan, which delineates a national transport strategy. Until the early 1970s, this plan focused mainly on automobile travel, but since 1973 it has included societal goals, such as preserving open space, or reducing traffic fatalities, energy use, and vehicle emissions (Koeberlein 1997). Gasoline taxes have traditionally been higher in Germany than in the US. In 2013, a gallon of premium gasoline cost about \$8 in Germany and \$4 in the US (EIA 2013). Over the last 40 years the German gas tax was raised several times to fund government expenditures, but never with the explicit purpose to curb driving. Since the mid-1970s, the German federal government has also provided dedicated matching funds to state and local governments for public transport capital investments - if projects are part of local comprehensive transportation plans, comply with land-use plans, and consider the needs of the disabled and the elderly. German federal traffic laws protect cyclists and pedestrians and making their safety an integral part of the German driver's license written exam and road test. Since the early 2000s, the German government has also published a national bicycle master plan (FahrRad!). However, most innovations, such as integrated city-wide bicycling networks, were pioneered and then widely implemented at the local government level. The federal government supported local efforts with technical guidance and flexible funding, which allowed municipalities to divert highway funds to non-motorized modes.

US federal and state transport plans have a long tradition of prioritizing highways over other modes of transport. Since the passage of the Intermodal Surface Transportation Efficiency Act (ISTEA) in 1991, the US federal government has also increased funding for public transport, walking, and cycling. However, ISTEA's attempts to promote alternatives to driving were accompanied by simultaneous increases in federal roadway funds. ISTEA required and helped fund regional transportation planning and coordination. However, most metropolitan planning organizations (MPOs) do not have any legal authority to enforce regional policy priorities or to alter decisions made by local government jurisdictions or state departments of transport. Moreover, MPOs do not make any specific land-use planning decisions.

Transport Planning the Stuttgart Region

Besides the Federal Transportation Plan general aims and projects are laid down in the General Transportation Plan of the State of Baden-Württemberg. Projects for road and rail are listed, but not prioritized. The plan provides ideas how to plan for non-motorized transport, but these are only suggestions to the regions and municipalities. The Statewide General Transportation Plan acts as framework for the Regional Transportation Plan of the Verband Region Stuttgart, an integrated concept for mobility in the Stuttgart Region and guideline for all measures and decisions about transportation planning. Transportation planning on the regional level is further specified by Local Transportation Plans of the municipalities in which infrastructure projects, quality of services etc. are laid down.

Different levels of government, like the State of Baden-Württemberg, the Verband Region Stuttgart and the municipalities issue calls for tender for public transport services. Service is provided by different (often public owned) public transport companies. Calls for tender stipulate the quality and frequency of services and provide funding if farebox revenues do not fully cover the operation costs.

Backbone of public transport in the Stuttgart region is the Stuttgart Regional Public Transport Organization (Verkehrsverbund Stuttgart, VVS). Forty-one transport companies, either private or government owned, collaborate in the VVS to jointly serve the counties of Böblingen, Esslingen, Ludwigsburg, Rems-Murr-Kreis, and the City of Stuttgart. The VVS is not only responsible for the operation of public transport, but also for the planning and building of new railway lines.

The VVS network comprises all public transport in the region, and its tickets apply to all modes of public transport. This coordination and integration of different modes of transport (commuter rail, metro rail, light rail, and bus) and across different transport companies (including services, schedules, and fares) makes public transport seamless and customer friendly helping to increase ridership. For public transport passengers in the region it does not matter which specific company provides the service. Regional tickets are valid anywhere in the region, schedules are coordinated, and customers can get information about public transport in the region from one integrated database for trip planning (e.g. www.vvs.de). Also the VVS offers steep discounts for daily, weekly, monthly, or annual tickets, for companies, students or elderly. This is especially attractive for daily commuters using public transport as an alternative to the car.

Transport Planning in the Washington, DC Region

Federal legislation in the US requires long- and short-range transport planning for states and metropolitan areas. State Departments of Transport (DOTs), such as the Virginia and Maryland Departments of Transport (VDOT and MDOT), are responsible for statewide transport planning. In Washington, DC, the District Department of Transport (DDOT) receives state planning funds from the federal government. Statewide long-range plans identify a vision for the state's transport system in the next twenty to thirty years. Goals in the VDOT and MDOT long-range plans include enhanced quality of service, better safety and security, system preservation, and environmental stewardship. Based on the long range plan, states develop four-year short-term plans, which prioritize projects and identify funding sources.

Similar to the state level, MPOs are mandated to develop and maintain metropolitan long-range and short-range plan. Long range plans contain a region's transport goals for the next twenty to thirty years and describe strategies how to achieve these goals. These plans estimate a region's future transport needs based on land-use forecasts, are updated every four to five years, represent the region's priorities, and include a financial plan with reasonable cost and revenue estimates. The Transport Planning Board (TPB) is the main MPO for the DC region. Key challenges identified in TPBs long range plan include funding, congestion on roadways and public transport, serving dispersed populations, maintaining the system, environmental quality, and CO₂ emissions. TPB also published a policy vision that guides regional transport investments with the goals to provide a range of transport options, reduce auto dependency, increase public transport use, coordinate transport and land-use, and maintain the existing transport system. Short-range plans include projects to be built within the next three to five years, are updated every four years, are fiscally constraint, and are approval by the state governor. To be eligible for federal funding, a transport project has to be included in USDOT-approved statewide and metropolitan short range transport plans.

TPBs vision and its long-range plan are closely related to a region-wide plan titled Region Forward—developed by the regional council of governments (MWCOG). As a result, the three plans' transport goals are consistent with each other. The land-use vision and scenarios developed by MWCOG and TPB are not legally binding for member jurisdictions, but they provide a forum for regionally-focused discussion. However, most decisions are made on the local level.

4. Best-Practice – Comparison of Arlington County’s Rosslyn-Ballston Corridor and Scharnhauser Park in the Stuttgart Region

Both Arlington County’s Rosslyn Ballston Corridor and Scharnhauser Park in the Stuttgart Region are best practices cases of planning for sustainable transport. This section provides a comparison of local policies in both areas. In spite of large differences in transportation and planning systems, there are many similarities in coordinating transport and land-use at the local level to achieve more sustainable transport.

Arlington

Like many urban areas in the U.S., Arlington County experienced an influx of residents and development after World War II, and then steady decline as the "postwar boom" receded. During the 1960s and 1970s local opposition to the construction of Interstate 66 through Arlington County lead to a scaled-down version of the highway and the location of 5 stations of the new regional Metrorail directly under the then declining Rosslyn-Ballston Corridor (TCRP 2011). Plans focused redevelopment within a quarter-mile walking radius of stations to allow for easy pedestrian access. Metrorail service between Rosslyn and Ballston began in 1979. In spite of a quadrupling of office space and housing units since the late 1970s, redevelopment has only generated modest increases in car traffic on local streets (Leach 2004). Many of the newly generated trips are by public transport. Between 1990 and 2012, average weekday passenger trips by public transport in the corridor rose by 42% from 67,600 to more than 96,000. Approximately 16% of corridor households do not own a vehicle, and in some residential developments, an estimated 40-60 percent of tenants do not use a vehicle on a daily basis (Arlington County 2008). Single occupancy vehicle commuting has been declining in the corridor, while commuting by walking, biking, and public transport have been increasing.

Scharnhauser Park

Scharnhauser Park, belonging to the City of Ostfildern, is a former U.S. military site - Nelligen Barracks- that housed approximately 7,000 U.S. soldiers until it was abandoned in 1992 (Stadtchronik Ostfildern 2011). Enhancing the transportation infrastructure, especially public transportation, was required as a precondition for development not only for the regional but also local level. The mayor of Ostfildern stressed that the development of Scharnhauser Park would only take place if the light rail to the area was extended (Stuttgarter Nachrichten 1993; Bender 1994). Based on the Master Plan’s estimate of 10,000 passengers per day, the Stuttgart Straßenbahnen AG (SBB) decided to extend the existing railway line from Heumaden to Nelligen via Scharnhauser Park. That meant that Scharnhauser Park would not have been built without rail access and the rail line would not have been extended without development plans for Scharnhauser Park ("No light rail without Scharnhauser Park, no Scharnhauser Park without light rail.") (Bender 2004, p 178). Starting in the year 2000, just one line served the extension from Heumaden to Nelligen, but already in 2000 the city of Ostfildern and the SSB decided to establish a new line, the U8. In the beginning, the U8 ran only during peak hours; however, due to the success of public transportation within Ostfildern and the popularity of connections to Stuttgart, the schedules were extended to the entire day and the line was further extended using previously abandoned tracks.

From its founding in 1975 to 2011, the city of Ostfildern grew by 8,500 inhabitants, from 28,000 to 36,500 inhabitants. Most of these gains were due to the development of the settlement of Scharnhauser Park: More than 70 percent of this increase occurred after the development of Scharnhauser Park started in 1994 (own calculation based on Statistisches Landesamt Baden-Württemberg 2012).

Comparison of Local Policies to Coordinate Transport and Land Use

The wide array of policies and programs utilized in support of the development of the Rosslyn-Ballston Corridor and Scharnhauser Park are characterized by four key features that have contributed to the success in planning for sustainable transport:

First, building dense and mixed land uses around public transport stops.

In *Arlington*, this meant targeting "bull's eye" zones of mixed-use and high density development around public transport stations. The stations are about 1km to 1.5km apart so that access to a station is within a ten to fifteen minute walk from anywhere in the corridor. Density around the stations is planned so that the highest intensity development is in the immediate vicinity of the stations, while development density "tapers" down progressively as the distance from a station increases. The stations also serve as focal points for distinct neighborhoods with mixed land uses and varying emphases on government, educational, retail, and business development that foster a balance of land-uses throughout the corridor.

Scharnhauser Park is not a typical suburban, low-density settlement with single and semi-detached housing structure, but rather urban comprised of housing with a mixture of low, medium, and high-density housing (single and semi-detached houses, row houses, town houses, city mansions, tower blocks). There are also areas of mixed use and for commercial activities. The settlement pattern is characterized by short distances to the stops of public transportation -no part of the new town is farther than 500m away from the new railway station- and high density figures.

Second, long-range and comprehensive plans are important to assure sustained success.

Arlington County's Comprehensive Plan served as a blueprint for the corridor's development. As the main policy guide for development of the county, it establishes "the overall character, extent, and location" of development (Arlington County 2012). In conjunction, Sector Plans outline the overall vision of development around each Metro station, including design standards, public improvements to the streetscape and open space, and locations of various development uses. The result of this multi-faceted body of planning documents and adjoining processes is a blueprint of the planning vision for the corridor is coherent and dynamic.

In the case of *Scharnhauser Park* the establishment of the Master Plan as guidance for the development of the area determined several planning procedures in advance: the City of Ostfildern decided to change the Land-Use Plan in a way that identified Scharnhauser Park as a 'growth pole' (see above). The new housing area is seen as a new city quarter on its own, not an addendum to Scharnhausen or the center of the city of Ostfildern. As a matter of fact, the Regional Plan appointed Scharnhauser Park as a "regional center for housing" in the northern and "center for commercial development" in the southern part of the area. In 1992 a first feasibility study and urban design competition started to develop new ideas for how to re-use the site. After an interim use for the athletes of the World Athletics Competition in 1993, the city of Ostfildern bought the whole area and a development statute (Entwicklungssatzung) was enacted that gives the municipality the right of receiving the parts of gains of property value for parcels of land. These received gains were be used to build the infrastructure needed. In 1994, a master plan for the re-use was created and first developments undertaken. The master plan foresaw about 3,000 housing units for about 9,000 new inhabitants and retail spaces and office/commercial space for about 2,000 employees on an area of altogether 141.3 ha (349.2 acres).

Third, citizen participation is the key.

Arlington's plans have been developed through extensive outreach efforts to the community, developers, and other stakeholders. As a result, policymakers, developers, and community members have been able to work together using a broad and stable

understanding that is also conducive to refinements to the planning principles and innovations.

Public participation also played a major role in *Scharnhauser Park*: besides the two-tiered participation process for the Land-Use Plan and Local Building and Construction Plan as laid down in the Federal Building Code (Baugesetzbuch), the elaboration of the Master Plan as accompanied by public participation and citizens meetings, discussing critical points of newly roads, social infrastructure like kindergartens and schools as well as the design of public space, latter seen as a key feature for the new quarter.

A fourth major feature is the coordinated programming and policies that together support diverse transport, housing, and business opportunities.

In terms of transport, *Rosslyn-Ballston Corridor* planners leverage public transport service, pedestrian and bicycle facilities, parking regulations, transport demand management programs, and marketing in order to encourage and enable use of alternatives to the automobile. The corridor offers a wide array of transport options that are centered around the five Metro stations. Additional transport options include local and regional bus service via Metrobus and Arlington Transit, bike-sharing through Capital Bikeshare, and car-sharing.

In the case of *Scharnhauser Park*, by negotiations between the different levels of government and spatial planning agencies, financial support for the municipality was guaranteed, spatial aims of future development of the city of Ostfildern were changed, and further development was channelled to the area of Scharnhauser Park. This could happen in particular by their counter-current revised spatial plans of the Verband Region Stuttgart and the city of Ostfildern, by which the city of Ostfildern could get the right of additional land claims needed for the development of the Scharnhauser Park. The land-use agreement demanded higher population densities in the area to be developed. At the same time, Ostfildern, the county of Esslingen, and the transportation agency agreed on the simultaneous construction of Scharnhauser Park and the extension of the railway line, tying the new settlement to the transportation system of the Stuttgart Regional Public Transportation Organization.

Overall, *Rosslyn-Ballston Corridor* and *Scharnhauser Park* policies regarding transport work in concert with one another and also support each areas larger policy framework. The results have been increasing levels of public transport use, cycling, and walking.

Key future challenges for the both include affordable housing, historic preservation, the cohesive design of the built environment, and the continued improvement of facilities for pedestrians and bicyclists (Leach 2004). Housing affordability in particular is one of the greatest challenges facing the *Rosslyn-Ballston Corridor*. The primary tool to preserve affordable housing is the zoning framework, which provides a variety of incentives for affordable units, including density bonuses and a requirement of one-for-one replacement of affordable units in a designated area called the Special Affordable Housing Protection District. In addition, the county has established a revolving loan fund, the Affordable Housing Investment Fund, which finances affordable housing development in the county.

Housing is one of the major concerns also in the Stuttgart region. On the one hand, there is still a significant amount of population in-migrating to the Stuttgart region; on the other hand, land is a scarce resource in the region, resulting in a rather high population density and real estate prices. Politics and planning have to deal with the conflict of offering enough parcels of land for the population while at the same time protecting the landscape and nature from exhaustive land claims and reducing traffic caused by commuting. With the conversion of the former military site Nellingen Barracks to the Scharnhauser Park development, a unique but challenging opportunity arose for the city of Ostfildern and the region as a whole. For the rather small city of Ostfildern, this opportunity was beyond financial viability, but by negotiations with various levels of government (District, State, Federal), an agreement on assumptions of costs could be achieved as well as different funds e.g. the State Rehabilitation Program or grants for the State Garden Exhibition¹ could be used to buy the military site and invest in the infrastructure needed.

5. Conclusion

The Washington, DC metro and Stuttgart regions mirror the national differences in travel behavior. Outlying suburbs in the DC metro region are much more car dependent than outlying suburbs in the Stuttgart region and account for much of the difference in travel behavior (more than 90 percent versus 70 percent of trips by car). By contrast, the cities of Washington, DC and Stuttgart have almost comparable mode shares of car use (51 percent and 44 percent, respectively).

Reasons for differences in travel behavior can be found in the transport and land-use policies and planning. Since the 1970s, and especially since the 1990s, all levels of government in Germany have implemented policies that increase the monetary and time cost of car travel (gasoline taxes in Germany are about nine times higher than in the US: \$4.84 versus \$0.53 per gallon). Moreover, most German cities and regions have promoted walking, cycling, and public transport as attractive alternatives to the car. Compared to Germany, US federal, state, and local transport policies during the last sixty years have been more favorable for the automobile. Moreover, land-use policies in the US more strictly separate land uses and increase distances between trip origins and destinations.

In Germany different levels of government coordinate their land-use plans in an interactive process. As long there is consensus about certain policies, like reducing land claims, decreasing GHG emissions or car dependency, these policies are easier to implement on the local level, resulting in a more concentrated, denser development of settlements at the axes of public transport. In the US, land-use planning remains fragmented across jurisdictional boundaries, uncoordinated between levels of government, and typically not integrated with planning for transport. On the local level, land-use regulations in Germany typically foster mixed-used, denser land area compared to the US. This reduces the necessity of traveling and car use.

While fragmented land-use planning in the US is often seen as an obstacle to more sustainable transport, our case study from Arlington County, Virginia shows how a local jurisdiction can foster the integration of transport and land use. *Arlington County* successfully focused mixed-use, dense development around stops of a new metrorail system. Practices used in Arlington are similar to current efforts to integrate transport and land-use planning for more sustainable transport in Germany. As the case study of *Scharnhauser Park* highlighted, there is a reciprocal interest in the (re-)development of certain sites for the local transportation agencies while such a development is more likely to take place if accessibility is provided by high-capacity public transport infrastructure. By this, Scharnhauser Park gives a good example of how public transportation is a catalyst for the (re-)development of certain areas, while at the same time this development is the prerequisite for investments in public transport.

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ⁱ The Federal or State Garden Exhibitions are exhibitions of gardening, but also mainly used for urban or regional development, especially Brownfield areas