CASE STUDY

Houten

UTRECHT, THE NETHERLANDS

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HOUTEN SITE FACTS

- **Architect:** Rob Derks
- **Population:** 43,900
- **Urban Area:** 820 ha
- **Urban Density:** 54 persons/ha
- **Number of Residential Units:** 18,400
- **Distance from Utrecht City Center:** 8 km
- **Cars:** 415 cars/1,000 residents
- **Parking Spaces/Residence:** 1.1
- **Non-motorized Mode Share:** 55%
- **Public Transport Mode Share:** 11%
- **Households with Carsharing:** 2%

BACKGROUND

Houten, a city in the province of Utrecht in The Netherlands, is a unique example of an entire city designed and built to prioritize the cyclist and pedestrian. It is a greenfield development with good transit access, high quality bicycle infrastructure, provision of public bikes and carsharing, and application of employer contributions and educational programs to promote cycling. Non-motorized transport use is higher in Houten than in comparable cities while car use is lower.

The city's innovative traffic layout was a departure from the norms of the time when it was developed in 1968 and approved by the city council. The design limited intra-city car use and gave priority to traffic safety for pedestrians and cyclists. Core design features include narrow roads, application of traffic calming measures and separation of bicycle paths from car traffic whenever possible.

The basic layout of the city consists of two train stations, each surrounded by a ring road with a radius of approximately one kilometer. The rest of the city is covered by an extensive, 129 kilometer network of bicycle paths (Photos 1 and 2; Figure 1). There are 31 residential districts, each of which is only accessible to cars via the peripheral ring roads encircling the town. However, the network of paths for cyclists and pedestrians includes a thoroughfare that passes directly through the town center, providing filtered permeability for cyclists and pedestrians. The majority of schools and important buildings are located along this thoroughfare. Due to this design, cycling is the most direct mode of transportation and is often even faster than travel by car.[1]

Houten's innovative design features along with the city's persistent policies to favor cyclists and pedestrians have resulted in numerous measured benefits, including improved cyclist and pedestrian safety, increased activity levels of residents, and reduced use of motorized vehicles. Furthermore, this case study demonstrates that innovative design features are not limited to new districts within a city, but can be applied to new cities as a whole.

PLANNING PROCESS

In 1966 the national government identified Houten, then a small village with a population of about 3,000, as a high growth area and mandated a growth plan be developed to accommodate an eventual population of 100,000. In 1968 Dutch architect Rob Derks offered a plan heavily focused on filtered permeability: a dense network of direct routes for cyclists and a course network of general roads, offering limited city center access to cars (see Filtered Permeability sidebar, p. 49). The city council, which was then made up of civilians and farmers and no politicians, approved Derk's plan, which they believed would provide a more liveable quality to their city. They hired four city advisors (including Rob Derks) with expertise in architecture, city planning and transportation engineering to implement the plan. This combination of technical and planning expertise was key to the success of the development.

In 1974 an agreement was made with the national government to fund the first ring road. Construction began in 1978. Further infrastructure was publicly funded, both through the local government and using grants from the regional and national governments.

In 1994 Houten was again designated as a new growth area under the government's new Vinex Location program (see *Vinex Locations* sidebar, p. 50). Plans were made to construct a second train station, also surrounded by a ring road with bicycle paths and mixed use lanes throughout. This area is referred to as South Houten.

To this day, city policies in Houten have a strong focus on bicycle safety and bicycle rights. The local cyclist union is also very active in advocating for cycling infrastructure and cycling rights.

KEY POLICY AND DESIGN MEASURES

Sustainable transportation is one of the main priorities of the City of Houten. Beyond using urban design to encourage cycling and walking, the city has also applied several other policy measures, the combination of which has had a great impact on travel behavior of its citizens. These are described below.

Bicycle and Pedestrian Infrastructure

As mentioned, the city of Houten has over 129 kilometers of cycle paths, which are colored brick-red. In the city center these paths are completely separated from car traffic (Photo 3), although motorized scooters are allowed to use them. (Dutch law places low-speed scooters in the same category as bicycles, therefore they cannot legally be excluded from using the paths.) In order to improve safety, speed bumps are located on cycle paths throughout the city designed specifically to slow motorized scooters while providing minimal disturbance to cyclists (Photo 4). The entrance to many of the cycle paths are blocked by bollards, so cars are physically unable to enter these pathways. Only in residential areas do bikes share roads with cars, but speeds in these areas are limited and the streets are traffic calmed to maintain safety for pedestrians and cyclists. Furthermore, signs are located on these streets stating that cars are guests on the road and must give priority to cyclists. Bicycle tunnels and bridges have been built under or over the ring roads so that neither bicycle nor car traffic are interrupted (Photo 5). In addition, cycle paths connect Houten to the city of Utrecht where many residents commute for work.

This extensive focus on bicycle infrastructure and bicycle priority above the car on all city streets is unique to the city of Houten. Furthermore, infrastructure costs for Houten are no higher than for any other Vinex location in the Netherlands (*Beaujon 2002; Tiemens 2010*). This focus makes cycling in Houten easier, safer and more convenient than in other cities. Surveys have shown that even those not predisposed to cycling cycle more as a result of living in Houten (*Hilbers 2008*). This demonstrates the strong impact infrastructure can have on travel choices.

One issue encountered is that since so many residents cycle, it can often be difficult to find a bicycle parking spot, especially in high-trafficked areas like the city center (Photo 6). To resolve this issue, the city is currently constructing a staffed bicycle parking facility and bicycle shop under the tracks of the central train station.

Urban Design

Houten's early focus on urban design is a key to the city's current level of transport sustainability. When designing the city, Houten's

[1] http://www.youtube.com/watch?v=p4QT5rvnfSo

planning advisors considered how the location of housing and layout of roads and bicycle paths would affect resident travel behavior. They did not neglect the car in their designs, but created a layout that would give priority to cyclists.

Street Layout and Design

The street network in Houten consists of north and south ring roads, each with a radius of about one kilometer (Figure 1). From the ring road there are roads leading to every residence, however, generally there are no direct links between neighborhoods by car. In order to access another neighborhood, drivers must first enter the ring road and then exit again at their destination. Furthermore, even on these residential roads used to access homes, priority is given to cyclists (Photo 7). Other than these mixed-use roads the majority of streets within the city are for cyclists only and cars are restricted from entering. Due to the layout of streets and cycle ways, cyclists have much more direct access to various parts of the city, often resulting in cycling being the fastest mode of travel.

Urban design features were used to mark the transitions from the ring road to the residential areas. By law, drivers are required to slow down when exiting the ring road, which has a speed limit of 90 km/hr, and entering the 30 km/hr residential areas, but these design features help to further ensure safety at ring road exits. First, large buildings are located on either side of the road at these transition points to act as a visual signal to drivers that they are entering the city. Additionally, there is a change in the road from asphalt pavement to bricks and a fork to slow down car speed. Furthermore, no residential street is straight for more than 75 meters, which helps to maintain safe vehicle speeds and heighten driver awareness of the surroundings.

FILTERED PERMEABILITY

Filtered permeability is an urban planning and design technique that allows pedestrians and cyclists to travel through an area more directly than motorists. This makes travel by these modes more convenient and even faster than traveling by car, stimulating mode switching and reducing emissions. This approach may even include strategies to limit or restrict movement by cars.

Filtered permeability applications often include separating pedestrian and cycling paths from roads for motorized vehicles. Houten, for example has built a limited street network for motorized vehicles while providing a more extensive network of car-free paths for pedestrians and cyclists.

As a result, traveling by bike is often more direct and even faster than traveling by car. In addition, pedestrian and cycle paths have been separated from roads for motorized vehicles whenever possible, even at intersections where bicycle bridges or tunnels have been built to keep cycling traffic separate from car traffic.

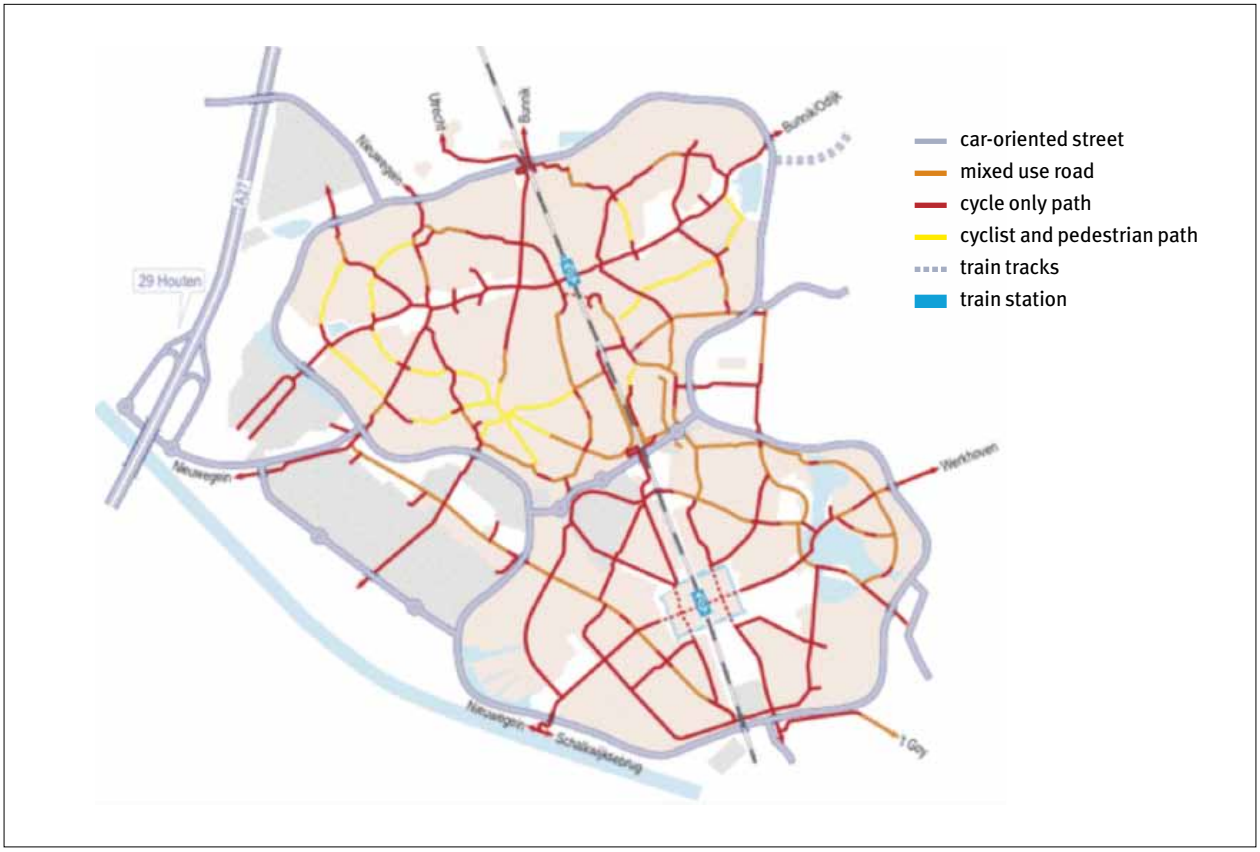


Figure 1: Street Layout of Houten

VINEX LOCATIONS

Vinex Locations are areas in the Netherlands, generally in the outskirts of cities, designated for housing development. The program was created by the Dutch Ministry of Housing in 1993 as an answer to the anticipated housing shortage, mainly due to the high growth rate of the population. More than just an urban-extension program, the Vinex project was intended to metamorphose the shape of the Netherlands. Over a million houses were to be built by 2015, in new neighborhoods fulfilling special conditions. "To fit the requirements of the consumer in the 21st century," special attention was given to quality, sustainability and social equity.

The principles of Vinex housing are:

- **Build cohesive neighborhoods in place of existing urban gaps to reduce the fragmentation of Dutch cities and to protect green areas**
- **Make easily accessible all urban facilities and, in particular, shopping centers in order to increase the potential customer base**
- **Reduce car-dependency by providing easy access to urban facilities by public transport or NMT**
- **Build a viable and social structure that will correspond to all layers of society**

Vinex Locations are required to create growth plans following certain standards. To avoid segregation, 30% of housing is required to be social housing, which is subsidized by the government and meant for low-income households. Additionally, housing must be high density with at least 30 houses per hectare, must conform to market conditions, must maintain the relation between existing and new urban areas and must use sustainable design (*Vinex Location Website*).

Public Space Design

The city of Houten has incorporated many open public spaces and green areas into its design. Next to the central train station is a plaza surrounded by a man-made canal and home to numerous shops and cafes. The plaza is often used for public markets, making it a bustling activity center. A similar plaza with shops and cafes but incorporating a Romanesque theme, is planned for the Houten Castellum station in the south of the city. Many small play areas and parks are located throughout the city so that no one has to go far to find green space. In addition, a small forest complete with cycle paths and play areas for children was created just outside the city. The objective was to create an area near the city, accessible by bicycle or walking, where residents could escape to enjoy nature without having to drive.

Land Use Planning and Design

In the core of each of Houten's rings is a train station, so that no one lives more than two kilometers away from a station. Next to each station is a plaza with shops and other amenities. Housing is arranged "like pedals of a flower" around these central areas (*Beaujon 2002*). This style follows the classic layout of a transit oriented development (TOD), with housing and retail focused around a central transit station, maximizing access for all residents. Furthermore, the majority of schools and important buildings are located along a bicycle thoroughfare, which runs through the center of the city, providing easy access to important destinations by bike.

A business park is located in South Houten close to the border between the two rings, providing many job opportunities to residents. In addition, the historic city center of Houten is located in the southwestern part of the northern ring, which consists of a plaza surrounded by shops and restaurants as well as several historical buildings, including a protestant church that dates back to the 1500's.

Public Transport

As mentioned, Houten has two railway stations, one located in the center of each ring road. Houten Castellum was recently renovated and additional track capacity was added. Every 15 minutes a train takes travelers from Houten Station to the city of Utrecht, with a journey time of 10 minutes. There are also four trains per hour running in the opposite direction, towards the town of Geldermalsen. Houten also has bus connections to Utrecht and other regional centers. The trains and buses make it easy for residents to access Utrecht and other parts of the Netherlands without needing a car.

Train and bus riders in Houten may use the OV-chipkaart, a contactless smartcard that will eventually be used on all public transport in the Netherlands. Introduction of this card simplifies the process of traveling to other parts of the country. The same card can also be used in the GWL Terrein development located in Amsterdam.

Public Bikes

An OV-Fiets (translated as "public transport bicycle") rental station with 35 bikes is located at a staffed bicycle parking facility near Houten's central train station (Photo 8). OV-Fiets started as a pilot project in the Netherlands in 2002 with the aim to integrate bike rental as part of the services offered by the Dutch public transport system. There are now over 160 rental points, mainly located at train stations throughout the Netherlands. The scheme has been designed for frequent users, mainly commuters, to encourage cycle use over motorized transport for the first/ last leg of their journeys between the station and their homes or places of work. Currently 50% of the nation's rail passengers have access to the scheme (*OV-Fiets (NL) 2008*).

OV-Fiets users must register with the system and a Dutch bank account is necessary for the subscription charges. Users can sign up using their existing annual rail season card (much like the Oyster scheme in London) or obtain a membership card. Each individual rental costs €2.85 per 20 hour period up to a maximum of 60 hours. The yearly subscription charge is €9.50. Members may use a bike at any location throughout the Netherlands, but must always return the bike to the station where it was obtained.

The OV-Fiets system differs from bikesharing systems being introduced in many cities, such as Velib in Paris and Stockholm City Bikes, in which short trips are encouraged and users can pick-up and drop-off bikes at numerous locations throughout the city. OV-Fiets, on the other hand, has one charge per 20 hour period, so users often keep the bikes for longer periods of time. Additionally, each bike comes equipped with a lock, making it possible for users to park the bike, for example, at their office during the day, and use

Table 1: Information about carsharing companies in Houten

	Wheels4All	Greenwwheels
Deposit	250€	225€
Monthly subscription fee (varies based on subscription type)	Several options: 2.5, 5, 10, 20 or 150€	4,700
Population density *(persons/ha)*	2.5, 5, 10, 20 or 150€	Ranges from:
Fee per km (varies based on subscription type)	0.11 or 0.13€	0.10€
Hourly fee (varies based on subscription type)	0.5, 1.6 or 2.5€	2.50€
Discounts available	No substantial discount available	Discount with Dutch Railway card (NS card)
Company membership option	Yes	Yes
Number of cars available in Houten	14	2

http://www.wheels4all.nl, http://www.greenwheels.nl

Table 2: Houten as compared to nearby and surrounding areas

	Houten	Zeist	Milton Keynes	South Houten	Veldhuizen
Population	43,900	60,400	196,000	18,700	9,350
Urban area *(ha)*	820	2,500	8,900	350	190
Urban density *(persons/ha)*	54	24	22	53	49
Number of residential units	18,400	26,600	NA	5,700	3,500
Cars per 1,000 residents	415	530	NA	449	NA
Mode share					
Car	34%	46%	70%	58%	77%
Public transit	11%	11%	10%	16%	10%
Bicycle	28%	29%	3%	24%	13%
Walking	27%	14%	17%	2%	0%

ITDP Europe, 2010; City of Houten; City of Zeist; Milton Keynes Council, 2009; Hilbers, 2008

the bike throughout the day for trips or errands. The bike must then be brought back to the same station where it was checked-out. Therefore it functions as a hybrid system between bikesharing and bicycle rental.

Carsharing

Two carsharing companies are located in Houten: Greenwheels and Wheels4all. Greenwheels has two carsharing vehicles in Houten, one of which is located near the central station. Wheels4all has fourteen cars located throughout the city. These vehicles provide residents of Houten with access to a car when needed without having to own one. More information about these companies is included in Table 1.

Employer Contributions

In the Netherlands, companies are required to compensate employees for their transport to work. This money is subsidized by the government through tax deductions. Typically employers provide a variety of options that employees can choose between, such as reimbursement for fuel, free parking, transit passes, and even providing money towards the purchase of a new bike. For example, City of Houten employees can purchase a tax deductible bike every three years. The City of Houten goes beyond national policy to restrict companies from offering compensation options related to cars. Companies may only offer transport subsidies related to bikes or public transit, in order to encourage employees to choose these options over commuting by car (*Tiemens 2010*).

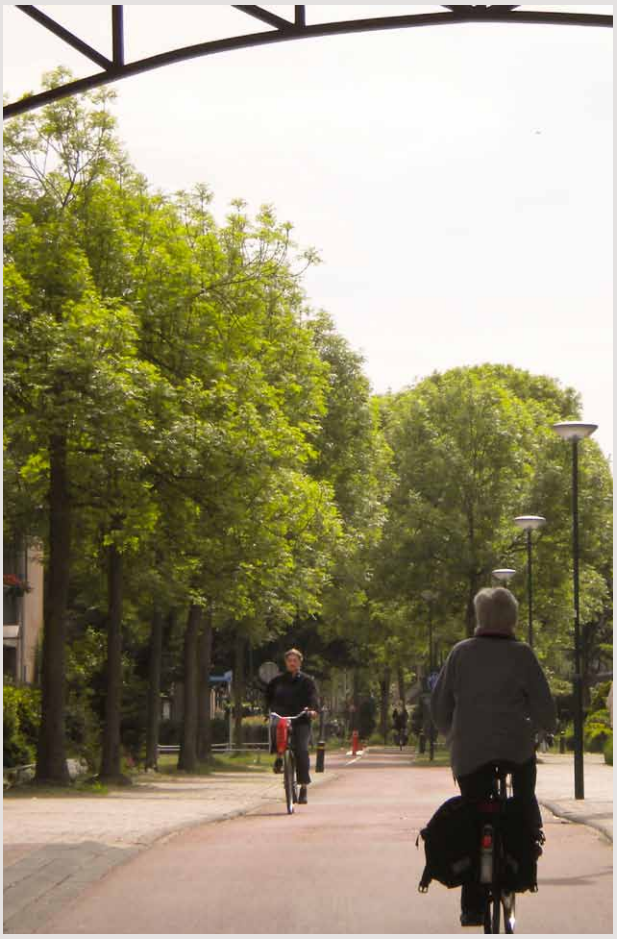
Educational Programs

Children are taught from an early age≠ not only about the health benefits of cycling, but also about bicycle safety. Since cycling is a primary mode of transport in Houten, it is essential that residents understand appropriate and safe bicycle use. Starting at an early age Houten's children are given a thorough education in bicycle riding and take a compulsory bicycle exam when they are 10 years old to test their knowledge of hand signals, road rules and riding ability. Children must take this test until they pass (*CylcePress 2003*).

QUANTITATIVE ANALYSIS

In order to quantify the benefits of Houten's unique combination of urban design structure and policy measures, we compared it to Zeist, as a reference point within the Netherlands, and Milton Keynes, England, to demonstrate the difference between bike-oriented and car-oriented urban design (Table 2). Zeist has a similar population to Houten and, like Houten, is located on the outskirts of Utrecht (a

1
Houten



2
Cycle path

Houten has 129 km of cycle tracks, many of which are fully separated from traffic.

3
A car yields as cyclists cross

4

Speed bumps slow motor scooters which are permitted by Dutch law on cycle paths.

5
Cycle tunnel

Cycle paths cross the ring road, giving both cyclists and motorists safe, uninterrupted travel routes.

6
Bicycle trailer

Children learn about cycling and cycling safety from an early age in Houten and many families travel together via bike.

7
Mixed use street

On residential streets, bikes share space with cars, but as the sign indicates, drivers must give cyclists right-of-way.

8
OV-Fiets bicycles

An OV-Fiets bicycle rental station near Houten's train station is a blend between bikeshare and traditional bike rental, allowing for day-long rentals to encourage passengers to ride to and from the station.

regional center with a population of 307,000). Like many cities in the Netherlands, Zeist has good bicycle and pedestrian infrastructure; however its street network is much more car-oriented than the Houten network. Milton Keynes, like Houten, was designed in the 1960's as a new city; it was the last and largest of the British government's new towns, under the 1946 New Towns Act. The city is located about 80 km northwest of London. Unlike Houten's bicycle and pedestrian focused, dense, urban design, Milton Keynes was designed with the car in mind, focusing on low densities and easy car access on high speed grid roads. In a further attempt to accommodate the car, the parking supply is quite high; as much as 2-3 times higher than what would be expected for a city of its size (*Whiteside 2007*).

Additionally, the area of South Houten is compared to the neighborhood of Veldhuizen, located in the Leidsche Rijn district of the city of Utrecht. Like South Houten, Leidsche Rijn was identified as a high growth area, or Vinex Location (see Vinex Locations sidebar). Both locations were required to follow the same Vinex Location guidelines, including reserving 30% of housing as social housing, providing a density of at least 30 houses per hectare, maintaining the relation between existing and new urban areas and using sustainable design. The neighborhoods in the Leidsche Rijn district were designed individually, each with its own identity. However, the urban designers of Veldhuizen and other neighborhoods of Leidsche Rijn took a different approach to the planners of Houten, placing more focus on cars and therefore providing more parking facilities, more main roads, and improvements to public transit (*Hilbers 2008*). Table 2 provides a summary of statistics for the entire city of Houten (within the two ring roads), the city of Zeist, the city of Milton Keynes, the area of South Houten (within the southern ring road) and the neighborhood of Veldhuizen.

Car and Bicycle Ownership Rates

While the car ownership rate of Houten is not necessarily low (415 cars per 1,000 residents), it is lower than the nearby city of Zeist (530 cars per 1,000 residents). A survey of Milton Keynes residents found that 45% of households have two or more cars (*Milton Keynes Council 2009*). This is higher than for the city of Houten where 36% of households have two or more cars (*ITDP Europe 2010*). The Milton Keynes survey did not collect exact numbers of cars owned per household.

Surveys conducted in both Houten and Milton Keynes asked about the bicycle ownership rates for households. In Houten only 2% of households are without a bicycle while in Milton Keynes 35% of households do not own a bike. The bicycle ownership rate is quite high in Houten at 3.4 bikes per household. The rate is much lower in Milton Keynes at 1.1 bikes per household. This is not surprising given that the Netherlands is known for having a much stronger bicycle culture than England. However, investments in bicycle infrastructure also likely contribute to this difference. The city of Houten has nearly three meters of cycle paths per resident while Milton Keynes has just over one meter of cycle paths per resident. Furthermore, the cycle paths in Houten are direct and are perceived as safe by residents, while the cycle lanes in Milton Keynes are not direct, can be difficult to follow and are perceived by some to be dangerous after dark (*Whiteside 2007*).

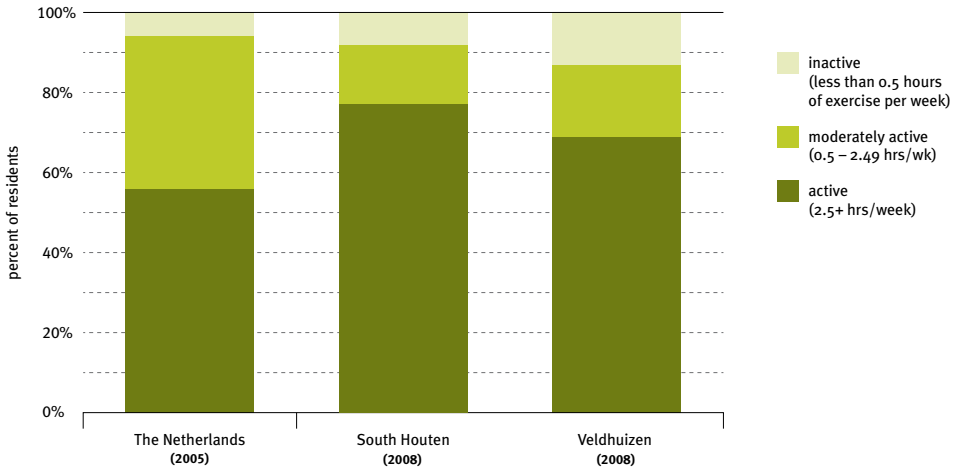
Bicycle Use and Perceptions

Results of a survey conducted by University of Utrecht students shows that people in South Houten are more active, on average, than people in both Veldhuizen and the Netherlands as a whole (Figure 2). Factors contributing to this increased activity are that residents of South Houten more often cycle for daily and weekly errands and also spend more hours per week on recreational cycling (2.3 hours per week for South Houten residents versus 1.4 hours per week for Veldhuizen residents). It would appear that the spatial design structure and extensive cycle network seem to encourage cycling in Houten. This is further supported by survey findings that residents of South Houten are more satisfied with the number of unhindered bike paths and give higher ratings for quality and safety of bike paths (Figure 3). In addition, more than half of survey respondents stated that their bicycle use increased after moving to South Houten (*Hilbers 2008*).

Mode Split

While Houten residents do more recreational cycling than residents in surrounding areas, encouraging more transportational cycling is key to reducing carbon emissions. A survey of South Houten and

Figure 2: Activity level of residents of The Netherlands, South Houten and Veldhuizen



Hilbers, 2008

Veldhuizen residents in 2008 found that more respondents from South Houten (24%) cycle to work than respondents from Veldhuizen (13%), as seen in Figure 4. Furthermore, 14% of respondents from South Houten cycle or walk to a public transportation stop or station and then take public transportation to work versus 9% in Veldhuizen. A far smaller proportion of South Houten residents (58%) travel to work by car than Veldhuizen residents (77%).

Surveys of residents of Houten and Milton Keynes found that far more work trips made by Houten residents (31%) are by bike than work trips made by Milton Keynes residents (4%), as seen in Figure 5. In addition, far more commute trips by Milton Keynes residents (73%) are by car than in Houten (53%). This demonstrates that Milton Keynes residents are much more dependent on their cars for work trips than Houten residents.

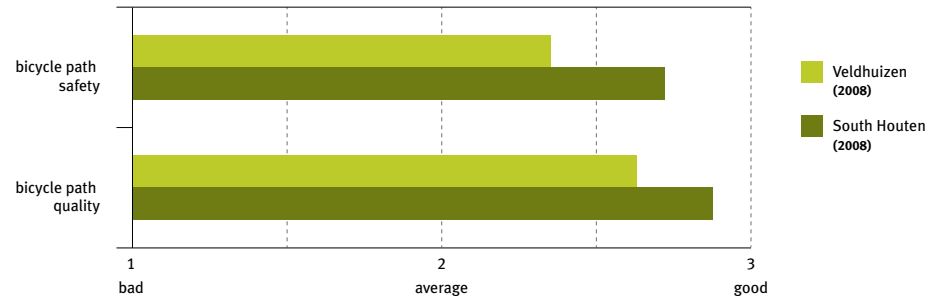
Still, many work trips made by Houten residents are by car, particularly for trips out of the city. However, by far, the most popular mode of travel for trips made within the city is cycling. The majority of Houten residents travel to the grocery store (53%), conduct other shopping (70%), run service related errands like visiting the bank or barber (79%) and visit friends and family in Houten (79%) by bike or on foot, as seen in Figure 6.

Overall, more than half of all trips made by Houten residents (55%) are made by non-motorized modes of travel, which is higher than for the city of Zeist (43%) and Milton Keynes (20%). Further, higher proportions of trips made by Milton Keynes (70%) and Zeist residents (46%) are by car than for the city of Houten (34%), as seen in Figure 7. A further study found that 42% of trips shorter than 7.5 kilometers in Houten are made by bike, and around 21% by foot (*City of Houten Website*). Another study states that car use in Houten is 25% lower than in similar cities (*Beaujon 2002*). All of these studies support the finding that the combination of measures present in Houten have contributed to improved sustainability of travel choices of residents, particularly for trips within the city.

Distance Traveled

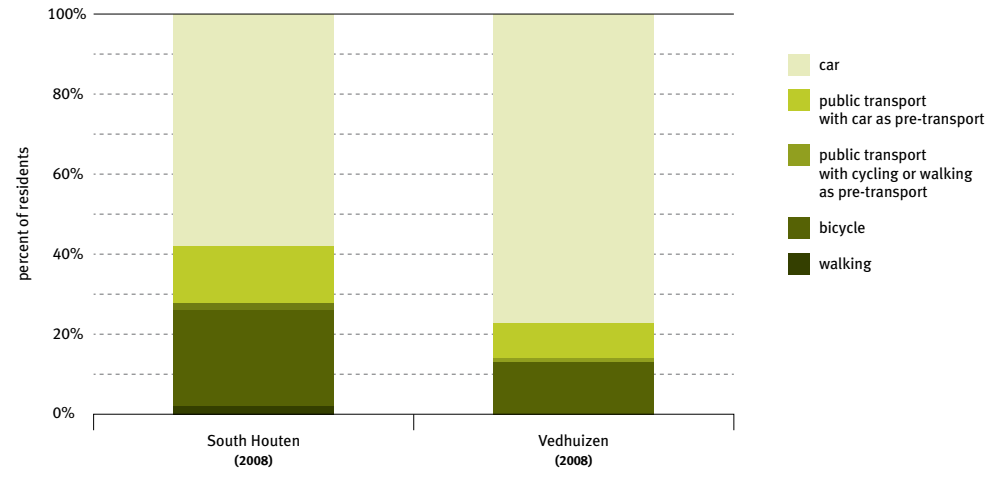
Distance traveled is a key measure for evaluating transport-related emissions. Resident surveys found that residents of South Houten have shorter commute times than residents of Veldhuizen, even while more people commute to work by bike and fewer by car. This suggests that residents of South Houten live closer to work, thus requiring less daily travel, and reducing the carbon footprint of residents (*Hilbers 2008*).

Figure 3: Perceptions of bicycle path quality and safety in South Houten and Veldhuizen



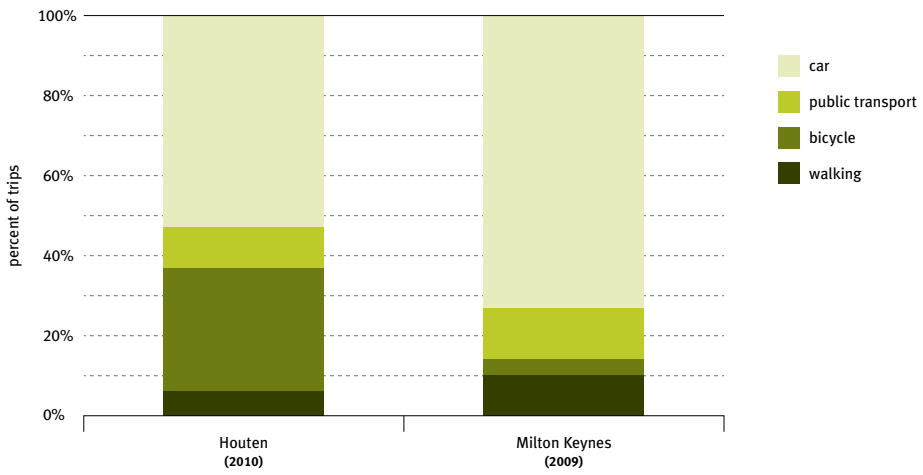
Hilbers, 2008

Figure 4: Mode of transportation to work for South Houten and Veldhuizen residents



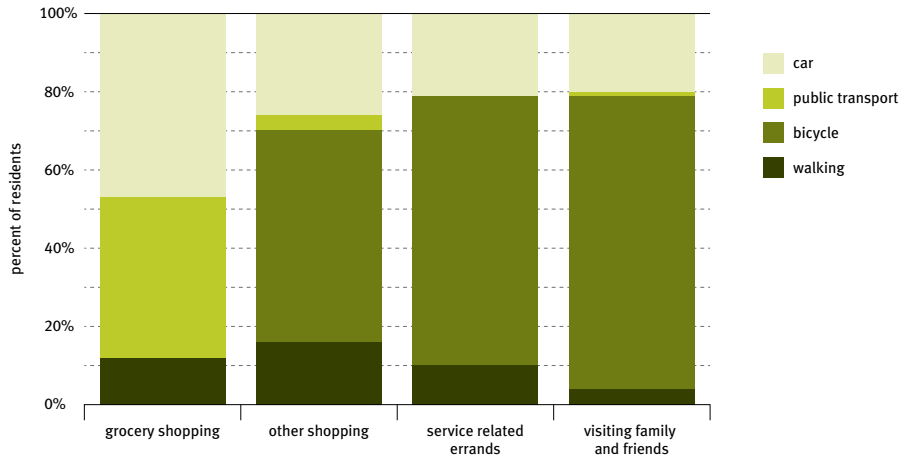
Hilbers, 2008

Figure 5: Mode of travel to work



Hilbers, 2008

Figure 6: Houten residents' mode of travel for various trip types (2010)

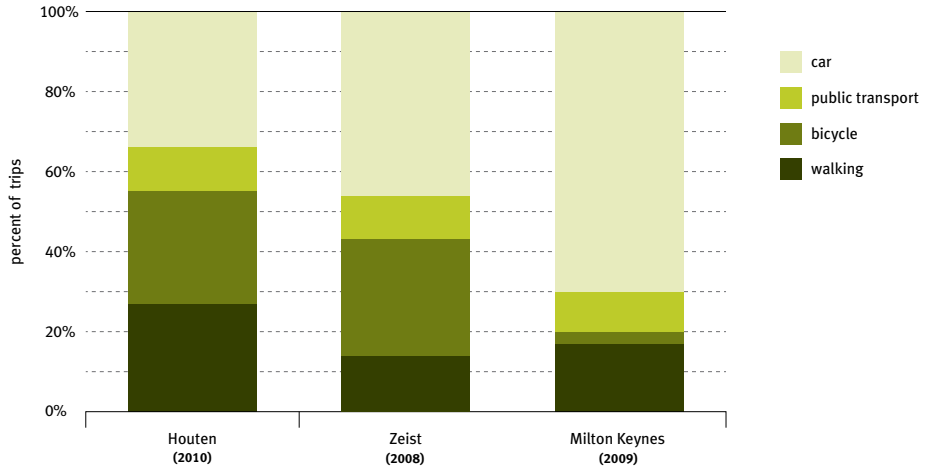


ITDP Europe, 2010

Indeed, surveys of residents throughout the city of Houten found that 21% of residents live within 5 kilometers of their place of work or education, and more than half live within 15 kilometers. However, the finding that almost half of residents live 15 kilometers or more of their place or work corresponds with the finding that 53% of resident commute trips are by car (Figure 5). For longer travel distances, residents are forced to travel by motorized modes since most are not able to cycle or walk such long distances. While Houten has good public transport access, it appears that many residents still choose to travel by car to work, particularly for destinations more than 25 kilometers from home. Increased car travel increases the carbon footprint of residents.

Half of Houten residents travel less than one kilometer to their grocery store, and 18% travel a mere 500 meters or less. The average distance residents travel to a grocery store is 1.2 km (*ITDP Europe 2010*). However, 47% of residents stated that they typically travel to the grocery store by car (Figure 6). Residents might be incentivized to drive to the store based on the low parking rates in parking garages in Houten and the high availability of parking spaces. If parking prices were increased, more residents would likely shift to cycling to the grocery store, since the majority of residents already cycle for most other trip purposes within the city (Figure 6). Indeed, many residents own bike trailers which can be used to carry goods (Photo 6). These trailers, combined with the short distance to a grocery store make shopping trips by bicycle feasible.

Figure 7: Mode split for all trips



ITDP Europe, 2010; Rijkswaterstaat Centre for Transport and Navigation, 2008; Milton Keynes Council, 2009

LESSONS LEARNED

Residents of Houten cycle far more and drive far less than their neighbors, and much less than their counterparts in Milton Keynes, England. However, the city has been so successful at promoting cycling and transit, that now over-crowding has become an issue. Bicycle parking facilities are filled capacity and residents complain about lack of bicycle parking. The city of Houten is aware of this issue and is currently constructing a staffed bicycle parking facility combined with a bicycle shop and bicycle repair services under the tracks of the central train station.

The demand for trains leaving from Houten's central station was also underestimated. As a result, frequency of train service to Houten was increased and the number of tracks on the line from Utrecht to the south via Houten is currently being doubled to four tracks.

An important strategy not applied in Houten is to restrict parking by limiting and pricing parking. There is more than one parking space per residential unit in Houten. As a result, the majority of households own cars and the car ownership rate in the city is fairly high.

In addition, two parking garages are located near the central station. The first two hours are free within these garages, then 1.50 Euros per hour is charged up to a maximum of 9 Euros per day. The shop owners in central Houten subsidize the free hours through their rent. They were worried they would lose business if people had to pay too much for parking (*Tiemens 2010*). However, as shown in Figure 6, most residents of Houten already walk or ride a bike for shopping trips, so parking prices could easily be raised without hurting business. Though most do cycle, the low prices for parking might encourage some residents to drive to the grocery store rather than cycle, even though they live within cycling distance of the store.

Other cities that choose to replicate Houten's model should limit or economically decouple residential parking in order to encourage reduced car ownership. In addition, non-residential parking should be priced in order to encourage residents to use other forms of transportation besides driving to do their shopping. ■

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Figure 1: City of Houten
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