The transport-urbanisation dialectic

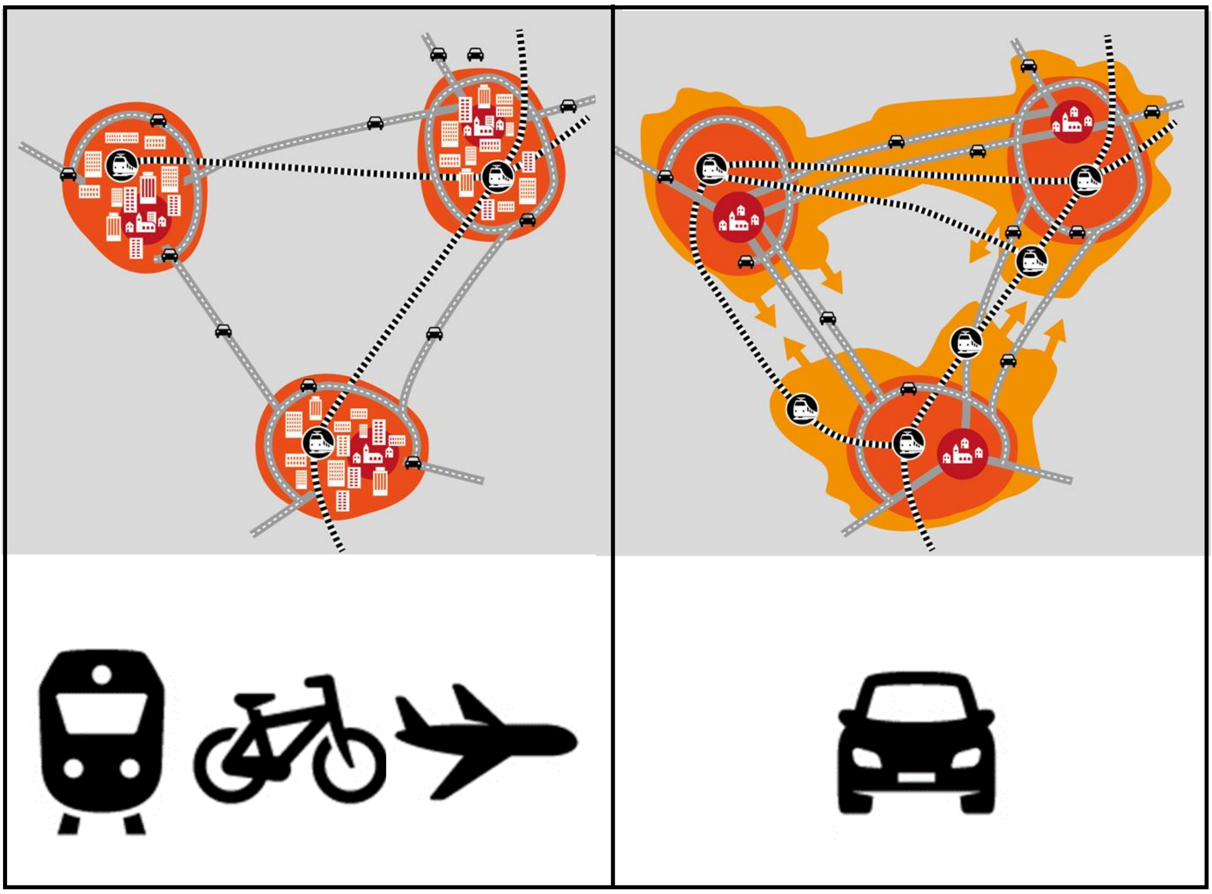

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Table of contents

1. Introduction

Most of the world's oldest towns and cities are located on waterways or the coast, taking advantage of the transportation opportunities on offer. With the arrival of the steam train, industrial towns begin to expand into the hinterland. As cars appear on the scene, we see a new wave of urbanisation as well as the emergence of suburbs. Since the onset of the industrial revolution, developments in transport technology have thus always left their mark on the spatial order (Section 2). Since the start of the twenty-first century, mobility patterns have been changing anew, for automobility has almost ceased growing (Section 3). As a result, the centrifugal impact of the car on the organisation of space has come to a halt and we are now seeing a new wave of urbanisation. Even though congestion is an unavoidable facet of urban life, accessibility is still better in towns and cities, the short distances outweighing the slow traffic speeds there (Section 4).

The recent changes in mobility patterns and use of space herald a need for change in public policy. To maintain economic growth and accessibility it is now essential that cities become more compact and inner-city mobility options are improved (Section 5). This means a complete turnaround of current policy thinking, which is still focused primarily on improving intercity connections. It is within metropolitan districts that mobility problems are greatest, and it is here that solutions need to be found. The new course proposed here leads to better utilisation of space, to more appealing cities and to landscape conservation. The coming decades – and perhaps century – we will be living with the spatial configurations we opt for today.

This article is based on international studies and data on the dialectic between spatial organisation and mobility. While many of the examples and illustrations are from the Netherlands, the principles outlined are universal, while mobility trends in the Netherlands differ little from those in other European countries.[1]

2. Transportation and use of space from the medieval era onwards

Mobility always covers distances in our physical environment. As transportation improved, spatial development became possible on an ever-larger scale and towns and cities could grow, which ensured that the benefits of agglomeration could be reaped. Together, these centrifugal and centripetal forces gave rise to an evolving dialectic between transport and urbanisation. Today's landscape is the physical imprint of that historical interaction.

Waterborne transport
As in many countries, all the oldest towns and cities In the Netherlands are located on a river or sea-arm (Rutte & Abrahamse, 2016). These are the places with the best transport options. In the eleventh and twelfth century Groningen and Dordrecht took shape along sea-arms, while Deventer, Utrecht, Arnhem and other towns developed along major rivers. Overland transport was by foot or by horse and carriage, which was slow and limited the amount of goods that could be carried. Access by water was far easier, so that was where the towns began to grow. Waterways were the infrastructure behind the economic success of the Netherlands' Golden Age in the seventeenth century.

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[1] This article was originally published in Dutch, as Chapter 7 of the book *De wereld van de stad: theorie, praktijk en toekomst* (Hospers & Renooy (eds.), 2021).

Near the station

The appearance of the steam train in the first half of the nineteenth century triggered major changes. Not only was it three times faster than horse and carriage, it could also carry far more passengers and goods. Steam trains were also a lot more reliable: waterborne transport depended on winds, tides and water levels, while trains had a fixed schedule with a printed timetable. Rail companies were the first true industries, with the first real managers, whose job it was to make sure departure times were properly coordinated and rail safety was guaranteed (Chandler, 1977).

The railways, along with the telegraph that emerged around the same time, revolutionised the organisation of space as well as the economy. Mass production and mass distribution took the place of itinerant salesmen and craftsmen with their own workshop. This economic transformation was rapid. The decades between 1840 and 1920 saw the emergence of large department stores, chain stores and multinational firms. Many of these companies are still major players in the global marketplace today (Chandler, 1977). Familiar Dutch names from that era include Heineken (1864), Stork (1865), Unilever (precursors: 1870 and 1872), Vroom & Dreesman (1887), Shell (precursor: 1890) and Philips (1891). Without the steam train, there would have been no industrialisation of the economy, or it would have proceeded very differently.

While the steam train enabled a huge expansion of spatial scale, mass distribution and production led to spatial concentration. From the mid-nineteenth century onwards, towns soon started to expand. Where labour was cheap, industrial towns like Enschede, Hengelo, Tilburg, Eindhoven and Helmond sprang up, complete with a railway station at their perimeter (Figure 1). In the latter half of the nineteenth century these stations were the most accessible locations and consequently a magnet for industrial activity. It was precisely here that towns underwent their greatest expansion in the decades around the turn of the century. As a consequence, train stations came to lie within the towns (Rutte & Abrahamse, 2016).

Figure 1: The Hague, Holland Spoor station, opened in 1843 (Wikimedia commons).

The Netherlands was not in the vanguard of railway construction, however. With our well-developed network of canals and horse-drawn barges, the added value of trains and trams was more modest. The very first railway ran parallel to the Amsterdam-Haarlem Canal and soon spelled the end of that waterway connection. Elsewhere it was often a challenge to get heavy steam trains across the often-marshy landscape and at first the long railway bridges need to traverse the wide rivers were technically unfeasible. With time, though, these two challenges were turned to our advantage. When it opened in 1868, the Culemborg railway bridge was the longest in the world. And Dutch expertise when it comes to building on soggy soils is still very much alive.

Despite getting off to a somewhat slow start, by 1930 the country had 7,000 kilometres of train and tram rails. For nearly a century, rail was the dominant form of transport, with economic activity concentrated round stations and tram lines. With the emergence of road vehicles this all changed, however. About half the original 7,000 km of rails have meanwhile been dismantled, mainly between 1930 and 1970.

Suburbanisation

The first motor car appeared in the Netherlands in 1896, but it was not until about 1950 that this new form of transport really began to take off. That year our country had only 120,000 such vehicles, but between then and 1970 private car ownership increased on average by 15% a year. By 1970 there were over 2 million cars on the roads and by 1980 that figure had doubled. This onslaught of car traffic had huge consequences for the spatial order. With a car, people are no longer bounded by stations and departure times, but can get anywhere, anytime. Spatial concentration around stations soon gave way to suburbanisation.

To preserve the country's open landscapes, spatial planning policy papers were put out by successive governments with the aim of preventing unfettered suburbanisation. Out in the real world, though, spatial developments were shaped by the popularity of the car, the construction of ring-roads around major towns and cities and steady expansion of the national road grid. As a result, town perimeters and rural areas became more accessible than city centres. The rising popularity of the car stretched urban perimeters outwards, as it were. In the 1960s there was even a threat of inner-city dilapidation, in stark contrast to the boom that later set in around the turn of the century.

Besides flexibility in terms of time and space, cars also provide speed, reducing door-to-door travel times. Between 1950 and 1990 the average speed of travel doubled from about 20 to almost 40 km/h (Verkeer & Waterstaat, 2002). This led to longer average trip distances, in particular for commuting to work. Between 1950 and 1970 automobility increased tenfold (Figure 2). This meant a complete change in the spatial behaviour of people, whose radius of action became far greater, with destinations ever more dispersed. As spatial behaviour changed, so too did spatial structure. Towns and villages expanded in size and suburbanisation was accompanied by a greater concentration as well as a scaling-up of all kinds of facilities. Schools, shops, hospitals and industrial estates came to lie further away from traditional town centres. As with the railways earlier, the arrival of cars meant spatial upscaling going hand in hand with spatial concentration.

The post-war Marshal Plan brought American transport specialists to Europe, keen to share their experience and advice. In the US, cars had already started making massive inroads forty years earlier. Inspired by the Americans, our country embarked on a series of grand traffic projects in the 1960s, including filling in Utrecht's Catharijnesingel Canal and a 2x4-lane highway through Delft's city centre. Today, the water is back in the Utrecht canal. Of the eight lanes planned for Delft, four never materialised and the other four have meanwhile been reduced to two. US-style solutions were just not appropriate here. The Netherlands was far more urbanised than the US in the early twentieth century, while cars took off only forty years later. Urbanisation and cars emerged in inverse order.

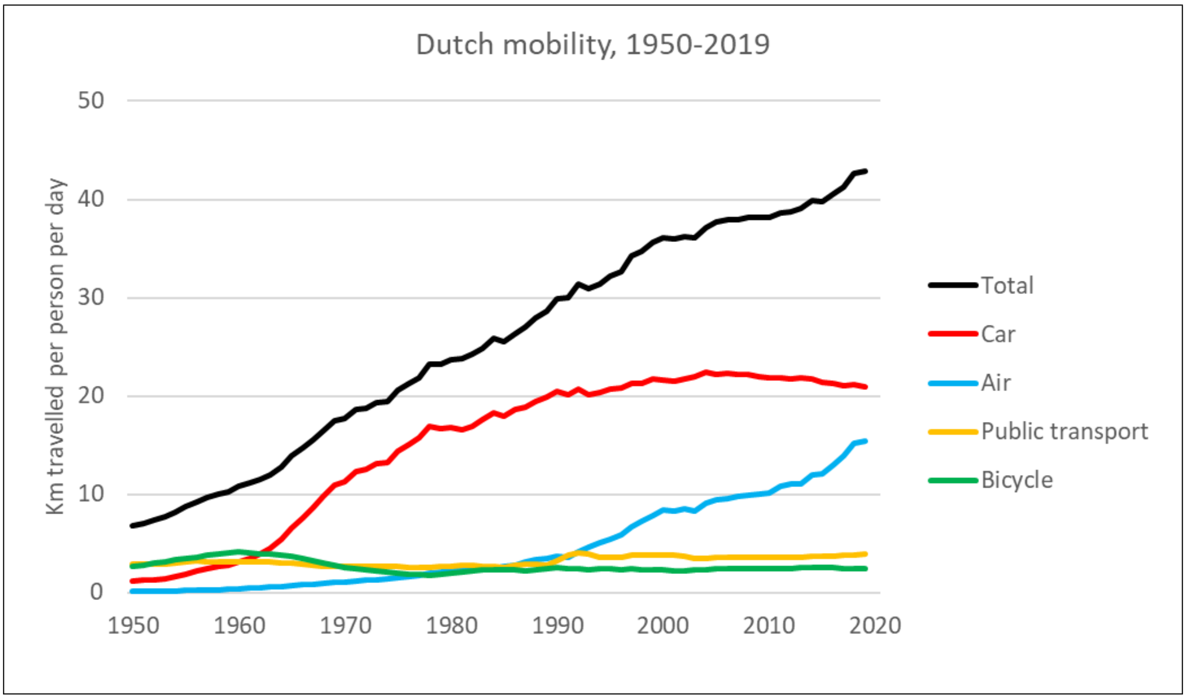

Figure 2: Trends in mobility, 1950-2019, in kilometres per person per day (based on PBL, 2020, KiM, 2020).

Once more, change

What this historical sketch illustrates is the strong interplay between transportation and the organisation of space. This should be no surprise, given that spatial behaviour and mobility behaviour are two sides of the same coin. New spatial configurations generate new locations for building homes and roads, for establishing businesses and recreational facilities. Over time, a spatial structure emerges that matches the transport technology of the day. It is a dialectical dance: not only is spatial behaviour steered by the dominant transport mode of the day; the spatial order also affects mobility behaviour. The bottom line is that rail and public transport match with spatial concentration, cars with suburbanisation. This tight connection between the spatial order and mobility makes it hard to change mobility behaviour. A switch from cars to public transport also means a change in destinations – those more accessible by public transport – and eventually even switching to a place of work or residence better served by public transport. Cars and public transport each come with their own spatial structure, limiting the extent to which they are interchangeable.

Meanwhile, we find ourselves in a new phase of the spatial dynamic. Since 2000 there has been no further increase in average car speed. Over the years our spatial behaviour has come to revolve entirely round the flexibility and speed of the car (Bleijenberg, 2017). In sociocultural terms, too, the car is now entirely 'naturalised' (Jeekel, 2011). But the pronounced growth of automobility is now over (see Figure 2) and with it the centrifugal force exerted by the car. This is one of the reasons we are now seeing a new wave of urbanisation. Centripetal forces meet less resistance.

Despite the clear picture provided by the statistics, it is not yet sufficiently realised that the era of ever-rising automobility is now behind us and will not be coming back. The stagnation of cars as the dominant mode of transport is entirely in line with the laws of mobility growth, though, as the next section describes.

3. Speed determines mobility

The primary function of any form of transport is its speed. The history of mobility can be summed up in two words: ever faster. Until the industrial revolution, travel was comparatively slow: 5 km/h on foot and 8 to 15 km/h by horse and carriage, horse-drawn barge and sailing ship. At 30 km/h, the steam train was a massive improvement. The electric train was even faster and cars now average 45 km/h. The increase in travel speed is by far the biggest factor behind the huge growth in mobility, from an average of just a few kilometres per person per day in 1800 to over 40 km today (Grübler, 1990).

The key influence of speed on mobility is apparent from the formula:

$$Mobility\left[\frac{km}{day}\right] = Population\,[number]\ x\ Travel\ time\left[\frac{hours}{person.day}\right] x\ Speed\left[\frac{km}{hour}\right]$$

Total mobility is given by population size times average daily travel time times average speed. While infrequently used, this formula is right on the mark. Because average travel time remains roughly constant in the longer term, it is only an increase in speed that leads to mobility growth. A large swathe of the population travels about 1.1 hours a day on average (Schafer & Victor, 2000; Schafer, 2011). In this respect there is little difference across countries, while in any given country average travel time has remained virtually unchanged for many decades. Figure 3, for England, shows no change in average travel time from 1972 to 2019, even though mobility grew by about 50% over the same period. The marked growth in mobility over the last century was therefore due not to people spending more time travelling, but to travel becoming faster. Coupled with population growth, this explains why mobility in the Netherlands increased sixfold between 1950 and 1990.

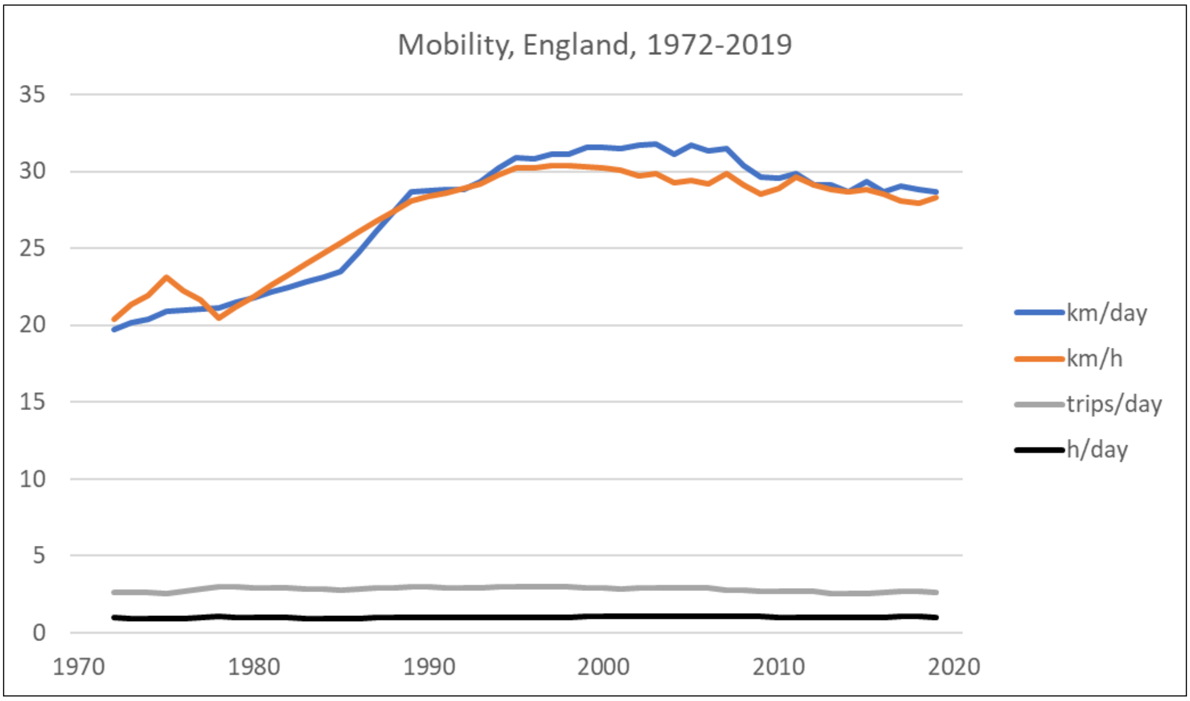

Figure 3: Mobility trends in England, 1972-2019 (all modes except air; Department for Transport, 2020).

Between 1950 and 2000, average car speed increased from 33 to 45 km/h in the Netherlands (Verkeer & Waterstaat, 2002). This was due mainly to construction of a closely knit motorway grid, which today carries half the country's traffic. Since 2000 average car speed has remained about the same: around 45 km/h (CBS data). The fine-grained national road grid has reached completion. Because the time spent in the car is not set to change either, the logical conclusion is that individual automobility will likewise see no further growth. So, the main explanation for stagnating automobility is that average car speed is no longer on the rise.

Speed determines not only the total distance we travel, and thus mobility growth, but also the mode of transport we opt for. If cars and public transport are equally fast, half the people will take public transport. If public transport takes twice as long door-to-door, the percentage of people choosing this option drops below 20%. If a trip takes three times longer, virtually no-one will use it. Because public transport takes more than twice as long for almost 90% of all potential car trips, its overall share remains low. The average Dutch resident opts nine times as often for the car as for public transport. In the major cities, though, where car speeds are low, public transport is certainly popular. Between 2014 and 2018, public transport grew by 15% in the Dutch coastal conurbation. Public transport and the city go hand in hand.

Faced with a choice between air and rail, too, speed is the major determining factor (Bleijenberg, 2020). People opt for air travel because it is quicker than rail over long distances. Though a limited difference is travel time is acceptable, for distances over 1000 km air travel is so much faster than a high-speed train that few people opt for the latter.

Speed goes a long way to determining how far we travel and what mode of transport we choose. Its crucial importance is not reflected in conventional thinking on mobility, though, which revolves around pricing, income, demographics and personal preferences. By the logic of the current paper, it is these factors that determine speed. A car may be fast, but if it is unaffordable there is no increase in travel speed. Starting around 1950, incomes rose, and the cost of cars fell, which meant they became affordable for ever more people. Essentially, speed became an affordable commodity. It is thus economic factors that determine the rate of uptake of a faster transport technology. As with so many innovations, we see the familiar pattern of a slow start, followed by strong growth and then saturation (Smil, 2019). This so-called S-curve is immediately apparent in Figure 2 for automobility.

Today, cars are affordable for virtually everyone, their 'naturalisation' is complete, and their speed is no longer increasing. In short, the 'car system' has reached full maturity. Rising Incomes and falling car prices since 2000 have not meant more car-kilometres, but more luxurious models. Between 1950 and 2000, it was affordability that put a brake on automobility growth, but today it is speed. Because speed is not properly factored into most of the computer models used for traffic projections, they predict continuing growth of automobility. When these models were developed in the early 1970s, though, car use was still growing rapidly. They also rely mainly on the traditional growth factors of income, costs and demographics. These traffic models were fine for projecting the emerging growth of the car between 1950 and 2000 but are unsuited for the current phase of stabilisation. The predictive models need to be adjusted to match the new reality.

4. Urban and rural accessibility

As we saw earlier, successive modes of transport have had a major influence on development of the spatial order and continue to do so today. Conversely, spatial structure affects mobility behaviour. Thus, people living in the most urbanised municipalities drive one-third less kilometres than those living elsewhere. This marked difference is due to multiple factors. Because of the density of the urban environment, the average trip distance is 7% shorter, while average car occupancy is 6% higher, car ownership 20% lower and the number of car trips even 30% lower (Dutch statistics). Overall, this leads to one-third fewer car-kilometres per capita. On the other hand, the number of trips by public transport is three times higher in the most urbanised municipalities and there are 10% more trips by bicycle. In the largest four Dutch cities, mobility behaviour differs even more from the national average. In Amsterdam, for example, car ownership is just below half the national figure, the share of cars in the sum total of trips is 40% lower and use of public transport is over four times higher (Dutch statistics; Amsterdam, 2019). The degree of urbanisation is thus of major influence on mobility behaviour. Besides speed, it is in fact the only real factor affecting that behaviour. Table 1 summarises characteristic differences in mobility behaviour as a function of urbanisation (based on international statistics).

	Metropolis	Large town	Rural	Average
Trip distance	5 km	10 km	15 km	10 km
Commuting distance	10 km	15 km	20 km	15 km
Average trip speed	15 km/h	25 km/h	35 km/h	30 km/h
Car speed	20 km/h	35 km/h	50 km/h	45 km/h
Share of car trips	15%	50%	70%	60%
Car-kilometres per capita	10 km/day	25 km/day	35 km/day	25 km/day

Table 1: Mobility behaviour as a function of urbanisation (Bleijenberg, 2017).

The single most important cause of the differences in mobility patterns between urban and rural areas is vehicle speed. Cars cannot simply drive unimpeded through a metropolis. In the Netherlands' four major cities – including their nationally administered city motorways – average car speed is 30 km/h, and even 3 km/h less during rush hours (TomTom, 2017). In the most urbanised settings, then, cycling and public transport may become competitive with cars in terms of speed. In addition, the quality of public transport is better in cities, because more people use it. Thanks to the short distances involved, more destinations are accessible by bike. Together, these factors mean mobility in the major cities looks very different from the average for the country as a whole.

The explanation for low car speeds in major towns and cities lies in the shortage of space. Having to continually make the most of the available space means that keeping densely urbanised areas accessible requires modes of transport that are 'space-efficient'. On this point cars score poorly, requiring an area 10 to 20 times greater per passenger-kilometre than metro, tram, cycling and walking (Amsterdam, 2017). More than anything else, it is the unavoidable dearth of physical space in the major cities that is spurring a new trend in mobility, and an attendant need for a new approach to transport issues there.

In smaller cities, cycling is the solution, given the relatively short distances. In Groningen, for example, half of all trips are by bike, with public transport accounting for 9%. In similarly sized towns like Leeuwarden, Middelburg and Zwolle, there is also plenty of cycling. Electric bikes increase the radius of action by 50% and will consequently improve the accessibility and appeal of smaller cities. It goes without saying that this implies a need for high-quality cyclist provisions, including dedicated bike lanes, priority at traffic lights and enough parking space at stations and elsewhere. In some towns 'cyclist tailbacks' are once again becoming a familiar sight (Figure 4).

Figure 4: ‘Cyclist tailback’ in Delft, 1958 (TU Delft Beeldbank, photo P.J.A. Ritter).

Even though towns and cities slow down car speed, they still provide better accessibility than rural areas, because of the relative proximity of so many destinations there. In the three northernmost Dutch provinces, for example, the average distance to hospitals, secondary schools, theatres, train stations and other key facilities is three to four times greater than in the four major cities (CBS data). In the north of the country, it is only the distance to motorway slip roads that is slightly shorter than the national average.

Towns and cities are characterised by shorter distances and lower speeds. Accessibility is defined by a combination of the two. This simple yet essential relationship is captured in the formula:

$$Accessibility\ \left[\frac{1}{hour}\right] = \frac{Speed\ [\frac{km}{hour}]}{Distance\ [km]}$$

Accessibility is what can be reached in an hour and this is given by speed divided by distance. Figure 5, depicting workplace accessibility in the Netherlands, is clear proof that accessibility in the heavily urbanised west of the country is far better than in rural areas, despite there being more congestion in and around the major cities. This is the so-called ‘congestion paradox’: the larger the town or city, the more congestion, and the better accessibility (Geurs, 2016). Proximity of destinations is thus more important than slow traffic speeds. It is precisely the better accessibility in the large metropolitan districts that is driving the migration of businesses and people to the city.

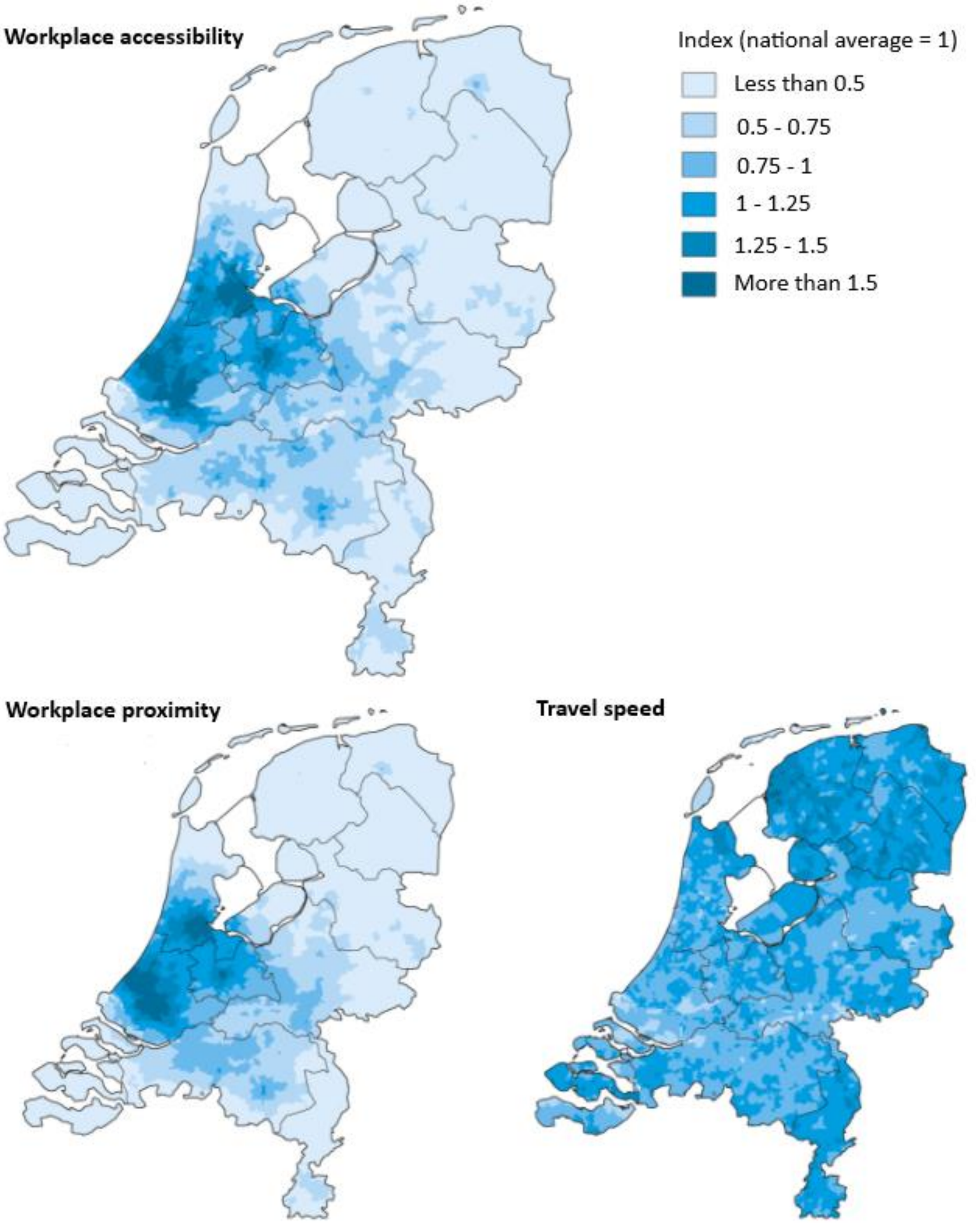

Figure 5: Influence of proximity and travel speed on workplace accessibility, 2010 (PBL, 2014).

The primary aim of mobility policy should be to improve accessibility. It is accessibility rather than mobility that is the commodity of value for the economy and for interpersonal contact. Over the past forty years, though, political practice has prioritised speed and congestion, even though these are only half the story. That urbanisation also helps improve accessibility was left out of the equation, a major error that continues to this day, despite this being precisely the outcome of the six-year academic research programme *Duurzame Bereikbaarheid Randstad* [Sustainable Accessibility in the Coastal Conurbation]. Spatial concentration – the 'compact city' – is better for both accessibility and sustainability. Now automobility has almost ceased growing, policymakers need to shift priority from speed to spatial concentration or, in other words, to the other side of the accessibility coin.

In urbanised areas there will always be congestion, a fact borne out by there not being a single urban agglomeration in the world that is free of congestion. Los Angeles is a prime example. Despite it having the most motorways (km motorway lanes) per capita in the world, it still suffers the worst congestion in terms of lost time per capita. In a metropolis, average car speed is about 20 km/h, in large cities around 35 km/h (Table 1). On city roads lost time is even double that on incoming motorways (data: TomTom Traffic Index). The mobility problems facing major cities thus have their main focus inside rather than outside.

Given low city car speeds, it is easy to understand what happens when a city motorway is widened with the aim of boosting average speed to 80 km/h, say. Before too long, a substantial fraction of the new road capacity is being utilised by traffic that previously used smaller roads. On top of that, people start travelling less together, spawning new traffic. Before too long, congestion returns – to the surprise of many, but entirely predictable once the motorway is seen as part of the city road grid. One percent extra road capacity leads to one percent extra road traffic, the sure-fire conclusion of an extensive statistical study of 228 urbanised regions in the US (Duranton & Turner, 2011). For good reason, the article in the *American Economic Review* reporting on the study is entitled *The Fundamental Law of Road Congestion*. Once this logic is adopted, it becomes obvious that in urban areas it is new road capacity that is the main driver of car traffic growth, and in the heavily urbanised Netherlands this will also largely be the case.

Besides the ‘waterbed effect’ of the urban mobility system, added road capacity also attracts new economic activity, since readily accessible locations act like a magnet for further urbanisation. Once again, this brings with it extra mobility. The bottom line is that congestion can never be made to vanish. Its persistent nature has been systematically underestimated by policymakers and consultants alike, with past projections being consistently outpaced by actual developments (Annema & Vonk, 2009). Indeed, banishing congestion is entirely the wrong objective. What we need is better accessibility, as this – rather than mobility – is what engenders economic and social progress.

5. The spatial configuration and mobility of the future

As the historical sketch at the beginning of this article showed, changes in transportation technology have a major impact on spatial development. Now the pronounced growth of automobility has made way for stabilisation, we once again see a new spatial dynamic emerging. Several years after average car speed stopped growing, urbanisation began to accelerate. Figure 6 shows, that since 2005 the Netherlands’ four major cities have seen the greatest population growth, followed by the next category of smaller cities. According to projections by CBS and PBL, the Netherlands Environmental Assessment Agency, this trend is set to continue through to 2050. People and businesses are now moving to the cities, small and large, and the decades of suburbanisation are over.

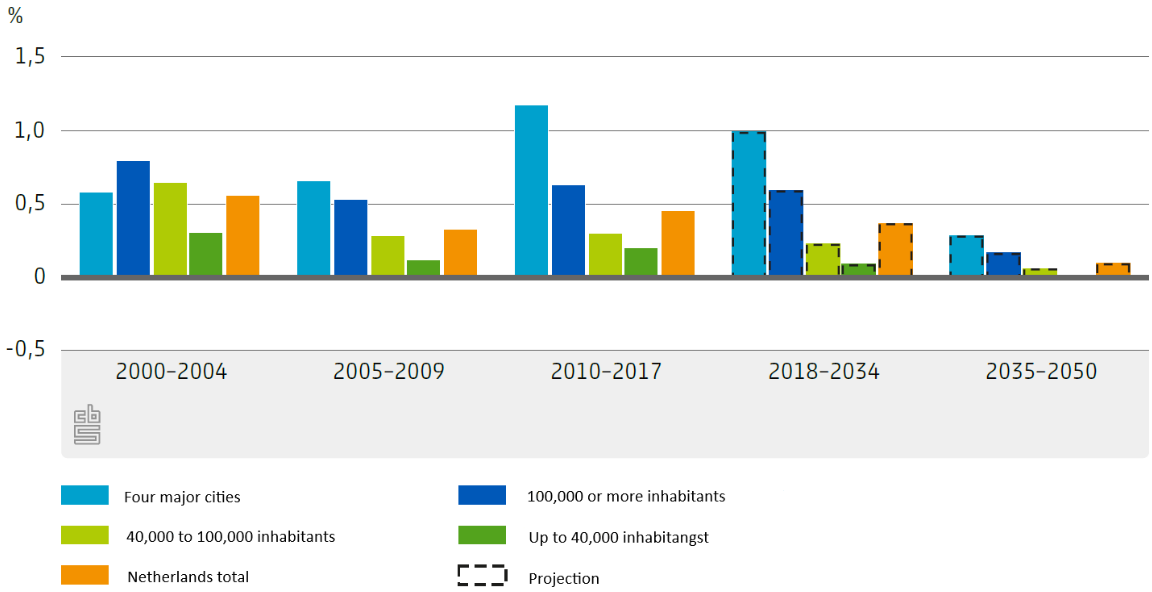

Figure 6: Annual population growth by municipality size (PBL/CBS, 2019).

The next question is: will smart cars and Mobility-as-a-Service (MaaS) have any major impact on future mobility, over and above transport speed? This seems unlikely, unless driverless cars indeed become a reality. Continued uptake of a range of driver-support systems will improve traffic safety, it is true, and green-powered electric cars will slash pollution levels, while information technology will improve traffic flow and make multimodal travel easier. Important as these innovations are, though, they will have no great impact on mobility behaviour, because the speed of the various modes of transport will remain essentially unchanged. Driverless cars, on the other hand, will have an impact, making car mobility available to those currently unable to make independent use of a car: children and certain senior citizens, for example. Driverless cars do away with the need for fine-meshed public transport, in both urban and rural settings. Congestion will also increase. This is because average car occupancy will continue to fall, and more people are able to travel by car. One may question whether driverless cars are in fact socially desirable, however, while some doubt whether such vehicles will ever be suitable for the public road.

Stabilised automobility and increased urbanisation are thus the two changes to which policy should be geared. There needs to be a shift in priority from intercity road and rail connections to improved transport services within towns, cities and urban agglomerations. It is in the major cities that mobility problems are greatest, and it is there that solutions can be found. In most cases these involve small-scale interventions for the benefit of cyclists, along with further sophistication of public transport. In terms of administrative organisation, intermunicipal bodies are the best placed to improve urban accessibility, implying the need to transfer funds and responsibilities from national to local government. Towns and cities need the means to maintain their mobility. This is also essential to promote further urbanisation, since readily accessible locations attract businesses and people alike. Conversely, we need to stop expanding motorway capacity, since this stretches urban perimeters outwards and leads to inefficiently structured space. Given the stabilisation of automobility, neither is motorway-widening necessary.

The second pillar of any policy to improve accessibility is urban 'densification'. Many large municipalities are already working hard on this notion of the compact city, like Utrecht (along the Merwede Canal) and Delft (along the Schie Canal). Densification is often the cheapest way to improve accessibility, as it involves less outlay on infrastructure and mobility. The only issue is that building in an existing urban setting is often considerably more expensive than green-field construction, where the higher infrastructure and mobility costs are borne by others. To remove this unfair brake on development of the compact city, the Netherlands' present Infrastructure Fund needs to be re-imagined as an Accessibility Fund that could be used to cover the additional expense of urban densification compared with green-field construction. Reinstatement of zoning plans may also help make towns and villages more compact and preserve what little uncluttered landscape there is left.

The turnaround in spatial and mobility policy argued for here is pivotal to our future prosperity. Such a move will steer society towards an efficient organisation of space, with good accessibility and limited mobility costs. It will strengthen the urban economy, thanks to the benefits of agglomeration and the creation of an environment conducive to innovation and creativity. By reinforcing the urban-rural contrast, spatial and landscape quality will be preserved. The compact city with the nearby open landscapes, is an attractive place to live. With its appeal to professionals, creatives and tourists, a compact city is also good for the economy.

History has bequeathed the Netherlands numerous 'pretty towns' rather than a single major metropolis like London or Paris (Tijl, 2018). This heritage brings with it certain obligations. The magnetic pull of a metropolis almost automatically leads to ongoing spatial concentration and densification. London and Paris can never become a Los Angeles: a low-density metropolitan region somewhere between urban and suburban. While the Netherlands, with its 'pretty towns', can never become a London or Paris, it could become akin to Los Angeles. If we so choose, we can continue filling in the open spaces and cluttering the landscape, but now that both population and car transport are settling into zero growth, now is precisely the time to make consistent policy choices when it comes to spatial planning and mobility. We are currently in the process of creating the spatial structure we may have to live with for the rest of the century. Basic spatial structure changes little over time, as Figure 7 illustrates for my hometown Delft, where a good part of the medieval urban configuration and even the basic street plan still orders our day-to-day lives. It is our choices today that will determine the spatial structure of the future.

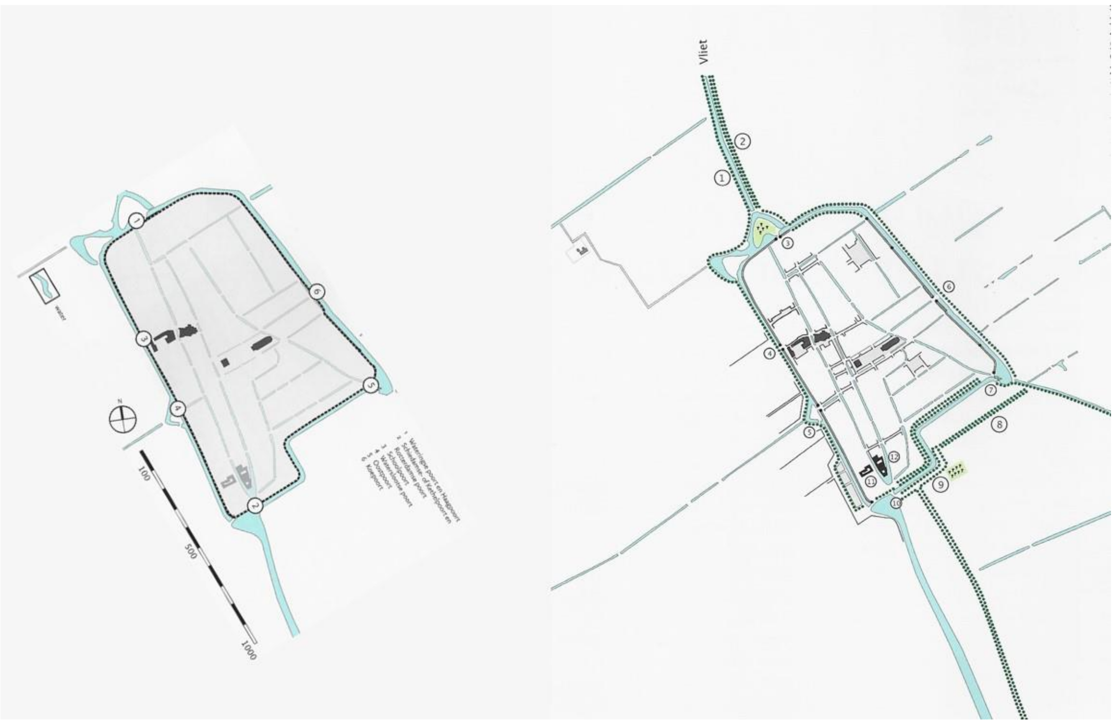

Figure 7: Structure of Delft; left c. 1350, right 1850 (van der Gaag, 2015).

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