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# Light railways and busways as key driver for sustainable urban development: The Swedish experiences with transit-oriented development (TOD)

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## Abstract

Sustainable urbanism and good placemaking revolve around creating and maintaining sustainable and attractive places, by reviving planning and urban design paradigms, by experimenting and innovating and by building synergies between the old and the new. The expectations for wide accessibility and networking are very high and the challenge today is to integrate and improve the efficiency and effectiveness of urban and transport systems. The transports have to fulfil the ongoing demands for enhanced efficiency, comfort, safety and speed, as well as the environmental factors in the light of global climate change and energy crisis. One accent in the last 20 years has been on transit-oriented development (TOD), compact cities and urbanity-empowering public transports like light railways or light rail transit (LRT) or bus rapid transit (BRT) with its busways as key drivers for sustainable neighbourhoods.

TOD in a Swedish (European) perspective is by no means a new idea. Three cases of newer light railway and busway projects (Stockholm, Gothenburg and Norrköping) are explored in this article and they are seen through a historical overview of the TOD experiences in Sweden and around the world. We also investigate and draw attention to the values of placemaking and sustainable urbanism via the advantages and disadvantages of the urban and regional public transport systems and TOD principles.

Keywords: transit-oriented development (TOD), Sweden, light railway (LRT), bus rapid transit (BRT), sustainable urbanism, placemaking

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Sustainable urbanism and good placemaking revolve around creating and maintaining sustainable and attractive places, by reviving urban planning and design paradigms, by experimenting and innovating, and by building synergies between the old and the new. The transports play crucial role in the sustainable urban endeavour and the expectations for wide accessibility are very high today. The challenge is to integrate and improve the efficiency and effectiveness of the urban and transport systems and the transports have to fulfil the ongoing demands for enhanced efficiency, comfort, safety and speed, as well as the environmental factors in the light of global climate change and energy crisis. One accent has been on public transports and transit-oriented development (TOD) or compact cities with urbanity-empowering public

transports like light railways or light rail transit (LRT) or bus rapid transit (BRT) with its busways as key drivers for sustainable neighbourhoods. Transit, a shortening from mass transit, is an American catchall for public transport (Cervero, 1998:15) and TOD can be described as a policy to synchronize urban planning and development with public transports. Peter Calthorpe, who introduced the catchy coinage in the beginning of the 1990s, defines TOD as design or development of moderate and high density mixed-use urban areas at strategic points along the regional public transport system (Calthorpe, 1993:41-45).

The European parallel to the American TOD is roughly the compact city. It is advocated by the European Commission (EC) and has been central in the European sustainable cities debate since the 1990s. The vibrant and lively compact city and the contained and ecological green city are two principle sustainable cities. The compact city favours architectural heritage, by respecting rather than imitating the old, greater diversity by mixed uses, particularly housing in inner city areas, and solving urban problems within existing boundaries of the city without extending its periphery (EC, 1990:30). The argument is that density and diversity are more likely to result into people living close to work places and services that are required for the everyday life (EC, 1990:40). The ambition of the compact city is also to make the private car an option in cities rather than a necessity (EC, 1990:30) by creating integrated, intermodal transport systems which fully exploits the potential of public transport (EC, 1997:11-2). There are numerous experiments of compact neighbourhoods in the last 20 years throughout Europe with a paramount accent on intermodality and urbanity. Like in American TOD, LRT and BRT are preferred and widely applied in many European sustainable neighbourhoods.

But TOD as policy to synchronize urban planning and development with public transports in a Swedish and European perspective is by no means a new idea. There is wide body of knowledge and heuristics about public transport systems, cities and their interplay. We focus in this paper on three cities with newer light railway and busway projects (Stockholm, Gothenbourg and Norrkoping) and they are positioned in a historical overview of TOD experiences in Sweden or through a prism of the principle public transport cities.

## The principle public transport cities

The cities throughout the history have been shaped by transport technologies and the mobility of their citizens. We made a simplified categorization (Figure 1) to describe and cluster the public transports infrastructures as technologies which have similar effect on cities. There are three principle public transport technologies by effect on cities: 1) *public transports on streets* (buses and trams); 2) *completely separated*, either *elevated* or *on the ground* (heavy railways or busways); 3) *underground* (subways); contributed by a hybrid of the three: 4) *public transports partially separated on ground* (light railways or busways). The categories for technologies and infrastructures are unorthodox and open for further discussion. We abducted the common distinction in transports (*light* versus *heavy*), where *heavy* means always complete or full separation regardless if it is a bus or rail system, whereas *light* attribute is for systems that anchor on partially separated, or are partially on street or partially fully separated.

Figure 1: The public transport technologies through infrastructures (designed with Karl Kottenhoff)

	On streets in traffic	Dedicated lane on streets	Partially separated on ground	Fully separated on ground or elevated	In tunnel or underground
Bus line	X	X	(X)		
Light busway		(X)	X	(X)	
Heavy busway			(X)	X	(X)
Tramway	X	X	(X)		
Light railway	(X)	(X)	X	(X)	(X)
Heavy railway				X	(X)
Subway					X

The categories show the anchor (designated by (X)) and ranges (designated by (X)) of the various public transport infrastructures and their position as public transport technologies shaping cities. Two principle technologies tend to concentrate over specialized infrastructures and excel either on urban (public

transports on streets) or regional scale (fully separated on ground or elevated public transports), whereas the underground public transports excel both on urban and regional scale. The hybrids, public transports partially separated on ground, also tend to have wide span claiming both domains.

Each principle technology enabled distinctive urban and regional growth pattern and unique placemaking. The public transport on streets accelerated the urban life and enabled elongation and interweaving of the cities along the bus lines and tramways. The completely separated public transport orchestrated discontinuity of urban fabric and regional existence as temporal convergence of distant places: the railways principled urban dispersal or fragmentation of the city in its region. The public transport underground strengthened the polycentric agglomeration of the existing cities by adding speed, capacity and concentration: the subways connected urban nucleuses in a network. There are four principle public transport cities, analogous to the technologies (Figure 2): 1) the elongated and interwoven city of buses and trams; 2) the railway city of pearls; 3) the networked city above the underground; and 4) the compact city along the light railways and busways. The four principle public transport cities are fuzzy models for TOD, each with its own history and future.

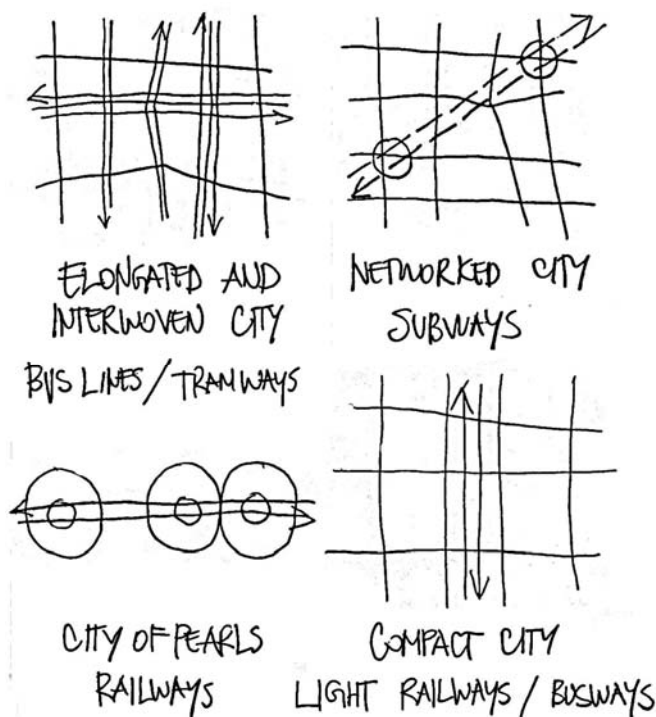


Figure 2: The principal public transport cities

## The principle public transport cities in Sweden

Very few people lived in cities in the 18th century. In 1800 Stockholm had 75000 inhabitants, followed by Gothenburg (*Göteborg*) with 13000, and Karlskrona and Norrköping (*Norrköping*) with 10000. Only 10% of the Swedish population was urban in 1800 and there were 6 cities that had more than 5000 inhabitants (SCB, 1969).

From the 1830s the public transports facilitated rapid urbanization in Sweden and played different roles, experiencing changing reputations, in the urban and regional growth of Stockholm, Gothenburg and Norrköping. There is regional growth (Figure 3) in the three cities, but the lines have very different inclinations. Stockholm grew tenfold, Gothenburg four times, while Norrköping region doubled its population. Stockholm, Gothenburg and Norrköping developed differently. The buses and trams influenced the growth of the three cities in the 19th and the first half of the 20th century shaping their urban cores. While Stockholm developed continuously as metropolis with railways and subways merging into a metropolitan system, Gothenburg and Norrköping preserved their tramways and began to disperse in their

regions or stagnate as consequence of the high motorization and excellent car accessibility. Stockholm experienced decrease in urban density, but it increased the urban borders along the powerful public transport network that gradually extended throughout the 20th century and made the public transports competitive to the private car. The urban cores of Gothenburg and Norrköping became literally urban fragments in a regional road hierarchy crowned by speedy motorways.

From the 1990s the advocacy for compact and urban living influenced or reintroduced urban growth in Stockholm and Gothenburg. Their city populations slowly recuperate or increase. There are ongoing infill developments and redevelopments. Gothenburg reached its urban population level from the 1970s in the 2000s. Norrköping had almost no change in urban population in the last 40 years with very slow regional growth.

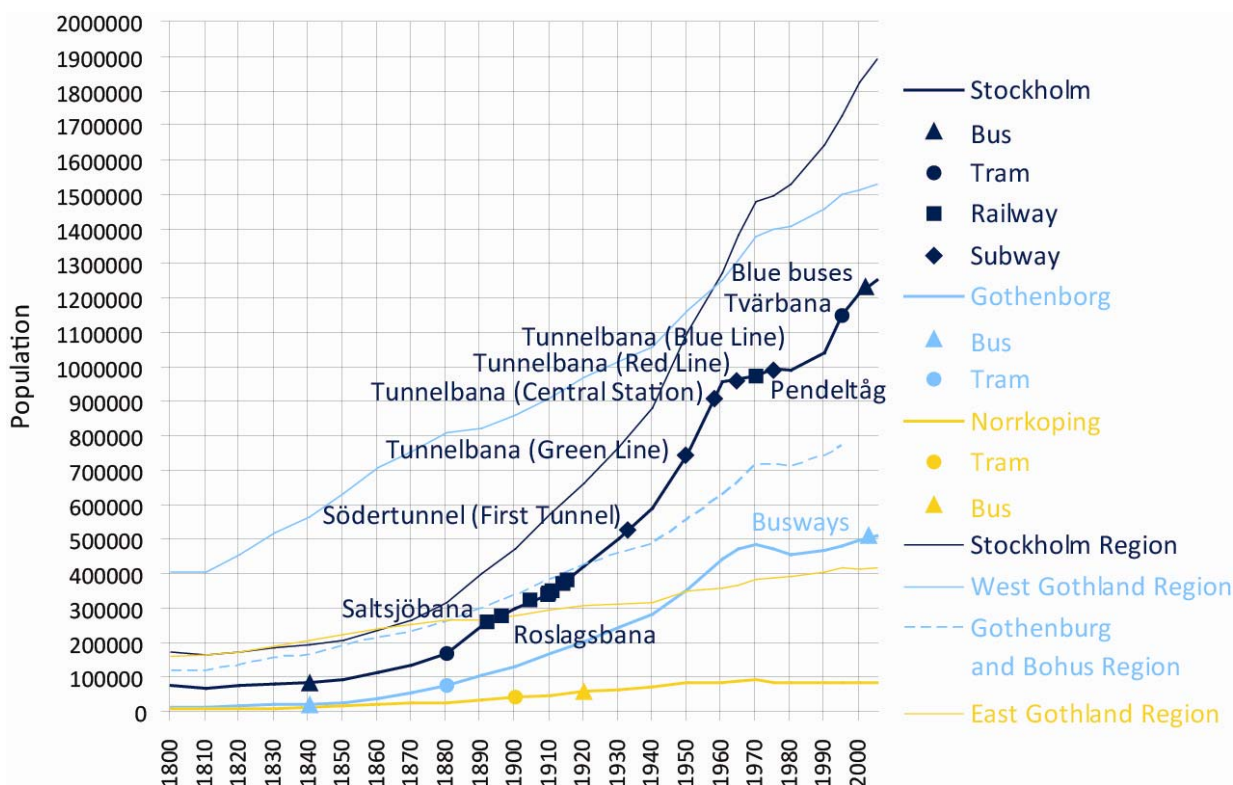


Figure 3: The population growth in Stockholm, Gothenburg and Norrköping and their public transports

### The buses and trams elongate and interweave the cities

The buses and trams as public transports on street elongate and interweave a continuous amoebic city. The streets with public transports were and often remained as very attractive directions in the city. The omnibuses, cable cars, horse cars, trams or streetcars, motorbuses or commonly buses, trolleybuses or trolleys, are modification of a same public transport technology and if we consider capacity and speed they did not change dramatically. Hindered by the traffic on the streets, they are slow transports, reaching averagely 10-20km/h, thus delimiting their line lengths to 10km. The longer lines are usual, but they are not attractive to the travel time budgets of one hour per day<sup>1</sup>. Their lack of speed is compensated by a longitudinal attractiveness, urbanity and wide access to the general public by shortening walking distances. They add vibrancy on streets, give pleasant urban vistas and create mobile public spaces.

The omnibuses (*omnibussar*, *hästomnibussar*) in Sweden were introduced in Stockholm and Gothenburg in 1835 and 1837, while trams or horse cars on rails (*hästspårvagnar*) rolled in Stockholm and Gothenburg

<sup>1</sup> Yakov Zahavi researched and developed the theory behind the travel time budgets, while Cesare Marchetti popularized with his article about human mobility invariants.

from 1877 and 1879. The trams (*spårvagnar*) preceded the buses (*bussar*) in Norrköping and opened service in 1904 followed by the motorbuses (*motorbussar*) which came in 1921.

### The buses and trams in Stockholm

The omnibuses arrived in Stockholm as inspiration from Paris. There were 6 lines with 15 and 30 minutes service already in the 1860s. They reached its peak in the 1870s<sup>2</sup> and they were continuous and fierce competition to the trams. The central line in Stockholm was operated by omnibuses and motorbuses even in the heyday of the trams in the beginning of the 20th century (Holmberg, 1958; 1960:75-7).

The tramways came in Stockholm<sup>3</sup> in the end of the 1870s and they expanded very quickly. Stockholm was a stage where several tramway and railway companies competed for turf from the 1890s. As a consequence the city made amoebic extensions northward, eastward, south-eastward and southward to a radius to 10km by 1920s shaping the urban core of Stockholm today. But already in the 1930s it was decided to remove the tramways in the inner city and replace them with buses.

The slow public transport in the inner city of Stockholm relies almost completely on buses from the 1960s. The buses are important part of the urban life today<sup>4</sup> and it is almost impossible to think about Stockholm without its blue buses that perpetually traverse the main streets and the sightseeing roads. They give acceleration to walking, comfort and astonishing urban outlooks, vibrancy, quick refuge from the cold and they often support the initial and final communication to the speedy metropolitan system, the tunnelbana and other railway links.

The bus lines and tramways made attractive urban corridors (buses on Drottninggatan or trams on Hornsgatan, Sveavägen, Kungsgatan, Odengatan are some examples) and interwove the streets, squares, churches and neighbourhoods along. They shaped the urban core of Stockholm in what is today.

### The trams in Gothenburg and Norrköping

Gothenburg and Norrköping are only two cities in Sweden that kept their tramways throughout the history. But the cities had very different growth patterns. Norrköping is one of the oldest industrial centres in Sweden that grew very slowly, whereas Gothenburg had accelerated growth, then quick dispersal and urban decline.

Gothenburg experienced rapid industrialization in the second half of the 19th century and the city spread out of the spiky city wall already in the 1860s. The trams arrived in Gothenburg in 1879 and facilitated the radial expansion outward, supported by boats and ferries crossing the river (Göta älv) on the north. In the 1920s there was an extensive network of radial and orbital tramways within a radius of 5km and the city grew rapidly and compactly along. As in Stockholm, the bus lines and tramways made attractive urban corridors (Västra and Östra Hamngatan for example) and connected the main squares and neighbourhoods along. But Gothenburg did not develop metropolitan system as Stockholm (see Figure 3). There were no suburban railways and the two proposals for a subway (underbana from underground railway) in 1934 and 1967 remained on paper. Under the pressure of accelerated motorization the city experienced urban

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<sup>2</sup> In the middle of the 1870s the most central *omnibus* line carried consecutively over 500000 passengers per year. The central line was successful even in the heyday of trams transporting over 1 million passengers per year in the end of the 19th century.

<sup>3</sup> The first decision to lay 3 tramways in Stockholm came in 1870, but the company that got the concession bankrupted. Eventually, a new company was established that started a service in 1877. The revenues on the first day showed that more than 10000 passengers took the trams. In the beginning of the 20th century there were 9 tram lines operated by two companies, 7 in the north and 2 in the south of the city. The two companies were bought and incorporated in the public company in the 1910s that has been responsible for the public transport in Stockholm until today. In the 1920s there were 12 urban and 9 suburban tramway or light railway lines, and 3 urban bus lines.

<sup>4</sup> In 2009 there were almost 300000 daily journeys by bus within the inner city. The urban buses, especially the blue buses have most prominent status, but buses exist with various interiors and purposes. Stockholm has been a laboratory for buses for almost two centuries. There are urban and suburban buses coloured in red and blue. The interiors of the urban red and blue buses are more carefully designed to look like mobile public spaces, with lower floors and less seats, whereas the suburban have interiors enhanced for higher speeds with more seats.



decline and decentralization with very strong regional growth beyond the attractive radiuses of the tramways. The city extends in a region with over 80km radius today (Hagson and Mossfeldt, 2008).

Norrköping is one of the oldest Swedish industrial centres. It is located on a river that was regulated with series a dams to power manufactures and factories since the 17th century. The city had a dense urban core already in the 18<sup>th</sup>, but it developed much slower than the other industrial centres. It elongated northeastwardly and southeastwardly along two tram lines which opened from 1902 and the buses in the 1920s completed a radial public transport network extending roughly 5km. Norrköping developed compactly within that radius until today and the tramways accent the most important directions in the city with denser developments and enrich the urbanity and charm of Drottningatan, the most attractive street in the city.

### The railways principle the city's suburbs

In the 19<sup>th</sup> century the railways were exciting and revolutionary technology of speed, infrastructures, clocks and timetables, wagons and compartments, classes and tickets. They were hated and fenced for bringing the industrial landscape and overcrowding in the city, but they were also esteemed, inciting inspiration, fantasy and adventure. The railways had higher speeds and own infrastructure, and unlike the stops on the streets, the stations were nodes, pearls on an impenetrable string. They were placed on distances that prevented overlapping buffers, gave total control over the accessibility. The railway city of pearls was motivated by monopolistic entrepreneurship that targeted twofold gains. The developers bought almost worthless land on the periphery, laid railways and designed suburbs. The buildings were sold or leased, while the fares were bringing continuous and lucrative profits.

The railways are speedy transports which make a hierarchy of access and desirability and link urban pearls scattered over wide distances. The city of pearls can theoretically extend over 100km, far beyond the access of the car. The city of pearls exists in reality as metropolis, a mother city, usually networked by subways, buses and trams, which subordinates the pearls and other urban fragments scattered in the region. Stockholm is the only city in Sweden which developed as metropolis or city of pearls with urban fragments connected by heavy rail or bus links and the satellite pattern was visible already in the 1930s. The urban fragments beyond the suburban railway network were connected by direct or express buses even then.

### Edelsvärd's ideal railway city

The railways as exciting and revolutionary technology inspired many. Adolf Wilhelm Edelsvärd was an architect which made a model of an ideal city with a railway station in its core which it is probably one of the oldest TODs.

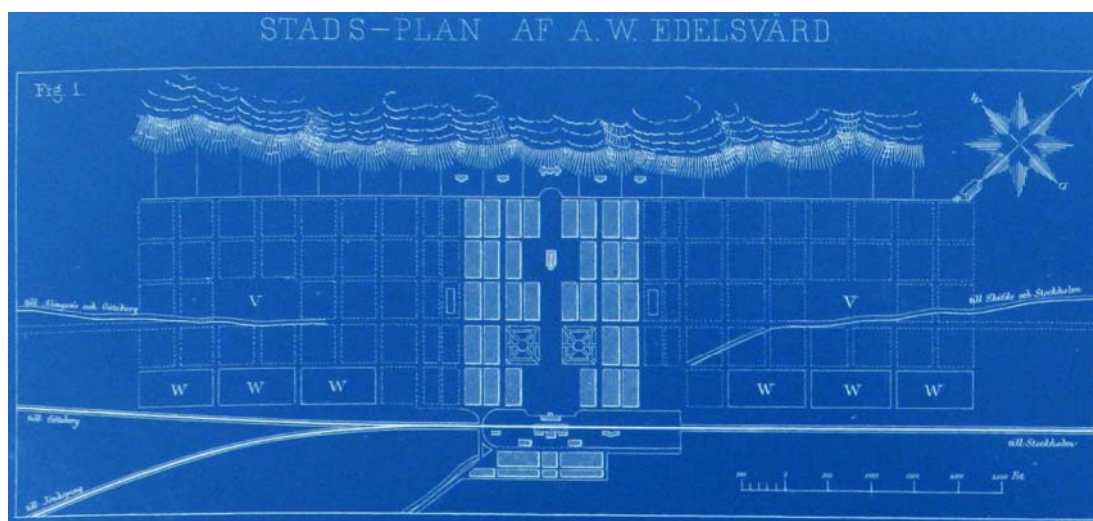


Figure 4: Adolf Wilhelm Edelsvärd's ideal city/urban plan from 1859 in *Tidskrift för Byggnadskonst och Ingenjörsvetenskap*

Edelsvärd's city (Figure 4) is functionally divided. It has an urban core of public buildings (hatched blocks) with a picturesque boulevard as an axis. The sequence of public spaces starts with a square in front of the railway station, parks on both sides, square with church surrounded by court and other public buildings and ends with fair and amusement park (*tivoli*). The industry (W) is located along the railway and the houses on the wings (hollow blocks). In the core of the housing quarter there is a square (W). Each housing block is around 400 feet and divided by an alley. There are 12 houses in each block and the building coverage of the plots is 30-40%, while the rest is used for gardening (Edelsvärd, 1859), reflecting the picturesque and naturalism of the industrialization period.

### The railway suburbs in Stockholm

The garden suburb was the realistic counterpart to Edelsvärd's ideal railway city. The suburbanization of Stockholm started in the 1890s. The tramway and railway companies who competed for turf in the city also bought land in the countryside and laid suburban railways to profit on increasing land values (see Svalhammer, 2008:57-8). They even developed *garden suburbs* which achieved copious fame as *cities of villas* (*villastäder*) in Sweden. The entrepreneurs quickly understood that railways dramatically increase land values and that the garden suburbs are very attractive and the battle for turf in the city expanded in the countryside.



Figure 5: Collage of photographs from Djursholm, the city of villas on the north of Stockholm, and Djursholmsbana or Roslagsbana today, the suburban railway, from the end of the 19<sup>th</sup> century and today (source for the historical photographs: Stockholms Spårvägmuseum/Stockholm Transport Museum)

There were two entrepreneurship models in suburbanization of Stockholm. Sometimes the development and railway companies cooperated, whereas sometimes one company laid both railways and developed land. Djursholmsbana (or Roslagsbana today) is a railway which connected Djursholm, one of the first



garden suburbs with a terminus then on the north of the city. One company was running the trains and extended the railway network northward, while another company planned and developed suburbs along. Other companies had funds to invest both in the development of railways and land. Knut Agathon Wallenberg was a banker and politician who both financed the Sältsjöbana, suburban railway which terminated in Slussen, and developed a string of suburbs eastward (Svalhammer, 2008:43).

### The ABC suburb and city

The ABC principle was a Swedish response to the modernist *functional city*<sup>5</sup> inspired also by the advocacy for polycentric *metropolis* and neighbourhood or community focus in Lewis Mumford's *Culture of cities* (Nyström and Lundström, 2004). The *metropolis* structure described by Mumford (1934:486-93) existed in Stockholm as an array of radial railways with suburban *strings of pearls* already in the 1930s and Sven Markelius, the planning director in the city of Stockholm, recognized and established it as a model for future development. The ABC principle was actualized either as *suburb* or a *satellite city*, a cluster of suburbs. The *suburb as a pearl* (Figure 6) has urban sectors that should represent a Stockholm in a miniature, whereas the *satellite city*<sup>6</sup> literally suburbanizes the suburbs by a hierarchy of centres (Figure 6).

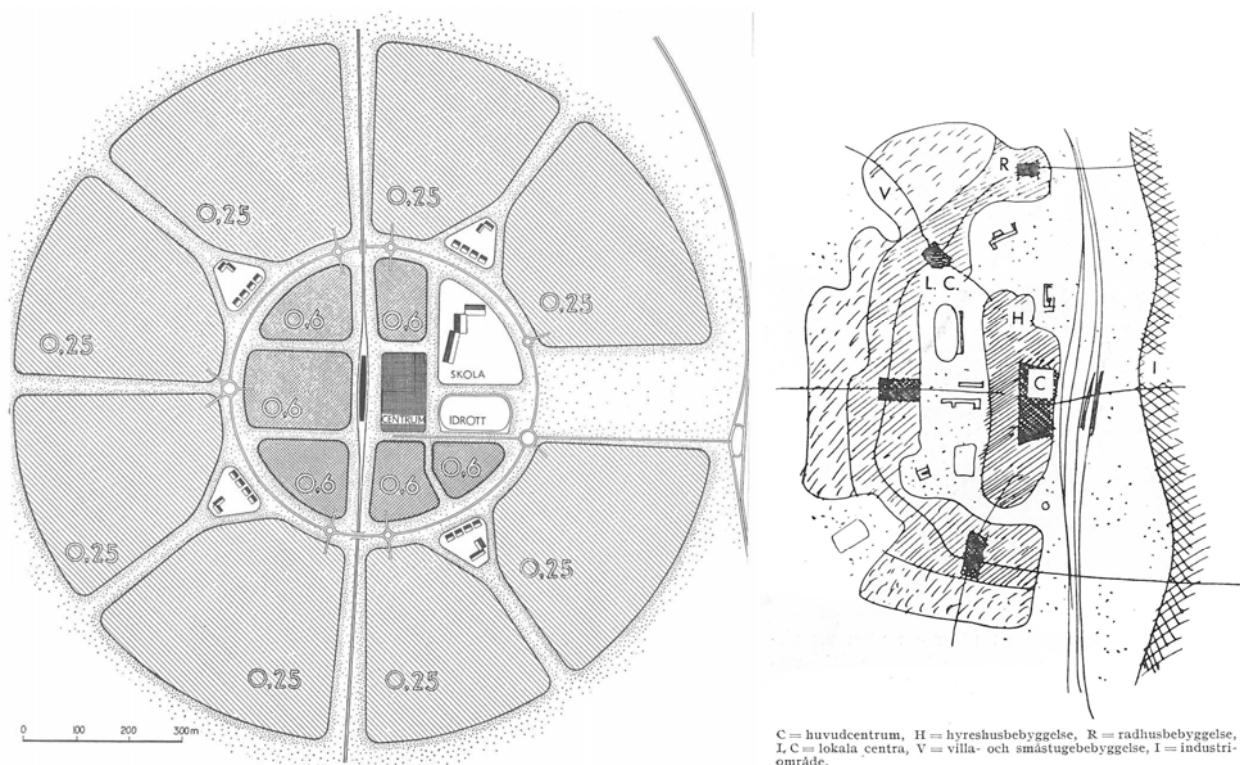


Figure 6: Suburb as pearl from *Future Stockholm (Framtida Stockholm)* in 1945 on the left (the numbers represent the floor area ratios of the housing districts) and the satellite city by Sven Markelius on the right from *Byggmästaren 1945* (C main centre, LC local centre, H multifamily housing, R row housing, V villas, I industries)

Stockholm's metropolis model one of the most successful TODs. Despite the high motorization in the Stockholm region the share of public transport is very high, especially during rush hours. The centres in the ABC suburbs or cities act as public transport nodes, whereas the diversity and density of the ABC city attracts passengers and balances the public transport demand between the suburban pearls and the urban nucleuses. The urban or suburban centres are interconnected with the speedy and frequent tunnelbana or

<sup>5</sup> The ABC city stands for *arbete* (working), *bostad* (housing) and *centrum* (centre) and is much inspired and critical to Le Corbusier's urbanism and the *functional city* in CIAM's Athens Charter.

<sup>6</sup> Sven Markelius in two articles (Markelius, 1945; 1956) argued for larger suburbs with at least 50000 inhabitants with various typologies to support the housing preferences. The *satellite city of pearls* was a response to that problem. Markelius planning office produced both the visionary overture *Future Stockholm (Framtida Stockholm)* and the unbinding *Generalplan för Stockholm 1952*, which shaped the ABC principle and what is Stockholm today.



other rail or bus links with high capacity. In a same time there is public transport hierarchy of slower and faster, feeder and trunk lines which bring passengers from the less dense fringes of the ABC suburbs or cities into the centres.



Figure 7: Collage of photographs from Vällingby, the first ABC city, from the 1950s and today. The photographs of the centre (C element in ABC) are on the left and on the right are the photographs from the diverse residential areas (A element in ABC) surrounding the centre (source for the historical photographs: Stockholms Spårvägmuseum/Stockholm Transport Museum)

## Networked inner Stockholm

The networked city in reality is the urban part, the heart of the metropolis hierarchy. The subways connect suburban railways or expand as railways outward. Terribly expensive, they preserve the city above, protecting the traditional urban fabric and historical heritage. In a same time they affect the vibrancy of urban life by networking the places above. They rival or outperform any surface transport in congested urban cores and they do not cause visual impacts as the elevated systems. They act much like the diagonals of Rome or the baroque European capitals, just invisible to the city above.

## Stockholm's inner city and its tunnelbana

In 1913 Knut Agathon Wallenberg opened a debate about a subway that will network the radial suburban railways and tramways. The subway was branded *tunnelbana* (railway in a tunnel) and the first tunnel opened in 1933 under the south island between Slussen and Skanstull. In the 1930s the politics changed favouring busses and subway over trams and the entire system adopted the catchy brand tunnelbana (see Svalhammer, 2008:78-92). The central station opened in 1957 connecting the radial tramways and railways into a powerful system. More than one million passengers aboard the tunnelbana daily and the Stockholm's underground is a city itself which keeps the city above alive and vibrant. The urban buses give attractiveness to the main streets and make slow links between the squares and monuments, the tunnelbana connects them city very quickly and comfortably.



## Compact city along light railways and busways as sustainable European city

The light railways emerged as a compromise between tramways and railways in the 19th century as systems partially on the street, partially fully separated. Many, especially American cities developed along light railways or interurbans in the end of the 19th and the beginning of the 20th century. Los Angeles developed the most extensive railway network in the world which in its peak, in the 1920s, had over 1600km of interurban railways connected with over 320km of tramways.

The advocacy behind the compact city in the last 20 years in Europe revives this historical public transport city and revolves around partially separated public transport infrastructures like light railways and busways. Stockholm and Gothenburg have started experiments with sustainable neighbourhoods having light railways and busways as structuring urban elements, whereas Norrköping extended its tramways in order to renew, diversify and intensify the neighbourhoods along.

### Hammarby Sjöstad and the other developments along the Tvärbana in Stockholm

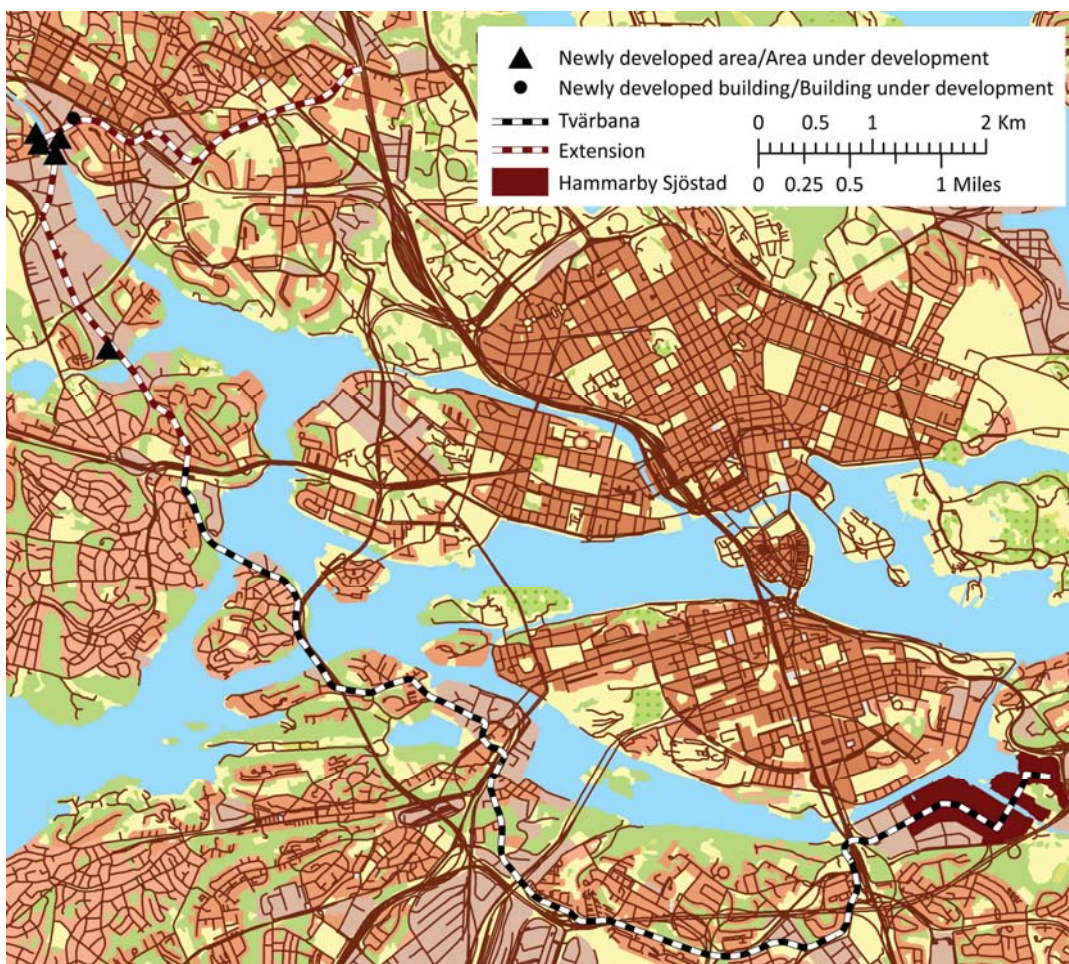


Figure 8: Tvärbana and new urban developments

Hammarby *sjöstad* (translated as waterfront city) evolved in a sustainable city model in the 1990s. It fuses the traditional and ABC city in a compact unity along ideally sized light railway corridor. It has offices, shopping and even industry, but these varied functions are mainly put in different parts, whereas the buildings along the corridor have vertical mix of function as in the historical core. The politicians wanted a true urban feel (*stadsmässighet* in Swedish) along the esplanade, as in the inner city. It is located south

from the inner city district Södermalm and separated by a lake. The northern waterfront developed a pattern of quasi enclosed urban blocks in the early 1990s maximizing the lake views, which replicated on the southern waterfront.

The winding green esplanade of the *Tvårbana*, the orbital light railway, is the backbone of the neighborhood. This 37 meter wide urban corridor collects pedestrians, bikers, trams, buses and cars in clearly defined linear stripes. The median tramway is partially separated from car traffic and fenced by longitudinal park. The bicycle lane is placed between the car lane and a strip of on street parking. The sidewalks are the last stripe having direct contact with the commercial frontage of the buildings.



Figure 9: The waterfront and the tramway bridge, the pedestrian zone parallel to the main esplanade, the main esplanade and the Luma station on a square in Hammarby sjöstad

The city planning office wanted less private cars and high share of public transport and had heavy restrictions on parking places. The sustainable mobility measures were subverted by the development companies who had problems selling the apartments. Some apartments were sold in a package with a new car.

The neighbourhood also attracted younger affluent families with high demand for mobility and wide accessibility and the slower light railways and the extra transfer seemed like a worse alternative than the car. The neighbourhood was not directly connected to the metro or railway lines, but the people needed to make transfer through an old greyish industrial area on the west which felt like leaving the city. To solve this problem the newest debate are about extension of the metro in Hammarby Sjöstad which will put the neighbourhood on the regional system map.

There is ongoing extension of the *Tvårbana* northwards towards Sundbyberg and Solna with parallel infill developments and redevelopments in Sundbyberg and Ulvsunda (Figure 10).





Figure 10: Ongoing urban developments in Sundbyberg on the right and in Ulvsunda on the left

### Norrköping's tramway extension in Hageby

Norrköping is one of only two Swedish cities, with Gothenburg, that have kept its tram system over the years. There are two tram and four urban bus lines in the city and the trams handle almost half of all the passengers that use the urban public transport. The city opened a 4 km extension of the tramway to the southern suburbs of Ljura, Hageby and Navestad in 2011.

The extension should make these suburbs more attractive and sustainable and inspire new urban infill projects. The tram extension connects Ljura, a housing area from the 1950s, Hageby Centrum, a 1960s shopping centre and terminates in Navestad, a housing area from the 1960s. Navestad has two housing complexes called Golden Ring and Silver Ring that were upgraded in the 1990s. To diversify Navestad, there are plans for more retail, housing and public spaces. The tramway extension will have 10 stops are laid on grass, which reduces noise. The simultaneous development along the tramway extension was the renovation of Hageby Centrum. Some new developments are finished and some ongoing (Figure 11).

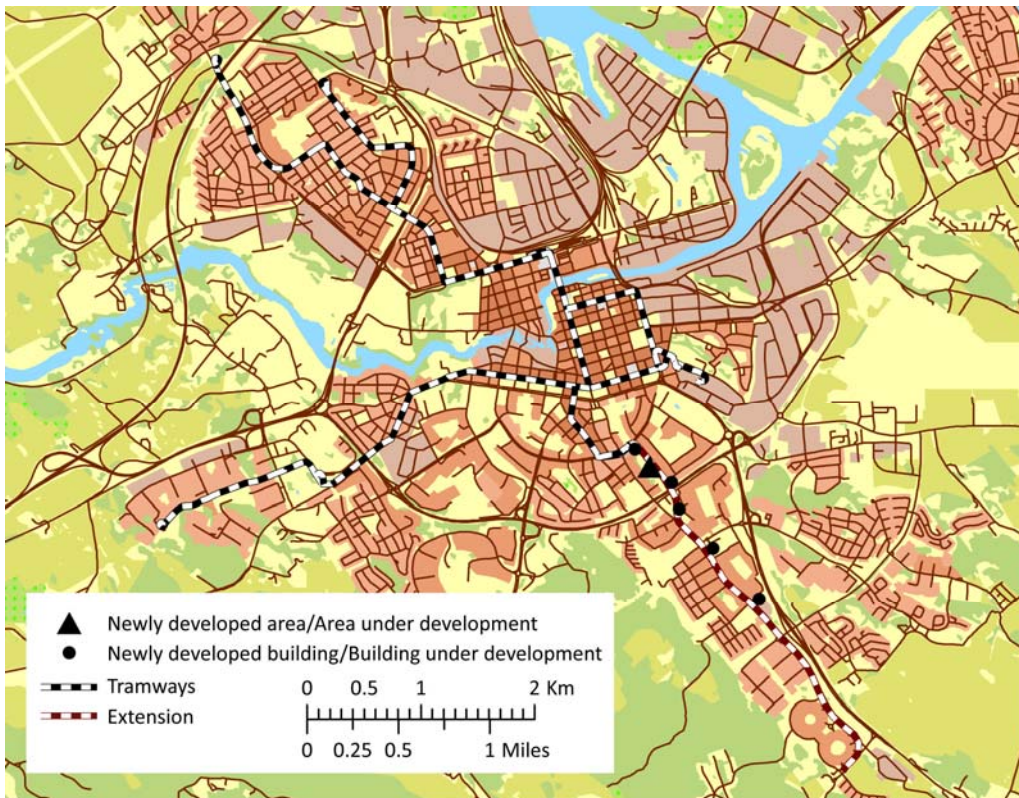


Figure 11: Urban development along Norrköping's tramway extension



Figure 12: The newly developed Hageby centre (Mirum Galeria from 2012) up and down on the left, new developments up on right and a new area assigned for development in the fall 2012 down on right



## Gothenburg's busways in Norra Älvstranden

Gothenburg and its region have been the industrial centre and largest port in Sweden since the mid 1900s when Götaverken, Lindholmen and Eriksberg, three of the world's biggest shipyards opened on the north shore of Götaälv (the wide river that separated the city from the industrial zone). The manufacturing power further strengthened when Volvo formed on the end of the 1920s. But since the 1970s, Gothenburg suffered from deindustrialization that heavily hit the northern industrial waterfront. The industrial area gradually emptied and the city assigned the northern waterfront (Norra Älvstranden), between the Götaälv Bridge in the East and Älvsborgs Bridge in the west, for development. Large portion of the land is owned by the city and the renewal started in the 1990s with quite heterogeneous and fragmented developments. Eriksberg, an early development, much like the northern waterfront opposite of Hammarby Sjöstad displays a pattern of quasi enclosed urban blocks opening prospects on Götaälv, still closing up towards the streets to achieve an urban feeling. The more recent developments show less urban attitude, using more building typologies associated with the modernist era, but still focusing on maximizing water views.



Figure 13: Urban development along Gothenburg's busway

Göteborg kept and carefully developed its tramway system in the city limits from 1879, but there was no agreement of a tram extension along the waterfront. Instead, the city and the public transport authority decided for a system of busways adopting the motto 'think railways, run buses', which also influenced the emergence of blue buses in Stockholm. The busways in Gothenburg however on some parts have been developed on a grand manner and served by double articulated buses. Lindholmsallén (Lindholm's esplanade) is extremely wide (almost 90 meters), including separate bus lanes in the middle, a wide longitudinal park with double tree lines, double car lanes, another green stripe, single tree line, two-way bicycle lane and a separate sidewalk. The urban development is slow, but ongoing. It is located mainly on the waterfront. The dense development around public transport nodes is yet to come in this part of the Norra Älvstranden. The esplanade today feels very open and empty.



The waterfront is also served by a Älvsnabben (River quick). It is a popular ferry line within the public transport system, connecting five stops on the northern and two on the southern (city centre). Two departures per hour in rush-hours is not very much, but it is about to increase in the near future. The Älvsnabbare ('river Quicker') shuttle is, as its name suggests, a quicker shuttle line connecting Lindholmen on the north shore to Rosenlund on the southern shore – each sixth minutes in rush-hours. Since spring 2011, travelling with Älvsnabbare is free of charge. Similar ferry line free of charge exists in Hammarby Sjöstad, which was introduced instead of a bridge between the southern and northern waterfront.



Figure 14: New and ongoing developments along the busway on the left and developments around Lindholmen station on the right

## Light railways and busways as key drivers for sustainable urban development

### Light railways and busways as drivers for urban development

The rapid urbanization was essential in integration of the public transports in the cities in the 19th century. Cervero (1998:95) argues that public transport redistributes rather than produces growth and the public transport cities were product of urban concentration around train stations and bus or tram lines. The urbanization and population growth are prerequisites for urban and regional development, whereas the public transport stops and lines are one of many urban attractors.

The urbanization and population growth have different patterns. Stockholm is a capital, Gothenburg a large city and they grow much faster than smaller cities like Norrköping. But there are new developments, infill developments or redevelopments, along the new light railways and busways in all the three cities. We can also see urban development regardless if it is a light railway or busway. The busways in Gothenburg as partially separated public transport systems add value and trigger developments along as the light railways in Stockholm and Norrköping.

## Compact city and TOD

Choay argues that the planning includes rules and models. The rules are procedures for conceiving and generating space and models are prototypes, a model space or a model of space (Choay, 1997). When we talk compact neighbourhoods or TODs, seems that the models prevail. We see a wide replication of a similar urban model of sustainable neighbourhood not only in Gothenburg and Stockholm, but in cities in Germany, Holland, France and Great Britain. It is a model of dense and diverse urban environment along an intermodal boulevard as main axis.

In Europe there is a strong tradition and tendency to think in finished models which end in multiple replications. Sometimes these neighbourhoods are very difficult to change when they are completed. Even Edelsvård in his model (Figure 4) leaves empty blocks to be used in the future. The question is do we have to think in models and replicate them when sustainability escapes blueprints?

## Urbanity and intermodality advocacy

Every age imprints itself on the cities. The public transports dominated the 19th century and the beginning of the 20th and the private car the 20th which reflected on the planning paradigms and tendencies, urban models and regulations. Mixing as urbanity or intermodality of public and private transports prevails in the sustainability and cities debates today.

The urbanity is widely highlighted and pursued today both by the compact city and TOD models. The urban advocacy seems to work in Sweden lately and we can see recuperation and population growth in the larger Swedish cities like Stockholm and Gothenburg. It however evades the smaller cities which have stagnating urban population, but experience population growth in their regions. Without urban growth and development it is difficult to integrate the public transport systems into the cities. Therefore there is a need for a louder advocacy for urban living and public transports especially in the smaller cities, which are sprawled as the larger ones, but almost completely dependent on the private car.

The intermodality is also widely advocated, especially among planners and the light public transports seem to dominate that stage. But LRT and BRT with their light railways and busways are disadvantaged compared to the fully separated systems. They are too slow to compete with the private car on regional scale. There must be incredibly strong policies restricting car access and urban containment to make them competitive. There is ongoing project about the tunnelbana in Stockholm at KTH, Royal Institute of Technology, and the preliminary results from the traffic models and simulations show that if the tramways or light railway remained instead of the tunnelbana, the number of daily passengers would decrease between 50% (within inner city), 70% (to the inner city) and 75% (through the city from north to south). The results are from the lectures and seminars held by Maria Börjesson and Daniel Jonsson.

## Placemaking as an alternative to models

Placemaking is about communities and processes, not about completed models. It is about the human scale, citizen perspective or view *inside of* cities in urbanism. Jan Gehl's 'in between buildings' describes lucidly the prospect *within*. It started as a loud critique of modernism, the architect's perspective from the top and its city grandiose in the end of the 1950s. William Whyte and Jane Jacobs wrote the *The exploding metropolis* or *The death and life of great American cities* and the view *inside* was entangled in Gordon Cullen's *Concise townscape* and Kevin Lynch's *wayfinding* and *imageability*. The argument is that 'the city is for humans, not for race of giants playing a new kind of chess' (Jacobs, 1958:158) and places, districts or neighbourhoods must be developed within neighbourhoods and with human prospect. The development of Pearl District in Portland, one of the most famous American TODs, is an example of placemaking through action plans, proactive planning and community involvement, instead of finished or defined models. By living, planning and designing together the community enjoys its urbanity and diversity today. In this ongoing urban process the neighbourhood and public transport entangled together and the Portland Streetcar became a driver for urban development. Namely in 10 years there has been \$3.5 billion investment along the line. Without placemaking and gradual integration of the public transports in the city,

urbanity can evade TOD and the tramways and light railways will not necessary bring vibrancy and liveability. In South Waterfront, a new development in Portland, we can see exciting, but finished new architecture, integration of urban design and location of tramway stops, but without real feeling of a place that exists in Pearl District.



Figure 15: The vibrant urban life and a tram stop in the Pearl District and newly developed South Waterfront and the Portland Streetcars terminus

Secondly and very important, Portland Streetcars are urban public transport system and cannot compete regionally with the cars. That is why there are so many cars in the Pearl District and the share of public transport is low. The Portland Streetcars are only a Downtown alternative when the people have regional existence. It is not only important to make places, but also to network these places in the region with competitive public transports.

### Placemaking and networking places

We show in this paper that there is a long history and tradition of integration of public transport in urban and regional planning and some old models and operators worked fine. The two operators are basically placemaking and networking places, or pursuing liveable and sustainable places in continuous process of change and adaptation, and superposing metropolitan systems that will interconnect these places and make regional hierarchy. Citizens today have regional existence which sometimes extends over 80km. Stockholm is an example of where the public transports make regional hierarchy with variety of technologies and modes. It is not always necessary to have one choice, one model and one system, which can be replicated. The hybrid public transport systems like light railways or busways with wide infrastructural coverage have to be compared with combinations of innovative, old or new public transport systems that excel in urbanity and mobility, on urban or regional perspective.

The synchronization of public transports and cities implies two approaches which are not exclusive. The first is basically the compact city which revolves around policies of containment and preservation of the



urban fringes as green wedges or agricultural land. In the smaller cities the LRT and BRT systems can act as mobility systems if the regional accessibility is somehow restricted. It is very challenging prospect, since many European and American cities developed extensive road hierarchies along the E-motorways or the Interstate Highway System which enables excellent car access almost anywhere in the regions. The second solution is to enact a public mobility hierarchy even in the smaller cities, a metropolitan system with wide regional accessibility brought by attractive and speedy public transport infrastructures like heavy railways or busways and urban mobility by slower, not less attractive bus lines and tramways or light railways or busways. It is again a challenge to superpose an expensive public network over the extensive road hierarchies.

In the end for gradual and continuous placemaking there is a need to consider the disadvantages and desirability of the different public transport infrastructure on the urban scale. The effect of the different public transports and infrastructures on cities is often forgotten. Various public transport infrastructures have different attractiveness and permeability around stations and along lines. There are desirability cores which are important urban catalysers, inducers and drivers for urban development.

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