

1. Between 1850 and 1900 horse-drawn and then electric streetcars enabled large numbers of upper and middle class commuters to move further out of the city eventually giving rise to residential enclaves organized around streetcar lines referred to as “streetcar suburbs” (Warner 1962). By 1910 almost every American city with more than 10,000 people had one or more streetcar lines and per capita transit ridership peaked in 1920 at about 287 annual rides per urban resident (American Transit Association 2006). In 1917 there were 72,911 streetcars in service in the United States but due to a number of factors that number had dropped to 17,911 by 1948 (Toronto Star 1999).



Figure X. Fourth Avenue Streetcar line freshly installed. Streetcars were provided before roads were improved or land subdivided for homes as a necessary precondition for development. Here is the scene a few years before these other urban features are built. Source: Vancouver: The Way it Was (Whitecap books)



Figure X. Streetcars going over the Kitsilano trestle, west of Granville trestle, now Granville Street Bridge (1909) Source: Vancouver Public Library



Figure X. Shown on Arbutus street in Vancouver (1952) this streetcar is an example of the Interurban type vehicle which was used for longer trips and between rural communities in the Lower Mainland.

Chapter Two: A restored Streetcar City

North American cities built between 1880 and 1945 were streetcar cities.¹ While this fact is mentioned now and then, seldom is it acknowledged how fundamentally the streetcar established the pattern of North American life, and how that pattern still constitutes the very bones of our city, even now that most of the streetcars are gone. A “day in the life” story will start to reveal this skeleton.

A day in the life

The year is 1922 and Mr. Campbell is house shopping. He has taken a job with Western Britannia Shipping Company in Vancouver. He and his family must relocate from Liverpool England, and he is house hunting. The company put him up in a hotel in downtown Vancouver for the first few weeks. This weekend is his first chance to shop for a family home. He plans to explore a couple of new neighbourhoods presently under development, and to use the new streetcar system to get there. A quick look at the map tells him that the new district of Kitsilano might be a good bet. It’s not too far from downtown and located a five minute walk from the seashore. The Fourth Avenue streetcar line will take him there from downtown in fifteen minutes. The streetcar enters the district of Kitsilano. Construction is everywhere. Carpenters are busy erecting one story commercial structures next to the streetcar line and very similar bungalow buildings on the blocks immediately behind. As he rides further into the district the busy construction sites become less frequent, replaced by still standing forests. The paved road is replaced by one of gravel - the streetcar line, ties placed right on the raw gravel, the only improvement. It looks so odd to have a streetcar line serving what appears to be raw wilderness. Taken aback by the wildness of the landscape, Mr. Campbell steps off the streetcar where a sign advertises the new Collingwood street development. Here things are more encouraging, as workers are laying fresh concrete to sidewalks and asphalt to the new grid of streets. Fifth, Sixth, Seventh and Eighth street are complete for a few blocks before disappearing into the forests of the as yet undeveloped lots to the east and west. For sale signs are tacked on forest trees still standing on as yet undeveloped lots. Stepping into the project show home, he is immediately surrounded by activity. Carpenters and job foremen are using the house as an office, while sales agents occupy the front parlor. They waste no time inviting Mr. Campbell in, offering coffee and dropping him in a seat before the printed display of new homes. All the different styles fit on the same size lots, with the bungalow detached single family home style seeming to predominate. Shocked a bit by the wildness of the

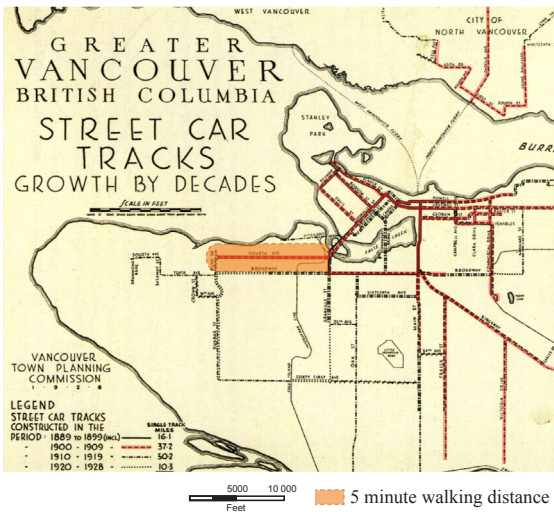


Figure X. Shows the 5 minute walking distance from the 4th Avenue streetcar line. The land developer for this zone would also provide the streetcar.

2. Early in the 20th century “streetcar lines and their adjacent residential communities were typically developed by a single owner who built transit to add value to the residential development by providing a link between jobs in an urban center and housing at the periphery” (Belzer & Autler 2002). Private developers built transit to serve their developments and as part of this formula small retail outlets were often built in clusters around streetcar stops, both to serve commuters and local residents (Belzer & Autler 2002).

3. This is what is called “tax lots” or “taxpayer blocks” and it refers to developers who built for low density interim land uses on land believing it would eventually gain value therefore making more permanent commercial buildings worth their while (Rowe 1991). The low density buildings produced enough revenue to pay taxes and essentially held the land for future development however, at least partially due to the depression, WWII, and highway expansion, land values didn’t rise and the low density developments remained (Rowe 1991).

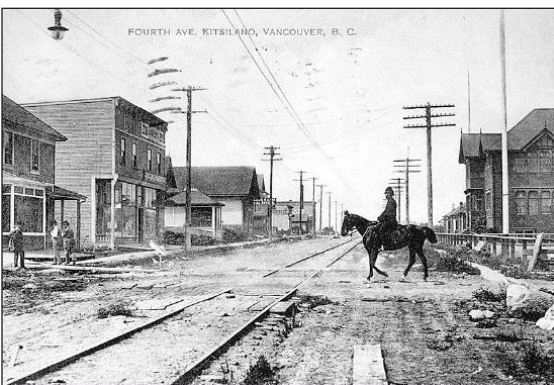


Figure X. One story commercial buildings on 4th Avenue, Vancouver, BC

Source: Abe Charkow (postcard collection)

landscape, he asks if this will change. The salesman laughs and says “Oh my, by this time next year all that will be gone and a whole new neighborhood will exist. Buy now while the prices are good because next year they will cost twice as much!” he laughs.

“Well how do I know I can get downtown to my job from here dependably?” asks Campbell.

Again the salesman laughs good naturedly and says “Because we own the streetcar line of course! Naturally we had to put the streetcar in before we built the houses, and a pretty penny it cost too! But nobody will buy a house they can’t get to will they!” he laughs.²

“You mean the developers build the streetcar lines before they build the neighborhoods? Wow, that’s incredible!”

“Just a fact of life around here Mr. Campbell. The streetcar lines have to be within a five minute walk of the house lots or we can’t sell em! People have to get around don’t they? But we make enough on the houses to pay it off. If we didn’t we’d be out of business. But there have to be enough houses to sell per acre to make it all work,³ that’s only natural right! We have it down to a formula: eight houses to the acre give us enough profit to pay off the streetcar and enough customers close to the line to make the streetcar profitable too! That’s why all the lots are the same size even when the houses are so different. You’re a smart business man Mr. Campbell I can tell. I’m sure you understand, eh?” he laughs.

“But what of commercial establishments sir” asks Mr. Campbell with reserved formality, “Where will we buy our food, tools and clothing?”

Again the salesman laughs. “Oh all along Fourth Avenue sir. Don’t worry! By this time next year it will be wall to wall shops. One storey ones to be sure at first but when this neighborhood fully developed we expect Fourth Avenue to be lined with substantial four and five story buildings to be proud of! Liverpool will have nothing on us sir! You’ll always be just a couple of minutes from the corner pub. Anything else you need you can just hop on and off the streetcar to get it in a jiffy!”

Naturally once Mr. Campbell’s understandable reservations had been overcome he was sold, and bought a house in the process. He was overjoyed to be able to buy a freestanding home for him and his family, something only the very rich of Liverpool could afford. All of the promises made came true more quickly than he imagined possible, with the single exception of the four story buildings to be proud of. Rather than ten years that would take another 80. First, the great depression slowed economic activity then, WWII redirected economic activity to the war effort. By the 1950s the economic pendulum had swung toward suburban development fueled by increasing car ownership. It was not till the 1990s that these streetcar

4. Handy (1993) found that residents living in traditional neighbourhoods made 2-4 more walk/bike trips per week to neighbourhood stores than those living in nearby areas that were served mainly by auto-oriented, strip retail establishments. Ewing et al (1994) found that sprawling suburban communities generated almost two-thirds more per capita vehicle hours of travel than the 'traditional city.' Neighbourhoods that have gridded streets, convenient transit access and destinations such as stores and services within walking distance result in shorter trips, many of which can be achieved by walking or biking (Hess & Ong 2002). Streetcar suburbs tend to have these attributes therefore reducing vehicular travel and allowing for higher than normal public transit service (Hess & Ong 2002).

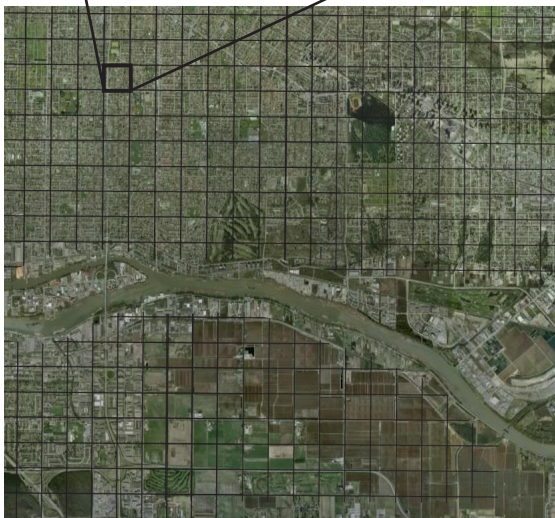


Figure X. The grid overlay makes it clear that urban blocks were cut from the original agricultural pattern. The unaltered agricultural pattern in Richmond near the bottom of photo still retains this original pattern.

neighborhoods would see the vision of four storey buildings lining both sides of the street realized.

Streetcar City as a unifying principle

The Streetcar City principle is not about the vehicle. It's about a sustainable relationship between land use, walking, and transportation. Streetcar Cities can exist without steel wheeled transit, but they can't exist without frequent and convenient transit that serves the local district. The Streetcar City principle gives us a shorthand way to signify a uniquely North American form that met and still meets many of the emerging principles for sustainable communities which we are all struggling to apply. The streetcar city principle orders and includes three others. The streetcar city that Mr. Campbell experiences necessarily has an interconnected streets system, different housing types in the same area, and a five minute walking distance to commercial services and transit.⁴

Basic structure of the Streetcar City

Streetcar cities, like Cleveland, Minneapolis, Seattle, Los Angeles and Vancouver have certain things in common. They are all laid out in a gridiron, with streets orienting to the cardinal axis. The grid is a subdivision of the original 40 acre blocks, commonly subdividing the 40 acre "quarter quarter" sections into 8 equal 5 acre blocks (inclusive of street space). Most homes are located within a quarter mile or five minute walk to the nearest streetcar stop, which means that ideally streetcar arterials were located every one half mile or every eight short blocks. In certain instances the streetcar arterials would form a grid of one half mile squares. More commonly a district might be better served by service in the east west direction on the half mile grid than in the north south. Commercial services occupy the ground floor of street fronting building along the line of the streetcar. This linear commercial oriented public realm is a unique feature of the Streetcar City which will be examined at length below.

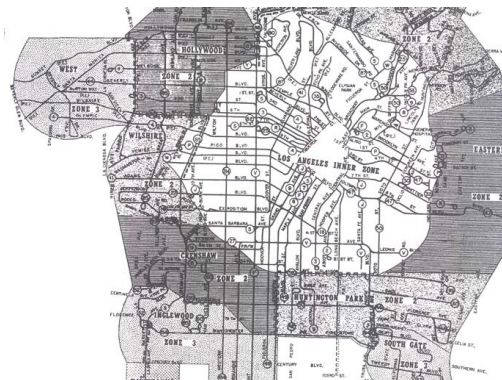


Figure X. Historic Los Angeles with streetcar routes

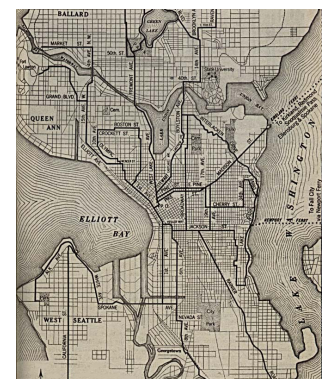
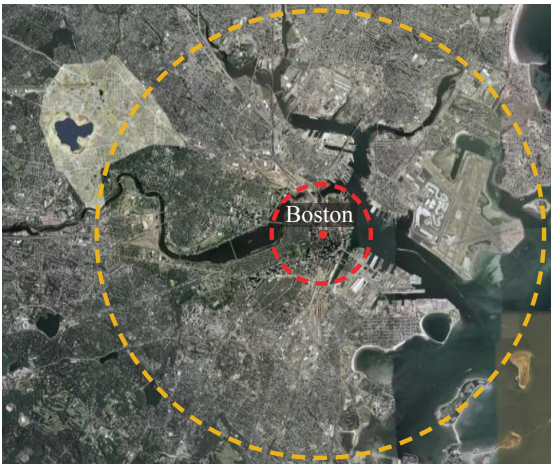


Figure X. Historic Seattle with streetcar routes



- Zone of mostly attached walk-ups (1 mile)
- Zone of mostly detached ground oriented streetcar city neighbourhoods (4 miles)

5. Despite dramatic technological innovations, the amount of time that Americans spent commuting to work remained relatively constant, at approximately 20 minutes, from the 1840s through to the 1990s (McLynn & Spielberg 1978). However, in the 1990s the average commute time began to increase and is now up 18 percent from its historic norm with almost 10 million Americans driving more than an hour to work, an increase of 50 percent since 1990 (Siegel 2006).

6. Historically, walk up tenements allowed for compact, high density, walkable cities. Ancient Rome reached urban densities of 95,000 people per square mile of built up land while Manhattan reached a peak of 130,000 around 1910 (Pushkarev & Zupan 1977). Renaissance Florence had a more typical population density of around 28,800 per square mile and from the city centre one could walk to the city edge in 15.5 minutes (Pushkarev & Zupan 1977). In 1880, 45 percent of all adult male workers employed in Philadelphia lived within one mile of the central business district and 96 percent lived within six miles (Gin & Sonstelie 1992). Historically, people had much less indoor housing space than we do today so higher average population densities could exist while the density of structures remained relatively low (Pushkarev & Zupan 1977). However, allowing for modern space requirements (dwelling units ranging from 1,000 – 2,000 square feet with one parking space and 100 square feet of open space per dwelling), Ellis (2004) found that four story walk-up townhouses could still reach densities of 30-40 dwelling units per acre or 19,200-25,600 per square mile. The benefits of this type of development have been studied by Cervero & Kockelman (1997) who found that compact, mixed-use, pedestrian-friendly designs can ‘degenerate’ vehicle trips, reduce vehicle miles traveled per capita and encourage non-motorized travel.

7. An example of the classic four-story walk-up city is the Beacon Hill district in Boston. Even today the built form of this neighbourhood supports a density of approximately 40,000 people per square mile (Beacon Hill Online). In comparison, streetcar suburbs in Cleveland historically supported population densities of around 2,000-5,000 people per square mile demonstrating the approximately 16 fold drop in density permitted by the streetcar access (Borchert 1998).

Streetcars made detached housing possible.

Much has been made of the American Dream of owning your own home on its own lot. The Dream was presumably realized after WWII when the auto oriented suburb was born. But the dream was realized two generations before in the Streetcar City. With the emergence of the streetcar, the radius within which urban North American’s could operate expanded dramatically. Prior to the streetcar, the radius of the average persons activities were proscribed by walking distance. Since the time of the Romans the time spent getting to work every day has been about 20 minutes on average.⁵ You can walk about a mile in 20 minutes, thus the distance between work and home in cities from the time of Rome to the early development of Boston and Cambridge was one mile. As cities became more and more active, the need to put more and more people within easy compass of work led to cities of higher density. The classic “four storey walk up” city emerged in the time of Rome and persisted till the mid 1800s.⁶ This is a city of roughly 30 to 60 dwelling units per acre, with a floor area ratio (FAR) of greater than 2, with a population that could easily exceed 60,000 people a square mile. In such cities single family detached homes were extremely rare. The vast majority of working class and middle class residents in such cities lived in apartment style structures while the rich lived more lavishly but still in high density townhouses – Boston’s Beacon Hill district is a good example.

With the advent of the streetcar twenty minutes got you much further. Using an average speed of ten miles per hour inclusive of stops and intersection waits of 10 miles per hour, the distance traveled in twenty minutes increases from the walking distance one mile to the streetcar distance of 4 miles. This fourfold increase in distance is actually much greater than it seems when you consider that this increases by 16 times the area one can cover in 20 minutes from one square mile to sixteen. Thus the same 60,000 people that were compressed into one square mile could now be spread over 16 (under 4,000 people per square mile) allowing much lower density housing while still maintaining easy access for workers across the service area. For the first time, the urban middle class could buy detached homes.⁷ Most streetcar city residential districts were therefore comprised mostly of single family homes, the bungalow style predominating. The Streetcar City form allows detached housing within walking and short transit distance of jobs and services over very large metropolitan scale areas. If our challenge is to reintroduce walking and transit into North American life, while not ignoring the desirability in the minds of most homebuyers for ground oriented detached dwellings, then the Streetcar City form is a proven prototype.

8. In 2000, 80.3% of the total population in the United States lived in Metropolitan Areas (MAs): 30.3% in central cities and 50% in suburban areas (US Census Bureau 2000). This means that 60% of the total metropolitan population still lives in central cities. Central cities are defined as the largest city in a Metropolitan Area (MA) with additional cities qualifying if specified requirements are met concerning both population size and employment to residence ratios of at least 0.75. Suburbs are the areas inside a MA but outside the central city (US Census Bureau 2000). Central cities have substantially higher densities than their suburbs and are the closest approximation to traditional streetcar cities for which census data is available.

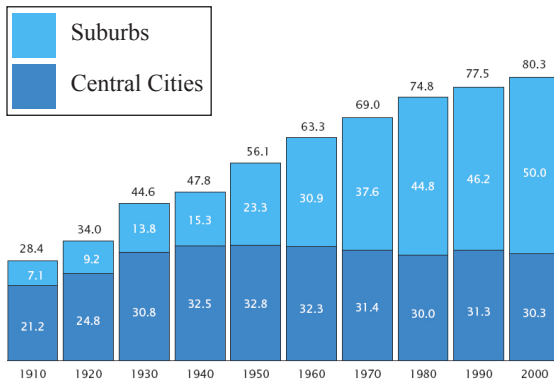


Figure X. Percent of Total Population Living in Metropolitan Areas and in Their Central Cities and Suburbs: 1910 to 2000

Source: US Census Bureau, decennial census of population 1910 to 2000

9. National City Lines (NCL) was organized in 1936 “for the purposes of taking over the controlling interest in certain operating companies engaged in city bus transportation and overland bus transportation” (Bianco 1998). In 1939, when NCL needed additional funds to expand their enterprise they approached General Motors for financing. GM agreed to buy stock from NCL at prices in excess of the prevailing market price under the condition that NCL would refrain from purchasing equipment not using gasoline or diesel fuel (Bianco 1998). Although it is not unlawful to make such requirements contracts it is this contract that resulted in so much controversy over GM’s relationship with NCL and the charges of a conspiratorial relationship that brought about the destruction of North America’s streetcar system. GM and their affiliates were never charged for replacing streetcars with motorized buses even though by 1949 they had been involved in the destruction of more than 100 electric transit systems (Snell 1973). What they were charged with was conspiring to eliminate competition in the sale of motor buses and supplies to National City Lines. They were convicted: GM was fined \$5,000 and its treasurer was fined \$1 (Bianca 1998).

Forty percent still live there

About 40% of North America’s urban residents live in districts once served by streetcar.⁸ As such this same population lives in districts where options to the car are still possible. Most of these districts are still pedestrian and transit friendly, although with rare exception the streetcar and interurban lines that once served them have been removed – Toronto a rare exception to the rule. While there is much debate about what precipitated the removal of North America’s streetcar and interurban systems, one thing is beyond debate. The U.S. courts convicted “National City Lines” for conspiring to intentionally destroy streetcar systems for the purpose of eliminating competition with rubber wheeled vehicles. While it seems impossible to us today, Los Angeles once had the largest and most extensive system of streetcars and interurban lines in the world. This system was completely dismantled by National City Lines, a “transit” company owned outright by GM, Firestone, and Phillips Petroleum. In 1949 GM was convicted of anti-trust violations for this practice, but by then it was too late. The streetcar boulevard system was irreparably damaged while an enormous and, in the minds of many, eventually fruitless effort to lace the LA region with freeways was underway. Now no hint of this original fabric can be directly experienced. Only by perusing the old photos can one sense the extent of the destruction.⁹

Linear not nodal

Linear public space is the distinguishing feature of the streetcar city. This is highly unusual and not generally appreciated. Most planning and urban design strategies see cities as places comprised of key places – crucial points in the landscape of the



Figure X. The last streetcars burn in Minneapolis, 1954
Source: Minneapolis Collection, M3857



Figure X. LA streetcars awaiting their fate, 1965
Source: Security First National Bank Historical Collection

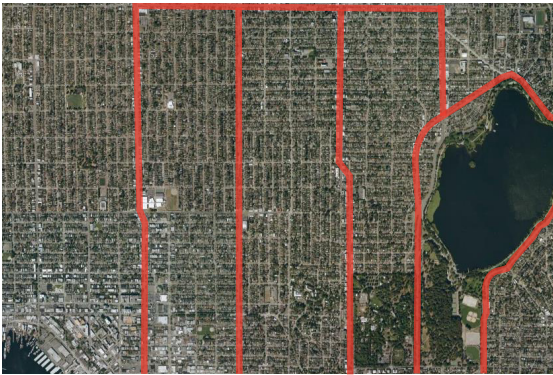


Figure X. Original streetcar routes highlighted in the University District of Seattle WA.

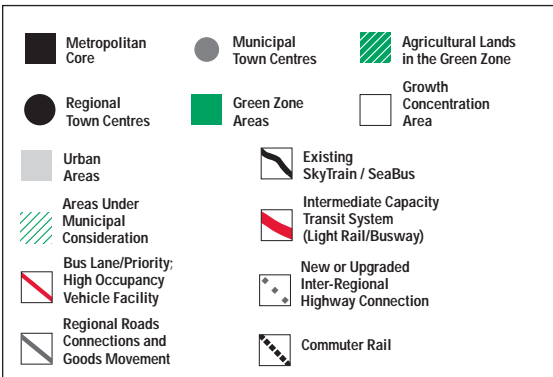
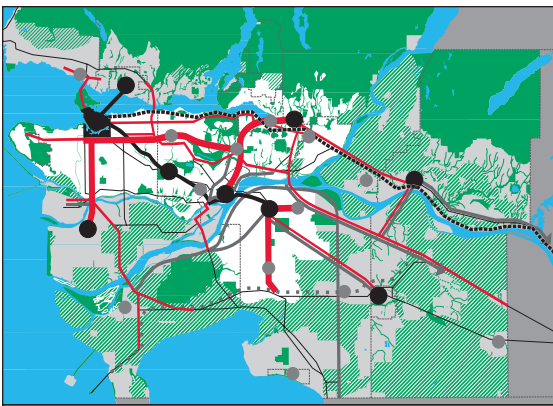


Figure X. Livable Region Strategic Plan: Transportation and Town Centres

10. Metro Vancouver’s Livable Region Strategic Plan calls for regional town centres to “accommodate a large share of the region’s future higher density commercial and residential growth” (GVRD 1999). However, between 1990 and 2000 the regional town centre’s share of the office market actually declined from 11 percent to 10 percent while business parks’ share grew from 20 percent to 30 percent (Royal LePage Advisors 2001). In 2000 half of the new office space in the Vancouver region was located in business parks outside of town centres (Memon et al. 2006). Taking a closer look at the distribution of business parks in Metro Vancouver we see that they are often located close to residential areas, services and transit. Instead of being inherently disconnected from the urban fabric it is the physical site design and single use zoning that frustrates connectivity, explodes distances between amenities and generally makes for an unwalkable, auto-dominated environment (Condon et al. 2006)

metropolis. The assumption that cities are made up of key centers and destinations deeply informs the planning, urban design, and economic development disciplines. For them, preserving and creating functional nodes is most often the goal. For example, the Vancouver region is justifiably famous for its Liveable Region Strategic Plan (LRSP), the plan to create complete communities linked by transit and protect the green zone. But the plan fails to mention the role of corridors at all. This may not seem like a significant disagreement, except it led to a transportation strategy primarily focused on equipping the widely spaced “Regional Town Centre” nodes with rapid transit connections. The plan was mute on the role of districts between the regional town centers, certainly more than 80% of the urban landscape.

The LRSP set aggressive targets for attracting housing and jobs into the town centers however. Housing targets were generally met for these nodes, and the region is rightfully famous for this achievement. But in its own reports the Greater Vancouver Regional District (GVRD) admits “failure” to meet regional town center job targets. Without both jobs and housing in the nodes only one “trip end” was close to transit, the housing end. The job end was still somewhere else.¹⁰ Thus the strategy to connect the town centers with rapid transit links was compromised. Thus it was assumed the plan had failed in a critical way. The Province now threatens to over invest in freeway expansion to “fix the failed plan”, noting that jobs were highly dispersed and thus not reachable by the new transit system.

But the jobs did not escape. They ended up in the spaces in between the town centres, close to the corridors. A strategy that had acknowledged the corridors as at least as important as the nodes would have likely led to a more balanced transit strategy, with buses and a rebuilt streetcar system (one was briefly proposed in 1995 for the Vancouver region but abandoned



Figure X. Four business parks in Burnaby show the characteristic patterns of large lots, single use zoning, and cul-de-sacs that characterize these developments. Distances within and between the parks are long and unlikely to be undertaken on foot.

11. In 2006, 73 percent of all transit trips in Vancouver were made by bus and 24.5 percent were made by skytrain (Translink 2006). The new 99 B-Line Service, along with implementation of the U-Pass, have led to dramatic increases in transit ridership and accounts for 73 percent of all new transit riders to the University of British Columbia (Walter 2000). In 1999 this accounted for 8665 total daily riders along the Broadway Corridor (Walter 2000).

12. In the past ten years population and employment in Vancouver has grown steadily, resulting in a 23 percent increase in trips to Vancouver (Memon et al. 2006). However, in contrast to the rest of the region where auto modes are increasing, new trips to and within Vancouver have increasingly been accommodated by transit, bike and walk modes resulting in an overall decrease in the number of vehicles entering and leaving the City by 10 percent (Memon et al. 2006). During the peak AM period (7am-9am) in 2004 there were an average of 140,000 commute trips into Vancouver, 250,000 internal trips and 70,000 commute trips out of Vancouver (Memon et al. 2006). From a regional perspective however only 19 percent of vehicles crossing the Port Mann Bridge (a notorious congestion area) are bound for Vancouver while almost 32 percent of these trips are destined for the Coquitlam area (Rock 2004). According to the Gateway Program Engineer (2006) 65 percent of all users of the Port Mann Bridge have origins or destinations outside of the Growth Concentration Areas, highlighting the failure of employment centres to organize themselves around transit hubs.

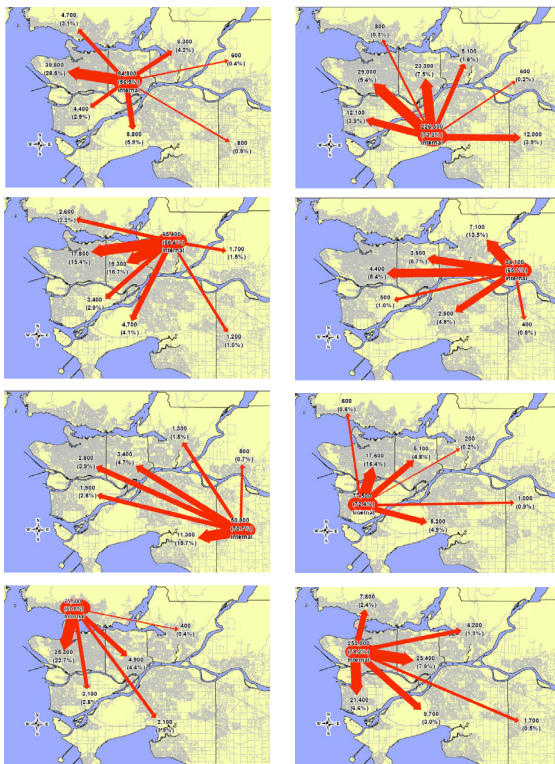


Figure X. Commute patterns for daily trips by origin, Vancouver (Translink 2004)

13. For a detailed look at the shift of employment to the suburbs see: Glaeser, Edward L. and Matthew E. Kahn. 2001. "Decentralized Employment and the Transformation of the American City." NBER Working Paper 8117.

for elevated subway Skytrain technology) getting their fair share. Instead billions were invested in a heavy rail system, the Skytrain, while many complained the bus system, which carries 80 of all trips in the system, was drastically under funded.¹¹

Web vs Hub and Spoke

Concentric hub and spoke Patterned on New York and London

This discussion of the Streetcar City generates skepticism for many. Most discussions of transit made by environmentalists and their brethren have concerned the need to move people from their cars to transit, and have focused mostly on the car trip from the suburb to the center. The presumption, now quite outdated, is that people live in suburbs and commute to the center city for work. This trip now constitutes a minority of regional work trips.¹² Much more common now are trips to other job locations throughout the metropolitan area. This more homogeneous distribution of jobs is seen by transit planners as a failure to be corrected through planning policy and transit investments. The supposed "failure" of the Greater Vancouver Regional Districts Livable Region Strategic Plan, discussed above, is one particularly vivid example of this fixation. Metropolitan areas throughout North America have attempted to preserve the job site dominance of center cities against these centrifugal forces. But in most North American cities with the exception of New York the brief post war period where jobs stayed in the center while residential functions moved to very distant suburbs was the exception rather than the rule.¹³ This massive region wide separation of activities therefore constitutes the exception rather than the rule. Unfortunately planners and advocates for both new highways and transit, folks who believe themselves on the opposite sides of a holy divide, both assume this exceptional status is a permanent condition of metropolitan North America. They both promote massive infrastructure investments intended to move people from where they presumably live, at the outside edge of the metropolitan region, to where they presumably work, at the center of the metropolitan region. Commuting statistics for most regions show that this is false. In the Vancouver region

14. Source: Travel Characteristics of Traffic on the Highway 1 Corridor. From Clive Rock, Director of Strategic Planning and Policy. To GVTA Board of Directors. July 2, 2004.

15. When comparing the map of Vancouver's historic streetcar lines and the current transit map of the same area one can clearly see how the motorized bus routes closely mirror the routes and major corridors set out by the streetcars. To a large extent these bus routes maintain the traditional streetcar grid.

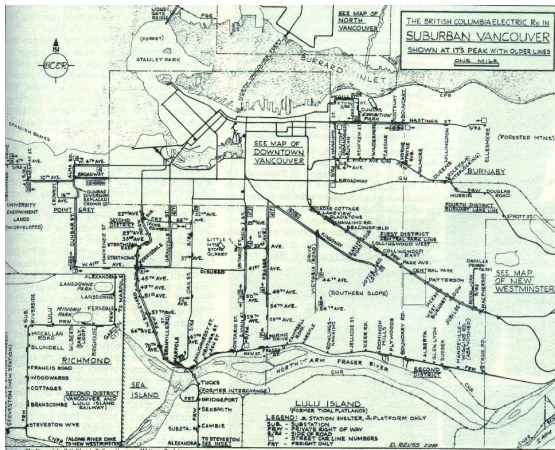


Figure X. Vancouver's historic streetcar lines
Source: *The Story of BC Electric Railway Company* (Whitecap Books)

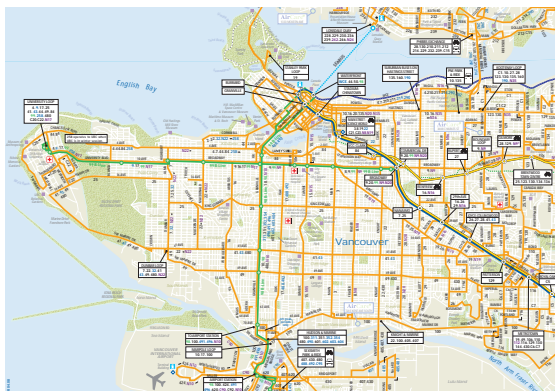


Figure X. Vancouver's current bus routes
Source: Translink

only 19% of trips crossing the Port Mann bridge from Surrey are destined for the center city of Vancouver.¹⁴ The other 80% are commuting generally from the east to the west, toward Vancouver, but occupy job locations in the first and second ring suburbs. Gradually these first and second ring suburbs are adding jobs to the point where they have nearly as many jobs as workers. At this point are they no longer suburbs but cities in their own right? If so what does that say about the logic of continuing to invest tens of billions of dollars in systems designed for trips that no longer exist.

Streetcar city was more grid

If we accept this organic evolution of metropolitan regions towards a more even distribution of jobs we can look with new interest at the Streetcar City model, and see what it can teach us. Streetcar City transportation systems were grids, not hub and spoke systems. Movement in the system was not to once central location or effectively served by systems where all transfers had to be made at a central hub. Rather, movement was along parallel north south or east west arterials. You could get anywhere in the system with a two seat ride and a five minute walk at both ends of the trip. In Streetcar Cities each part of the city was more or less equally served and destinations were always by the shortest possible route (given the natural rectilinear constraints of the gridiron city plan of course). Busses that have taken the place of demolished trolley lines in most gridded cities still work this way and still enjoy advantages that are a legacy of the Streetcar City form.¹⁵

The lesson for older parts of the region with the original Streetcar City fabric still in place should be to re-enforce that structure with transit investments to shore up the function of these arterials, shifting investment here and away from hub and spoke systems.

The lesson for the suburbs should be to examine the fabric of the transportation network in those regions against the new evidence of the wide distribution of jobs for clues about how a revived Streetcar City type strategy might be a wiser investment than continued over investment in a obsolete hub and spoke system. This is particularly important if one accepts that “complete communities” should be a feature of any sustainable city. Complete communities are communities where one needs to travel far less during the average day than we do now – cities that reverse dramatically our need to travel by whatever means except possibly by foot. It seems unlikely in the extreme that we can ever achieve the massive reductions in energy use required to bring global warming under control, to cite just one aspect



Figure X. “Light” rail Portland Max vehicle operating like streetcar in the foreground with a true light rail streetcar in the background.



Figure X. MAX line, Portland
Available under the Creative Commons Attribution 2.5 License

16. When National City Lines disassembled the streetcar system in Los Angeles they used predominantly economic arguments to support their actions. They argued that initial capital costs were much higher and that the cost of operating buses per vehicle mile was at that time half the cost of operating streetcars (Bauer 1939 as cited in Ortnier & Wachs 1979). With fuel costs rising, this calculus is certainly different today of course.

17. Portland’s Metropolitan Area Express (MAX) system is one of the most successful light rail systems in North America. According to the American Public Transportation Association’s Ridership Report (2007), Portland’s MAX system accommodates 104,300 daily trips and is the United States’ second most ridden standalone light rail system, second only to San Diego. Cervero (1998) writes that Portland has made a “stronger commitment to integrating transit and urban development” than any other city in the United States and that “if any American region is poised to become a great transit metropolis during the twenty first century, it is metropolitan Portland.”

of our linked sustainability crisis, if we accept the inevitability of residents in regions making daily trips half way across the region in thirty minutes or less, and invest in systems that make such trips possible. Both highway and transit advocates fall into this trap. Trips by transit are not free. A passenger mile in a bus or commuter rail takes less energy than an average car but about the same as in a prius. It won’t help us to get everyone onto transit unless we can find a way to radically decrease the average daily demand for motorized travel of any kind. Community districts that are complete and favor short trips over long ones seem an obvious part of the solution. Inexpensive short haul transit vehicles, like streetcars and of course busses, are likely features of a low energy solution.

Buses and streetcars.

When National City Lines disassembled streetcar systems in Los Angeles they marshaled strong arguments in support, arguments still leveled against streetcar systems when they are proposed. Streetcars are inflexible. They are on rails so if one gets stuck the whole system gets stuck. Streetcar vehicles cost more than busses. Busses don’t need overhead wires to run them. Buses do the same job as streetcars but do a lot more too.¹⁶ These arguments are often sufficient to end the matter. But lets approach the question from a different angle. Its not a question of busses or streetcar really. It’s a question of what kind of rail transit makes the most sense.



Figure X. Dallas streetcar

There is general agreement that light rail systems are a good thing, and that they should be a major part of any region’s transportation expenditure. Recent US transportation bills have allowed the use of gas tax for transit lines, resulting in new rail systems for places as unlikely as Dallas. Almost all of this new expenditure for rail systems has been made on systems expected to move riders from the edges of the metropolitan area to the center in thirty minutes or less. To call these systems “light” is a misnomer. They are heavy rapid transit systems that cost many billions to construct. Portland’s MAX system, one of the earliest and according to most one of the most successful of these commuter systems,¹⁷ operates like a large streetcar in the center city, moving at slower speeds on crowded streets. Once out of the downtown it operates as a grade separated system with a dedicated right of way, widely spaced stations and travel speeds of up to 60mph. The system had to be built this way. It was the only way to satisfy the



Figure X. Streetcar in Portland's revitalized Pearl District
Photograph by Scott Harrison

18. In 1996 Oregon voters rejected a \$375 million transportation package that would have funded the north-south light rail project as well as a 9 mile extension from Vancouver to Hazel Dell by a vote of 53 percent to 46 percent (Metro 2007). Although the measure failed state-wide, it was approved by a majority of voters within the TriMet service area (Metro 2007).

19. The majority of European cities rebuilt or upgraded their streetcar systems following World War II in response to "lower automobile ownership, a lack of domestic petroleum resources, plentiful electricity and a desire to not allow automobile usage to disturb the traditional economic and social patterns of these centuries-old cities" (Gormick 2004, p.v). A few large cities like Stockholm, Rotterdam, and Milan built heavy rail but most decided to restore or upgrade their streetcar services instead (Black 1993). In 1975 there were 310 cities in the world with streetcar/LRT systems in operation including most West European nations and Japan (Diamant et al. 1976). Great Britain and France were two notable exceptions to this trend in Europe. Very few tram lines survived in these countries after WWII however, more recently many cities in the United Kingdom and France are reintroducing streetcars from scratch, having had no light rail or tramway for more than a generation (Hyden and Pharoah 2002).

20. In the year 2006 the following percentage of citizens were over 65 years of age in each country: Japan (20.8 percent); Italy (19.7 percent); Germany (19.3 percent); France (16.2 percent); United Kingdom (16 percent); Canada (13.7 percent); Russia (13.7 percent); and the United States (12.4 percent) (Martel & Melenfant 2007). It is projected that 30 percent of Canada's population will be over 65 years of age by the year 2056 (Statistics Canada 2005) and that by 2050 those ages 60 and over will make up 22 percent of the world's population: 33 percent in more developed regions, 21 percent in less developed regions, and 12 percent in the least developed countries (Mirkin & Weinberger 1998).

primary performance objective for the system: get riders from the edge of the metropolitan region to the center in a half hour, or at speeds that compete with the car. Regional authorities typically assume that the role of rapid transit is to operate at speeds comparable to the car. This is a race that transit can never win before bankrupting the civic purse.

Portland style MAX technology costs approximately 100 million dollars per two way mile to build. Fully grade separated systems like the Vancouver Skytrain system cost twice as much: 200 million or more per two way mile. In the mid 1990s, Tri-Country Metropolitan Transportation District (TriMet) planned a north south MAX line to compliment the existing east west line. The new line would have run from Downtown Portland, serve the north side of the city, before connected across the Columbia river to the City of Vancouver, Washington. Voter approval via a referendum was required to authorize the local cost share. The bond measure was narrowly defeated, constituting a major setback for transit in the region.¹⁸ Officials in Portland were initially inclined to give up, but didn't. They still needed a system to serve the north part of the city so they cast about for more affordable alternatives. What they found was modern streetcar technology. Europe had never abandoned streetcars and many companies still manufactured them. A Czech company (get name) was able to provide the components of a system that could be installed, including rolling stock, for 20 million dollars a two way mile – only one fifth the cost per mile compared to MAX technology and one tenth the cost of Skytrain. Why so cheap? Car size was the same as Skytrain so it wasn't that. The system is cheap because while it can run in dedicated right of ways at speeds of 50 mph it can also very easily run on existing street rights of way. It can either share lane space with cars as it does in Portland or move faster on dedicated lanes in the center of streets as does the Green Line in Boston. The vehicles are so light that streets and bridges do not need reconstruction to accommodate. On regular streets all that is needed is a 12" concrete pad within which to set rails. Otherwise the street is not disrupted, nor are the businesses that may line it.

In Europe streetcar or tram systems are being expanded much faster than heavier rail systems,¹⁹ gradually replacing busses on heavily used urban arterials. They provide a much smoother ride than busses for elderly. With an aging demographic where those over 65 years old will soon constitute over 33% of the population, a 200% increase over today,²⁰ this is a key factor. Body balance is very compromised as we age. Unsteady rides and buses that are hard to mount and stand in are increasingly difficult after age 55 and almost impossible over 70. Low floor streetcar are mountable at grade and are free of rocking motion.

21. Breakthrough Technologies Institute; cost includes vehicles, the median busway improvements, station shelters, automatic vehicle location system, transit signal priority systems and a % of a new bus depot.

22. IBI Group. 2003. Bus Rapid Transit Evaluation Study. Prepared for Translink.

23. IBI Group. 2006. Streetcar and Local Bus Comparative: A technical memorandum for the City of Vancouver's Downtown Streetcar Project Update.

24. The average cost of new light rail construction in North America is \$35million/mile, excluding Seattle whose \$179million/mile price tag is well outside of the norm (Light Rail Now 2002). This calculation includes new streetcar systems which are significantly less expensive. Portland's modern streetcar line was constructed for \$12.4 million/mile (although some sources have it at \$16.4 million/mile (Light Rail Now 2002)), Tampa, Florida's was built for \$13.7million and the streetcar line in Little Rock, Arkansas was built for \$7.1 million/mile (Weyrich and Lind 2002). Existing systems show us that new light rail systems can be built well for \$20 million/mile and streetcars can be built for \$10 million/mile. When compared to bus service streetcars have higher capital costs for streetcar infrastructure and vehicles. The typical price for a modern streetcar is in the range of \$3 to \$3.5 million while a 40-foot transit bus costs between \$0.4 to \$0.5 million and articulated buses range between \$0.6 and \$0.9 million. These costs can potentially be offset by increased efficiency in operating costs. In most cases, the operating cost per boarding rider for light rail and streetcars is significantly lower than buses, primarily due to their higher capacity. For example, the operating cost per rider trip for buses in St. Louis is \$2.49 while for light rail it is only \$1.32 (Lyndon 2007). Streetcars also have a service life of 25 years while transit buses only have 17 years (City of Vancouver 2006).

25. Cervero (2007) cites the streetcar system as a major driving force in the development of the Pearl District in Portland which now has an average density of 120 units per acre, the highest in Portland. The streetcar has stimulated housing and transportation in the area as well as an estimated 1.3 billion dollars in investment (Ohland 2004).

26. Hovee & Company, LLC. 2005. Portland Streetcar Development Impacts. In Portland Streetcar Loop Project Environmental Assessment, January 2008.

Streetcars are always electric and thus don't pollute. Finally and most compellingly, they don't really cost much more than busses. Vancouver recently purchased a new fleet of trolley busses, eclectic vehicles that have been used on streetcar streets since the rails were removed in the 1940s and 50s. Vancouver's rapid bus system cost \$4.3 million per mile²¹ and features articulated buses with a maximum load of 80 persons per bus²². With a maximum load of 156 passengers per vehicle²³ streetcars can carry nearly twice as many passengers as articulated buses at a cost of \$26 million per 2-way mile.²⁴ While more expensive it is nothing like the quantum leap in cost between busses and heavier rail systems.

Portland and investment.

Most discussions of streetcar focus solely on transit issues, but the implications are much wider. Streetcars stimulate investment and busses don't.²⁵ This has been powerfully demonstrated in Portland where the introduction of a modern streetcar line spurred high density development that helped the City of Portland recoup construction costs through significantly increased tax revenues. Between 1997 and 2005 the density of development immediately adjacent to the new streetcar line increased dramatically. Within two blocks of the streetcar line \$2.28 billion was invested, representing over 7,200 new residential units and 4.6 million square feet of additional commercial space; even more impressive, new development within only one block of the streetcar line accounted for 55 percent of all new development within the City's core.²⁶ To put this in perspective, prior to construction of the new streetcar line land located within one block of the proposed route captured only 19 percent of all development. Most attribute this impressive increase in investment to the presence of streetcar.

Developers for the new South Waterfront development at the other end of the downtown from the Pearl District would

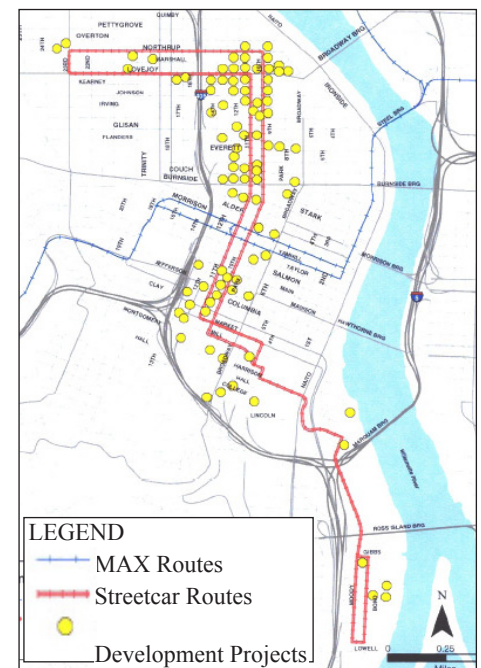


Figure X. This map of development projects along the streetcar alignment suggests that the lighter streetcar technology was a greater spur to development than the heavier MAX light rail
Source: Portland Streetcar Development Oriented Transit, January 2008, p. 7



Figure X. Bus Rapid Transit on the Broadway corridor in Vancouver, BC

27. Leicester, G. 2006. Implementation of Transit Priority on Broadway Corridor. Prepared for GVTA Board of Directors.

not proceed before the city guaranteed to extend the streetcar line to their site. The developer for the South Waterfront also spearheaded development of the Pearl District. They were quite certain that streetcar was a crucial element for financial success. If the free market is telling us anything at all in this case it is that the economics of streetcar, when the value of new investment is included, is much more cost effective than an investment in rubber wheeled diesel busses.

Does it have to be streetcar?

There are examples of streets that operate effectively as streetcar streets without the streetcars, demonstrating that the concept is about more than vehicle choice. Broadway in the city of Vancouver is an example. Broadway is the dominant east west corridor in the city, running from its eastern border at Boundary Street to its western border at the campus of the University of British Columbia. Broadway has always been a good street for transit, even after the streetcars were removed. All of the density and access features described above are found there. Residents who live near Broadway can survive without a car. Many of the residents along the corridor are students at UBC, who have always enjoyed a one seat ride to school on busses with three to five minute headways. More than half of all trips on the corridor now are by bus, over 60,000 passenger trips per day.²⁷ Very frequent bus service has re-enforced the function of the Broadway Streetcar Street corridor even without the streetcar in place. Walkable districts, sufficient density, three minute headways, hop-on-hop-off access to commercial services, and five minute walking distance to destinations at both ends of the trip all contribute synergistically.

Gradually restoring the streetcars to Broadway is eminently sensible. This will reduce pollution, better accommodate the infirm and the elderly, add capacity, provide everyone a more comfortable ride, and attract investment where you most want it. For these reasons the City of Vancouver is planning a streetcar line for Broadway. Unfortunately this contradicts the regional transit authority's preference for heavier "rapid" transit, meaning that Vancouver, like Portland before it, would have to start its own city transit authority to build and finance the project.

Conclusion

The Streetcar City Principle is about more than just the car. It's about a balance between density, land use, connectivity, transit vehicles, and the public realm. The Streetcar City is compatible with single family homes yet can be served by transit. It assures that walking will be a part of the everyday experience for most

28. Litman (2006) found that “cities with large, well-established rail systems have significantly higher per capita transit ridership, lower average per capita vehicle ownership and annual mileage, less traffic congestion, lower traffic death rates, lower consumer expenditures on transportation, and higher transit service cost recovery than otherwise comparable cities with less or no rail transit service.” Recent studies have found that 30 percent of residents moving into Portland’s new transit oriented development own fewer cars than they did at their previous home, and 69 percent use public transit more often than they did in their previous community (Podobnik 2002; Switzer 2003). It is important to note that the benefits of transit oriented development don’t come solely from the construction of a streetcar system. When applied to low-density suburban developments modern streetcars are doomed to low ridership and cost recovery (Gormick 2004). Reforming land use and increasing density prior to or in concert with the construction of streetcar lines is essential if the full benefits of the system are to be realized (Gormick 2004).

residents and eliminates the imprisonment of the suburban cul-de-sac for children and early teens. It has been shown to induce substantial shifts away from auto use to transit use and can conceivably be introduced into suburban contexts.²⁸ It is compatible with the trend to increasingly dispersed job sites and seems to be the form that best achieves “complete community” goals. The Streetcar City principle, whether manifest with or without steel wheeled vehicles, is a viable and amply precedented form for what must by 2050 become dramatically more sustainable urban regions. Other sustainable city concepts that presume extremely high density urban areas linked by rapid regional subway systems seem inconceivably at odds with the existing fabric of both pre war and post war urban landscapes. At the other extreme, assuming that some technological fix like the hydrogen car will allow us to continue sprawling our cities infinite future seems even more delusional. Part of the therapy for the sickness of our cities must be a clear eyed recognition of the status of the physical body of the city as it is, and a physical therapy calibrated to its specific capacity for a healthier future. The Streetcar City principle is intended to both provide simple insight into our condition, and a clear set of strategies that have proven themselves for decades.