Chapter Four: Locate Commercial Services, Frequent Transit, and Schools within a Five-minute Walk

[Insert Figure 4.1 in margin near here]

Many believe that electric cars and windmills will solve the climate change crisis, with no need for fundamental change in city form. This belief excludes an acknowledgment of the gargantuan energy and material demands consequent to such an ever more sprawling metropolitan pattern . Professor William Rees of the University of British Columbia, co-inventor of the ecological footprint concept, maintains that we are, as a species, already in "ecological overshoot" mode. Ecological overshoot is the point at which human activities are draining down more resources from the planet than it can resupply. In his estimation we are "draining down" the planet's "capital" now. And even more depressing, he also maintains that if every person on the planet enjoyed the same consumption levels as North Americans, it would take six planets to supply them. And these calculations do not even include the consequences of greenhouse gas buildup in the atmosphere, and the extent to which climate change would further drain the planets "capital" resources, and the ecological services that the planet can supply. Accepting these calculations then, a much more radical restructuring is required, as technology and manufacturing cannot save us. In fact they are what created the problem in the first place.

The conclusion is inescapable. The per capita consumption of materials and energy must be dramatically cut if we are to find a balance with the planets ability to supply them. Since 80 percent of North Americans now live in cities, it follows that the form and function of the city, along with the resource content of the food and material goods that flow into it for our use, must be substantially changed. Given that getting from

one place in the car is responsible for up to 40% of the problem, and that walking is a zero carbon substitute, a careful look at walking seems like a good place to start.

In our current situation, where the car is always at hand, North Americans will walk only if it's easier than driving. The break point for walking trips seems to be five minutes,[1] which is enough time to walk approximately one quarter mile or 400 meters. Most people think that walking five minutes is easier then firing up the car, pulling it out of a parking space, negotiating streets, finding a place to park, and exiting from the auto driver's crouch. Humans are incredibly sensitive to the minor benefits and costs of choosing one mode over the other, no matter how short the trip. Naturally some people will choose to make longer walks, while others will opt for the car even if the walk is ridiculously short, but the average threshold for walking is five minutes.

But the five minute walk rule is meaningless if there is no place to walk to. Many new suburban development are equipped with walking trails, but while these trails may be used every day by people who are in the habit of walking and jogging for exercise, the average person will use them much less regularly if at all. For the average person the most compelling destination for regular walking is the corner store. If a convenience store is located less than a five minute walk from home the average person will walk there many times a week to pick up bread, eggs, milk, newspapers and many other impulse needs.**[Figures 4.2a and b in margin near here]** In suburban-sprawl locations, there is a different kind of five- minute rule in play. There you will usually find "gas and go" stores distributed evenly throughout the suburban matrix, but at a five minute *driving* distance; these stores are usually inaccessible on foot, further exacerbating auto dependence in these landscapes.

If the basic corner store is joined by video rentals, bakeries, taverns and cafes then it is that much more likely that walking will be a daily part of life for nearby residents. If conditions are perfect, these stores are joined by coffee shops, hairdressers, hardware stores, used book stores, fruit and vegetable stands, pizza shops, accountants, dentists, and the local Subway sandwich shop. When most of your daily commercial needs can be met within walking distance, not only do you walk more, you use the car significantly less. Residents of Vancouver, where most residents can satisfy their daily commercial needs on nearby streetcar arterials, use their cars 30% less than do residents of South Surrey/Langley, BC, a car-oriented community. Residents of Vancouver also own fewer cars, 1.25 per family compared to1.7 per family in Surrey, BC.[2] Access to commercial services and frequent transit seems to explain these differences, as average family income in the two communities is nearly the same.

Among sustainable community advocates the five-minute walk rule has become axiomatic. However, it is usually imagined and applied as a walking distance radius or circle surrounding some fixed commercial point. This is indeed the way it works if there is only a small commercial node with one or two stores, but in Vancouver and other vibrant streetcar cities, commercial activates spread many miles along the streetcar arterial. When this occurs the five minute walk is no longer a circle but rather a continuous band that extends ¼ mile perpendicular in both directions to the streetcar arterial. The basic pattern for streetcar cities is a grid of streetcar arterials spaced at half mile intervals (see chapter 3).[3] This means that everyone will be within a five minute or quarter mile walk of some streetcar arterial, and often able to choose between two. These long linear commercial corridors comprise the bulk of public realm spaces in streetcar

cities. This linear public realm, so characteristic of most Canadian and U.S. cities, has implications for our understanding of their qualitative aspects – their "sense of place".

Sense of Place in Corridors

As touched on in chapter four, planners and urban theorists have focused on urban *nodes*, even though streetcar city *corridors* are the unique and defining characteristic of the North American city. It seems likely that their training and good intentions have made it difficult to cherish the seemingly undifferentiated linear corridors that are such a humble and ubiquitous datum for our experiences in most gridded American and Canadian cities. It may be that this inattention to the meaning and value of the corridor came from the careful study of older European and east cost cities, whose web of streets usually focused on key "five corner" intersections or squares as in Kevin Lynch's Boston.[4]

What may appear to outsiders to be miles of undifferentiated shops in the commercial corridor of the streetcar city appears quite different to those who use these corridors every day. Local users do not experience every mile of the corridor, but just the transition from their residential block to the more active arterial. Along the way they might pass the community school, a number of gardens, some townhouses on the block closer to the corridor, and then the streetcar arterial itself. Once at the arterial they turn either 90 degrees right or 90 degrees left to take advantage of services on the two or three blocks in either direction. Thus their sense of the place is determined by their walk to the arterial and their eventual familiarity with the blocks immediately in either direction. People who live two or three blocks away in one or the other direction will have a similar and overlapping, but not identical experience. Some of the shops they use and people they encounter will be the same, others different. In this way corridors are quite unique

and different than urban nodes. They allow for shared and similar experiences but experiences that gradually change depending on where you reside along the corridor. **[Figure 4.4 in margin near here]** Vibrant streetcar streets are experientially very rich, with busses or streetcars arriving and departing every few minutes, familiar shopkeepers sweeping sidewalks, denizens of ethnic social clubs arguing on sidewalks, school kids walking to the local library branch, and teens showing off. They offer a unique dialectic between the freedom of action allowed by the apparently infinite length of the corridor and the proxemic familiarity that characterizes the best of village environments. More can and should be said about these undervalued experiential qualities of these overlooked spaces, but for our purposes it is only necessary to add a qualitative argument to the practical, as the streetcar city principle must work in both practical and experiential terms to be of value. This discussion of the experiential value of the corridor is not intended to supplant the articulate explorations of the sense of place attributable to urban *nodes*, just to give *corridors* equal standing. Most of the eloquent arguments of Norberg-Schulz, Christopher Alexander and others,[5] can be equally applied to corridors, if one leavens these insights by also appreciating how corridors create both a personal and a communal sense of place; it is personal depending on what side street you live on, providing an individualized experience based on your own habitual trips to and from the corridor; it is communal, providing a shared sense of place for thousands of residents who use some or all of a corridor that is many miles long.

Transit, Density, and the Five Minute Walk

Transit has a synergistic relationship with pedestrian-dependent commercial services. If the solitary corner store has a bus stop outside, both the store and the transit

service are enhanced. The store is enhanced when bus riders pop in to buy a newspaper before jumping on the bus. The transit service is enhanced because riders can now use the trip to the bus to do more than one thing – ride to work and pick up the paper, ride back from work and pick up milk – making the bus that much more attractive. The more commercial functions at the stop the better, as this makes it even more possible to "trip chain," meaning to perform more than one errand on the same trip.

On streetcar arterials, trip chaining is even easier. Riders can hop off the bus or streetcar to stop at the pharmacy, the toy store, the radio shack, or the wine shop, then hop back on to continue their trip home. In this way, stores located along highly functional streetcar corridors gain customers from both the pedestrians who walk from nearby homes and the transit users passing by on the corridor. Some of these synergies also accrue to developments that are commonly known as transit oriented developments, or TODs, although as pointed out previously, anyone who lives outside a five or at most a ten minute walk of the center of the TOD will not gain these advantages. Only through chaining TODs in a pattern can these advantages be equally available. The streetcar city corridor is the simplest way to chain TODs in a pattern that is universally accessible.

Designing for the Bus or Streetcar

At headways (or frequencies, the length of time between one bus leaving and the next arriving) of seven minutes or less, users no longer need to consult schedules. They know that their wait will be four minutes on average, sometimes less sometimes more, but never more than seven minutes. These waits are insignificant in the minds of most riders, making it that much more likely they will use transit. For this reason, many transit authorities make achieving seven minute headways their Holy Grail.

In suburban areas of Vancouver the transit authority has provided bus service within 400 meters of almost all homes (thanks to the legacy of the agricultural grid and its quarter section roads on the half mile interval), although this is often as the crow flies. But the dendritic street system of “loops and lollipops” inside the half mile super blocks often forces walks of ten minutes or more. Given the low riderships characteristically generated by these suburban landscapes, regional transit authorities cannot justify buses at seven minute headways. More typically they are at 30 minute intervals and in some cases an hour. In low density landscapes dominated by the dendritic pattern, destinations usually require one or two transfers, thus taking many times longer than car trips. Furthermore, stops at the most common suburban destinations, such as shopping malls are notoriously unfriendly for transit customers. With so many disincentives for transit built into the suburban dendritic street system it is no surprise that transit captures only a few percent of all trips in such landscapes. Short of a major and gradual urban retrofit, nothing short of ten dollar a gallon gasoline is likely to change that.

[Figure 4.5 in margin near here]

With so few customers to serve per square mile in such landscapes, transit officials are hard pressed to provide frequent transit. At these headways users must organize their whole day around the schedule of the bus, not just on their departure trip but also on the return. Long headways combined with long multi seat trips and pedestrian unfriendly destinations make it unlikely that anyone with a car will choose transit, and

they don't. The large majority of transit users in most suburban areas are the infirm, the young, and those too poor to own a car.[6]

Conversely in streetcar cities this kind of entropy toward failure is reversed. Features of the landscape conspire to re-enforce pedestrian and transit use, making it more and more likely that residents will choose transit for its convenience and economy resulting in a more efficient transit system, more revenue for the transit agency, and a compelling justification to reduce headways on the corridor even more. But the key factor in this success, one that we have yet to address, is density.

It is now accepted that the higher the density in a service area the more likely it is that residents will use transit. Evidence for this comes from analysis of real places. Almost everyone in high density Manhattan uses transit, almost no-one does in low density sprawling Phoenix.[7] A minimum density of 10 dwelling units per gross acre,[8] or 25 residents per gross acre is the usual minimum standard for frequent bus service. This guideline is borne out by transit ridership figures from the Vancouver region, where the average density is between 10 and 15 dwelling units per acre. Here less than 50% of all commuters use the single passenger automobile to get to work. Conversely in third ring suburban locations like Coquitlam where gross density is less than five dwelling units per gross acre, and despite the availability of express buses and more than 90% of all commuters get to work in the single passenger automobile.

While density is the most important factor influencing transit use, other more subtle factors have an influence. An interconnected street network helps users get to buses, the even distribution of commercial services along streetcar arterials makes trip

chaining possible, and lots of jobs located on the corridor all play a crucial role, but have proven more difficult for researchers to definitively link to ridership.

If the average density of a very large area, say greater than 10,000 acres or 15 square miles, is 10 dwelling units per acre or more, and if this area is balanced with one job per household, and if there are convenient transit connections to the larger metropolitan region, and if a full range of commercial services are available in the district, then transit may be able to provide an alternative to the car. That's a lot of ifs. Fortunately many streetcar city areas already meet these criteria and suburban areas, as they mature, are increasingly approaching those thresholds as well. Most U.S. and Canadian suburbs start out with average densities of between one and four dwelling units per acre gross. Newer suburban areas in many parts of the nation, Las Vegas for example, are higher at about seven dwelling units per gross acre.[9] Other metropolitan areas are finding ways to add density to previously built low density areas. Vancouver and Portland for example are adding density and jobs to formerly car dependent areas in numbers that make it possible to provide additional transit service and anticipate viable commercial services in walking distance in locations that could not previously support them.[10]

Ten dwelling units per acre is the accepted figure at which buses can be economically supplied at short headways. For streetcars or trams the accepted figure is closer to twice that.[11] Densities of 17 to 25 density units per gross acre are not uncommon in streetcar cities and not unachievable in new communities. Also, as discussed in chapter two, there are many reasons other than ridership for investing in the streetcar, which may make streetcar an intelligent economic development strategy at

average densities between 10 and 20 dwelling units per gross acre. Trams or modern streetcars cost less to install and run than busses if you look at the 30 year amortization costs. And trams, no matter what the power source, produce only a fraction of the GHG per passenger mile as do diesel buses.[12]

The greatest opportunity for making suburbs more sustainable is along strip commercial corridors. While whole-scale alterations of existing single family fabric are not conceivable in most suburban communities, the gradual intensification of low density commercial strips is. These vast areas that typically have a residential density of close to zero could easily accept redevelopment where the residential component could be 40 dwelling units per gross acre or more. Conversions of this type are already widespread in the Vancouver area[13] and in many communities across the United States.[14] As these developments proliferate along suburban strips they increasingly exhibit the defining characteristics of streetcar arterials—higher densities within walking distance, continuous commercial, an even distribution of jobs and services along the corridor—and thus, provide transit authorities with sufficient justification for reducing headways. Strip commercial zones often occupy between eight and 15% of developed land in the suburbs. Were ten percent of this land developed at 40 dwelling units per gross acre it could move what might be average gross residential densities from six dwelling units to 10. And would likely be more effective at increasing walking and transit use than that implies, since all the new residents would be within one or two minutes of commercial services and a bus stop.

The Walk to School

In many suburban locations the neighborhood school is indistinguishable from the shopping center, a sprawling one story box set behind a parking lot and a bus drop off, attached to the arterial via the umbilicus of the cul de sac. With more and more school kids getting to school by bus the necessity to scale schools in relation to the population within a walking distance circle, formerly assumed to be ten minutes or less, has been eliminated. For decades now, single minded school parcel size standards, issued by The Council of Educational Facility Planners (CEFPI) in "The Guide for Planning Educational Facilities," have set minimum "recommended" land area requirements for schools—40 acres for a middle school for example, or 60 acres for a high schools. Offered as "recommendations", many states and provinces have turned them into requirements. Such minimum school site size standards have made small schools within walking distance impossible to build or preserve, insuring that virtually all students will need a motorized trip twice a day just to go to school. **[Figure 4.7 in margin near here]** If these same standards for school sizes were in use when streetcar cities were laid out, fully 30% of all neighborhood land would be occupied by elementary school grounds, rather than the less than 5% they used.

In the streetcar city a school was provided for each 160 acre half mile square, each square surrounded by streetcar arterials. The school was almost always located in the middle of the square, meaning no child was more than a six minute walk from the school and no child had to cross the arterial to get there. With a residential density of at least 10 dwelling units per acre (and larger family sizes than now) those 1,600 units usually produced enough kids to fill two class rooms for each grade 1–7. This meant that

schools had about 400 kids in them, a school size now considered “small” but that the *Small Schools Foundation* considers ideal.[15] The principal of the Bayview School in Vancovuer’s Kitsilano district, my son’s school, knows the names of all 400 students, and the kids know the names of almost everyone who goes there too.

When you get much over this 400 student size, it becomes more and more difficult to establish a “first name” school community. A school for 400 students should ideally fit into one four-acre block **[Figure 4.8 in margin near here]**.This likely means a school that is tall rather than spread out. Traditional schools were three stories served by stairs. This is still an efficient form. Elevators for handicapped can be installed at less cost than the building and land costs of sprawling one story schools. A three story school for 400 will have a footprint under an acre leaving three acres for recreation, enough for a large playground and a soccer field. Whatever parking is necessary should be accommodated on surrounding streets. The full perimeter of the block is usually more than ample for this purpose.

A four-acre site will be a very hard sell with most school districts. The habit of large sites is so strong it won’t be easily overturned. The compromise is the two block site of 8 acres. The negative consequence of a two block site is that it marginally impedes interconnectivity and, assuming schools stay below the 400 student threshold, removes an additional 2 to 4% of land otherwise available for housing or services within the five minute walk circle, increasing the difficulty in achieving sustainable densities with the detached housing forms so heavily favored in many metropolitan areas.

To fix this problem usually requires action at the state and provincial level, where funding for school construction and the standards governing construction most often

originate. This is the case in Minnesota where until 2009 CEFPI standards had the force of law, in effect mandating the construction of a few oversized schools far from students and the closing of older neighborhood schools when it came time for major rehabilitation. It took a new law, the Minnesota Education Omnibus Law (HF 2),[16] signed by Governor Tim Pawlenty in June of 2009, to fix what should not have even been a problem. The law includes provisions to eliminate minimum acreage requirements for schools, and to remove the bias against renovating, rather than rebuilding, old schools. School requirements like "recommended minimum" parcel sizes for new and retrofitted schools are just one strand of the Gordian Knot that must be untied before low carbon communities can be built and rebuilt.

Conclusion

All of our national *[what about local?]* attempts to substantially reduce GHG will fail unless we can change the local, unless we can make walking and taking transit easier than driving. And this is only possible if the things we need and want every day are within a five minute walk. If this five minute walk brings us to zones where busses and streetcars abound then it becomes equally convenient to hop on and hop off regularly, until at some point life without a car seems like not such a bad idea. None of this works without a balance between density, street network, frequent bus and streetcar headways, and even sensible locations for schools. Miss one of these components and you compromise the others. Streetcar city models provide many lessons for reapplying to other newer contexts, and impel us to protect these features in landscapes where they are threatened. Creating new and retrofitting old communities for walkablility and options to the car will be the challenge of our time. The various monumental pathologies identified

in the first chapter have their source in what seems like a humble decision. Should I drive to get that loaf of bread or can I walk? That decision amplified and repeated by many millions results in impossibly overloaded freeways and ridiculously expensive and unsustainable patterns of movement. Reconstructing our urban landscapes around the five minute walk is a key part of restoring health.

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[1] A pedestrian shed, or pedestrian catchment area, is determined by the distance most people will typically be willing to walk and is generally defined as a five minute walk to the center of each neighborhood, creating a unit of approximately ¼ mile (Watson et al. 2003). Studies at the Port of New York Authority bus terminal found that a 5-7 minute walk is typically the maximum amount people will walk although this varies somewhat depending on the trip purpose, walking environment, and available time (Watson et al. 2003).

[2] According to Metro Vancouver's Livable Region Strategic Plan 2000 Report, 22% of households in Vancouver don't own a car and only 26% have two or more cars while in Surrey and Delta only 5% of households don't have a car and 52% have two or more. South Surrey/Langley residents took about the same number of trips as residents in Vancouver but 88% were by automobile (Canadian Facts 2000a) as opposed to 58% in Vancouver (Canadian Facts 2000b). Between 2005 and 2007, 30.1 percent of commuters in the New York Metropolitan Statistical Area (MSA) used public transportation, 6.1 percent walked, 7.5 percent carpooled and 50.5 percent drove alone (US Census Bureau, ACS 2005-2007). During the same time period only 3.5 percent of commuters in the

Atlanta MSA used public transit, 1.3 percent walked, 10.8 percent car pooled and 77.9 percent drove alone (US Census Bureau, ACS 2005-2007).

[3] **[Insert Figure 4.3]** Figure 4.3 shows the historic grid of streetcar arterials in Vancouver, BC distributed in regular intervals. A five minute walking distance is indicated along Fourth Avenue in Kitsilano. As you can see the majority of the Vancouver is within a five minute walk of a historic streetcar arterial**.**

[4] "Five corner" intersection: Lynch, K. (1960) *The Image of the City* MIT Press

[5] See: Norberg-Schulz, Christian. 1980. *Genius Loci, Towards a Phenomenology of Architecture* Rizzoli, New York and Alexander, Christopher. 1977. *A Pattern Language: Towns, Buildings, Construction* Oxford University Press, USA.

[6] Income is the primary determinant of auto ownership, which in turn is the main determinant of modal choice. In the United States, transit use drops from 19.1 percent of trips in households with no car to 2.7 percent of trips by households with one car (Pucher and Renne, 2003).

[7] Based on data from the 2000 census, the commuter public transit rate for Manhattan, New York for workers over 16 years of age was 59.6 percent while in Phoenix this number was only 3.3 percent (US Census Bureau 2000).

[8] Dittmar and Ohland (2003) state that transit agencies in the United States generally use a planning criteria of 7 dwelling units per acre to support basic bus service. Densities of

30 dwelling units per acre can easily support light and heavy rail transit (Dittmar and Ohland 2003).

[9] In 2000, the density of Las Vegas' suburbs peaked between 5 and 6 dwelling units per acre (US Census 2000). Today, higher density communities are being planned and built under new comprehensive community plans (Smith 2006).

[10] According to Nelson (2007) up to 35 million of the 40 million new housing units needed to meet the demand of the next 100 million people living in the United States will likely be built for childless occupants. This group is already helping to fuel the resurgence of in-town living, high demand in many transportation oriented developments, unprecedented demand for central city and close-in suburban infill and redevelopment, and greater stability of housing prices outside of more distant suburbs.

[11] Pushkarez and Zupan (1997) found that 7 to 15 dwelling units per acre can support moderate levels of convenient transit of all type including streetcar and light rail which is reasonably sustained at 9 to 12 dwelling units per acre.

[12] See Research Bulletin No. 7 "A Cost Comparison of Transportation Modes" by Patrick Condon and Kari Dow, available online at the Sustainability by Design website: http://www.sxd.sala.ubc.ca/8_research/sxd_FRB07Cost_Comparisons%20Jan%209.pdf

[13] In Surrey, BC Bosa Properties is converting a suburban strip mall into a high rise urban village called the Semiahmoo Town Centre. This development features mixed use, pedestrian-friendly streets and high residential densities. **[Insert Figure 4.6]**

[14] An example in the United States is Belmar in Lakewood, Colorado where a mixed-use renovation and redevelopment of a failed mall site has become one of the most successful greyfield transformations in the nation (Dunham-Jones and Williamson 2008).

[15] http://www.smallschoolsfoundation.org/

[16] http://blog.smartgrowthamerica.org/2009/06/09/