

Transportation and Built Environment Influence on the Public Health of Commuters

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Assignment 1 PLAN 579

September 30, 2014

## **Introduction**

The suburbanization development model known as “sprawl” is a regulated form of development that is known for its bad aesthetics, poor economics and negative influence on public health. A century ago, cities in North America were walkable, connected, compact places with different land uses located close together (Frank et al. 2003). The implementation of systematic planning policies that concentrated on benefiting the driver of the private automobile have resulted in producing many North American cities that are places where land use is segregated, connectivity is poor and urban design characteristics are neglected. As cities have developed, expanded, and grown into suburbanization, a new set of urban health concerns have become apparent. These health issues are a product of the new land use and transportation patterns known as “sprawl” (Frumkin et al. 2004). Today, there is extensive criticism of the suburbanization development model, which had caused land use and transportation systems to be scaled to the automobile instead of the individual (Frank et al. 2003). These sprawled environments influence travel behaviour (Frank 2000), in turn influencing commute times and travel mode choice.

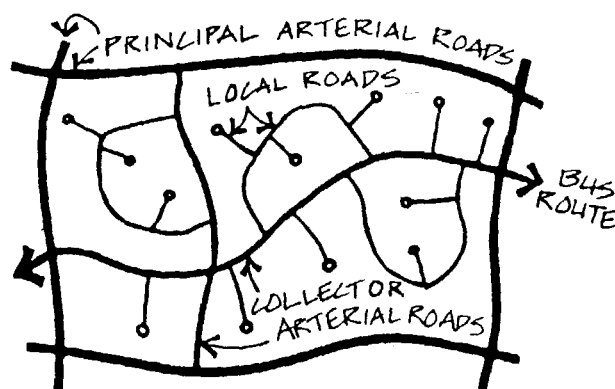
When the purpose of development is to serve the private automobile, travel mode options will decline, road congestion will peak at rush hours, and commuting time will increase. Canadians perceive that the time they take to commute to work is increasing. In fact, there is an actual observed increase in commute time for the public transit and private vehicle travel modes (Turcotte 2005). Focusing on commuting trips is important because work trips traditionally place the highest strain on transportation systems at peak hours (Redmond & Mokhtarian 2001) and many studies show its negative effects on the public health of individuals. Commuting entails more than just physically getting from home to work. The daily commute takes time, generates out-of-pocket costs, causes stress and interferes in personal relationships and wellbeing (Frey & Stutzer 2008). The transportation mode, commute length, and satisfaction of commute are significant factors when evaluating public health. This is a very important topic for public health planning because the majority of the population spends precious time commuting every single day.

## Research Methods

There is a strong relationship between the development and design of urban areas and transportation and their effects on public health. This summary of the literature focuses on the ways that the form of communities influences the length of commute times and travel mode options, and the resulting consequences that long commutes have on public health. Secondary research through the review of journal articles is used to determine the realities of commute times and travel mode shares, and their public health repercussions. Many studies argue that higher congestion and longer time spent commuting is worse for the psychological well being of people (Martin 2014). Long sedentary commute times are associated with health concerns and the decrease of personal free time. Finally, a case study review suggests possible solutions to increase travel mode options and decrease commute times through infrastructure development and transportation demand management, which results in an increased quality of life for urban populations.

## Transportation Systems and Commuting Today

Traditional suburbs were designed in the twentieth century using a hierarchical street network, with the objective to make automobile trips across neighbourhoods as difficult and slow as possible, and automobile trips on the edges of neighbourhoods as easy and fast as possible. Hierarchical street networks increase trip lengths and decrease the number of route choices and practical transportation modes available to the commuter. The sprawled, segregated and low-density land use patterns result in larger commute distances for suburban dwellers. The poorly connected land use and transportation systems make even nearby destinations feel far apart, especially for slower non-motorized travel modes such as walking and



cycling (Frank et al. 2003). This in turn has led to populations living in suburban communities having less travel mode choice and longer travel times for their daily commutes. Data from *Statistics Canada* shows that the average round trip commute for workers in large suburban and urbanized cities is longer than for workers in small towns, because it is necessary for workers to commute farther on average and a larger proportion of the population will use public transit (Turcotte 2005).

The urban form strongly influences how the population spends their time (Humpel et al. 2002). Suburban dwellers perceive distances to be greater because of their decentralized and poorly connected environments. This results in a greater proportion of the population driving. Sprawl and the built environment have been proven to influence private vehicle travel with regards to trip length, vehicle miles traveled, vehicle hours traveled and mode choice (Frank et al. 2003). When evaluating the impacts from sprawl and the built environment on transportation modal choice, commuting trips are an important metric because daily work trips overtax transportation systems by occurring at peak hours and volumes, and are combined with other travel trips. Public transportation policies are often focused on commutes, with the intent to reduce peak period trips and distances through the supply of incentives to carpool, take public transit, use non-motorized transportation such as walking and cycling to get to work, change departure times, or telecommute (Redmond & Mokhtarian 2001). However, studies have found that the public will ultimately take the mode of transportation that is the fastest and most comfortable if it is financially available to them. Researchers have found that when public transit is not advantageous for the population to use with regards to travel time and comfort level; its popularity will not increase, regardless of increasing fuel costs and environmental incentives. For example, despite high levels of congestion in Canadian cities, it is still faster for the public to use a private automobile to get to work over public transit (Turcotte 2005).

To understand commutes from a public health lens, improve forecasting and reduce congestion, it is important to understand the commute preferences of individuals and their ideal commute times (Redmond & Mokhtarian). The perception of a commute is just as important as measured commute times. According to a study, many Canadians perceive that the time they spend commuting

is continually increasing. It was found that on average, the duration of round trip between the home and workplace was nine minutes longer in 2005 than in 1992 in Canada (Turcotte 2005).

The ideal commute time however, is not a zero commute. In fact, the public can view work commutes positively. This can happen when the public receives desirable physical exercise from walking or biking, and when short commutes provide a buffer between the work and private spheres (Olsson et al. 2012). A study in *Transportation* shows that most people require some time to detach from the workplace. Researchers have found that the ideal one-way commute time is 16 minutes (see Figure 1). Nearly one-third of respondents reported an ideal one-way commute time of over 20 minutes. Less than two percent of surveyed respondents reported an ideal time of only 4 minutes and only 1.2 percent reported a daily preferred commute of zero (Redmond & Mokhtarian 2001). Telecommuting is seen as a controversial topic, with some studies suggesting that it increases productivity while other studies contesting the value of working in an office. This study on the ideal commute times shows that telecommuting is not the solution to improve the public health and wellbeing of commuters.

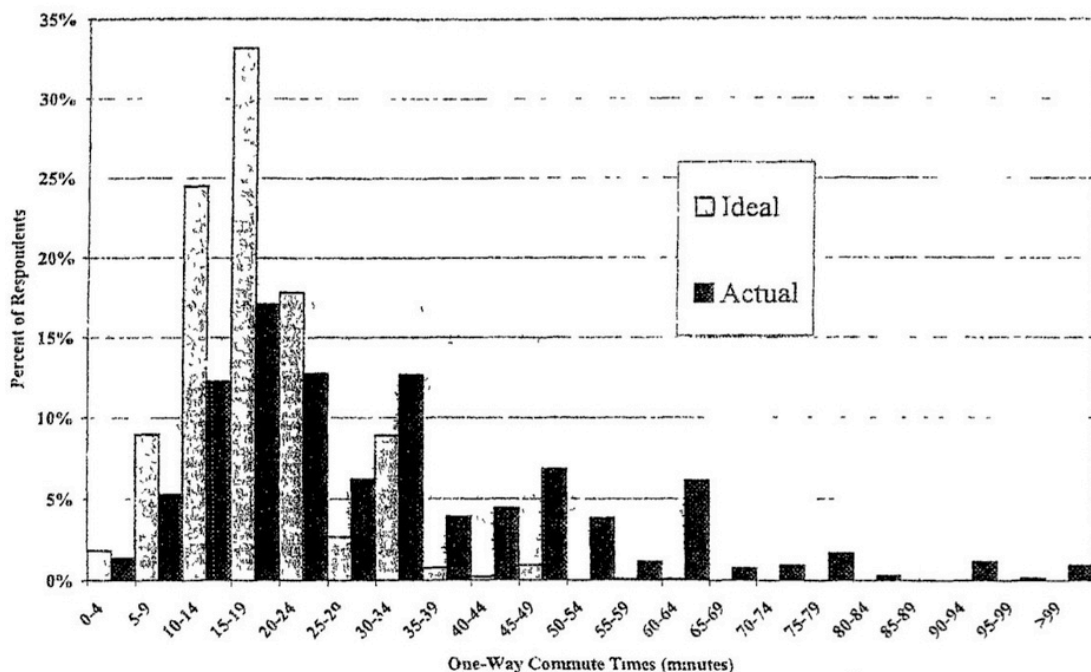


Figure 1: Ideal Commute Times (Redmond & Mokhtarian 2011)

These ideal commutes listed above are not a reality in North America. According to the US Census Bureau, the average American spends over 50 minutes

a day commuting. Furthermore, there is a large disparity between taking a private automobile and public transit. The US Department of Transportation found that in 2009, commutes by private automobile took 23 minutes on average and commutes by public transit took 53 minutes on average. However, this disparity is exaggerated as most public transit journeys are taken in large cities, where average commute times by car are well over the national average, and therefore transit commute times can actually be seen as a more competitive mode choice when compared with driving commute times (The Economist Newspaper Ltd 2011).

### **Commuting Time Impacts to Public Health**

Public health agencies recommend at least 30 minutes of moderate daily physical activity, for both short-term and long-term health and wellbeing benefits (Frank et al. 2003). Just getting the recommended 30 minutes a day can be difficult in the suburbanized car-centric environments many North Americans live in. Additionally, commute times in urban sprawled environments are long and commutes are most commonly executed through automated modes of travel. A study in the *American Journal of Preventative Medicine* argues that a personal travel time budget exists, suggesting that time spent in one travel mode can consume time available for another. The findings suggest that an increased amount of time spent commuting in a sedentary mode can lead to a reduction of time available for the individual to walk and cycle for both recreational and utilitarian purposes (Humpel et al. 2002).

A study from *Preventative Medicine* found that the longer people spend commuting in cars, the worse their psychological wellbeing. For your overall health and wellbeing, commuting through active modes such as walking or cycling is best, followed by the use of public transportation, finally followed by driving (Martin 2014). In fact, one study suggests that benefits associated with active travel modes can actually exceed the potential benefits from reducing the duration of commute. Researchers found that each additional hour spent in a car per day was positively associated with a 6% increase in the likelihood of obesity. Furthermore, each additional kilometer walked per day was positively associated with a 4.8% reduction in the likelihood of obesity (Frank et al. 2004).

Commuting by private automobile is found to be particularly harmful to health, as stated by a study in *Prevention*. Sitting in one position for an extended period of time puts pressure on nerves and restricts blood flow. Extensive hours commuting for long distances were reported as the worst for health: high blood pressure, less tolerance for frustration and negative moods were found to be higher for long-distance commuters when compared to the shorter- and medium-distance commuters. The negative mood generated from sedentary driving commutes impact health, office and family life. Possible solutions listed the study include:

- Avoidance of peak commute hours and traffic;
- Ride sharing, which was shown to significantly lower blood pressure in commuters; and,
- Allocating enough time to get from Point A to Point B to avoid frustration (Spilner 1995).

A second study in *The Scandinavian Journal of Economics* found the strain of commuting to be associated with a higher blood pressure, musculoskeletal disorders, a lower frustration tolerance, increased anxiety and hostility and adverse affects on cognitive performance (Frey & Stutzer 2008). Some studies show that people make adjustments to reduce the personal impact of congestion and lengthy commute times through relocating their residence or job, changing their modes to shorten their commute time and implementing strategies to make their commutes less stressful and more productive (Redmond & Mokhtarian 2001).

Influencing the transportation modal shift is an important topic in transportation planning practice. Commuter satisfaction is related to public health, with one study finding that people expressed the most happiness with their commute when they took what transportation mode they originally wanted to take. Commuter satisfaction was found to be negatively influenced by the desire or need to use a mode of transportation different than the one currently used by the commuter. The study in *Transportation Research* surveyed commuters in Montreal to determine which travel mode was the most positively perceived, as shown in Figure 2. The researchers found that pedestrians, train commuters and cyclists were more satisfied with their commute than drivers, metro and bus users. Long travel times were found to lead to lower satisfaction for all modes of transportation. However, walkers,

cyclists and train riders were the least affected by the fluctuation of commute times, because those commuters found their trip enjoyable rather than seeing it as a means to an end (St Louis et al. 2014). This shows that a positive commuter experience is extremely important, and public health and wellbeing will benefit from the opportunity and freedom for each individual to choose a travel mode that they will enjoy.

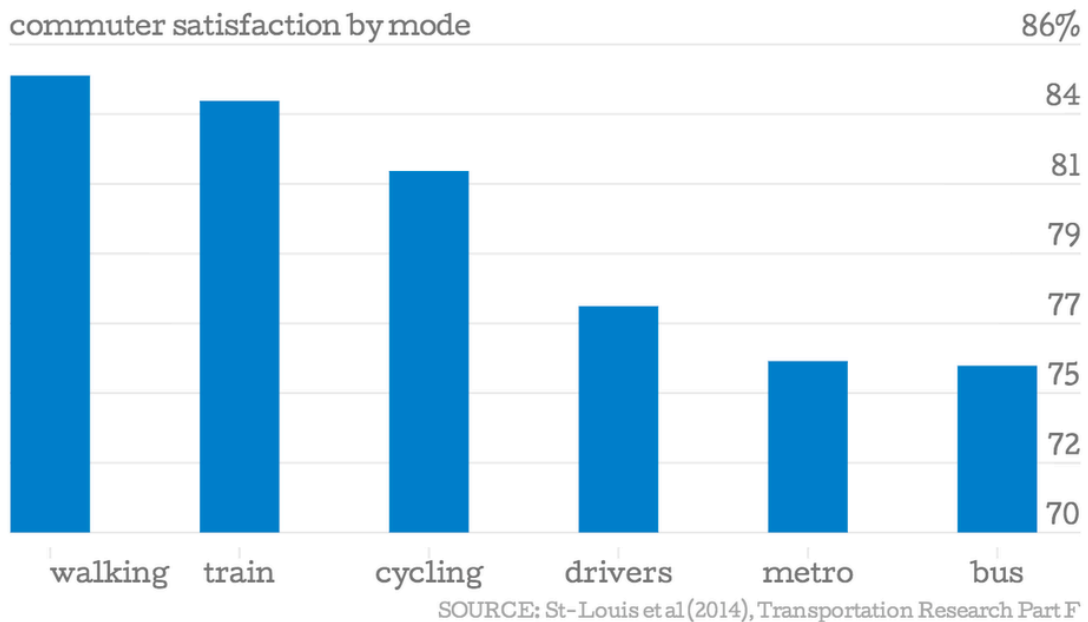


Figure 2: Commuter satisfaction by mode (St. Louis et al 2014)

Commuter happiness and wellbeing is found to depend highly on independent and uncontrolled variables. The transportation modes that are the most affected by external factors tend to display the lowest levels of satisfaction. For example, one study established that the satisfaction of drivers and bus riders decreased with longer trip times when traffic was unpredictable. The sample studied showed that cyclists enjoyed their trip more than bus riders regardless of time spent commuting. Bicycle riders budgeted an extra five minutes per day for the trip in case of delays, while bus riders budgeted fourteen minutes because their rides were so unpredictable (St Louis et al. 2014). A second study also found commuting to be more stressful when it was extended because of external factors, such as traffic congestion, that were uncontrollable (Frey & Stutzer 2008). Generally, the actual trip commute time is not as important for commuter satisfaction as the perceived trip time. This shows that unpredictable travel times can negatively impact the health and wellbeing of populations more than long commute times.



The choice of travel mode is an important variable in commuter satisfaction. A study in *Environment and Behaviour* found that drivers find their commute the most stressful because of external factors such as traffic, unexpected delays and other road users. Transit riders also complain about delays, resulting in stress as well as boredom. Walkers and cyclists, however, reported the most relaxing and exciting trips, and therefore seen as the most optimal form of travel (Gatersleben 2007). Non-motorized active commutes that are independent from external delays are found in multiple studies to be the most beneficial to public health and wellbeing.

The length of commute times is also an important factor when evaluating the public health outcomes. A study in *The Scandinavian Journal of Economics* found that members of the public with a longer commuting time report a lower subjective overall wellbeing. The study established that a commute over 45 minutes per day carries such a high cost to wellbeing that economists have found it is necessary to earn 20% more to make the trip worth it. The average daily commute times in the US and Europe in minutes is shown in Figure 3. The findings are clear: on average there is a lower reported life satisfaction for members of the public with longer commute times (Frey & Stutzer 2008). The satisfaction with work commute also decreases when travel distances are longer (Olsson et al. 2012). From the literature, it is understood that the attitudes towards the various travel modes should be used in conjunction with measured travel time when considering the public health consequences of commuting. The combined outcomes of trip perception and time spent travelling influence the health, wellbeing and happiness of the public.

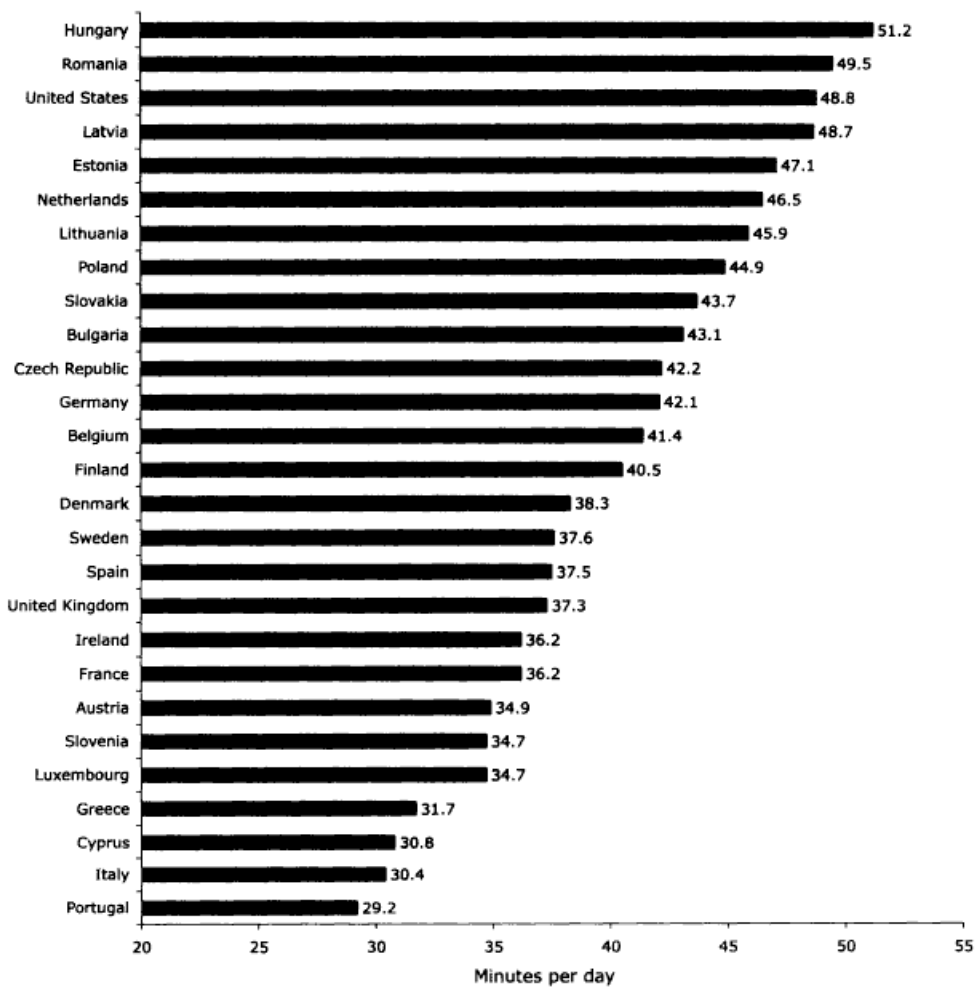


Figure 3: Average daily commute times in Europe and the US (Frey & Stutzer 2008)

### Best Practices and Conclusions

When designing neighbourhoods to be commuter-friendly, greater accessibility and mobility options shape a complete multimodal network. A well-connected urban form includes many optional street linkages between trip origins and trip destinations, resulting in greater connectivity through a grid pattern. Suburbanized areas can also become better connected by the provision of linkages between fragmented areas and the implementation of better pedestrian and cycling infrastructure and design characteristics. The built environment and transportation networks can be developed to offer desirable alternative transportation modal options to commuters, which in turn will benefit public health outcomes.

It is critical for the designs of the intermodal linkages to be improved if the convenience and attractiveness of non-motorized and public transportation is to be

increased. Developing efficient and well-designed intermodal terminals in airports, train stations and transit stops that facilitate convenient and quick transfers will create a competitive alternative for car commuting (Frank et al. 2003) for longer distances. This careful planning of the links between transit and local pedestrian and bicycle transportation systems will make a difference by giving the population the feasible choice to switch their primary transportation away from the private vehicle by making alternative travel an attractive and viable commuting option. The outcome will be fewer drivers and therefore less congestion on roads, resulting in shorter and more enjoyable commutes for the public regardless of travel mode preference. Providing these alternatives will allow for more choices to the public, increasing their commute satisfaction and reducing their commuting time.

A brief case study is the insight of German municipalities when designing their urban transportation systems, as early as the 1970s. Municipalities created policies that encouraged bicycling and discouraged car-use, invested in non-motorized infrastructure, subsidized bicycle travel, implemented restrictive parking, prohibited new construction of roadways and restricted vehicle speed limits in high-density areas. This resulted in a huge change in travel mode shift towards non-motorized forms of transportation (Pucher 1997).

A study in *Journal of Transport Geography* found that today, Americans bike, walk and use public transit for only 10% of all trips compared to 40% in Germany. The travel mode split based on trip purpose for each country is shown in Figure 4. The study found that this is true regardless of different socio-economic factors and land-use patterns: Americans living in dense, urban areas close to public transportation are still more likely to drive than Germans living in lower density areas of segregated land use. The reason for this current disparity was differences in transportation policies in Germany making private vehicle travel slower, more expensive and less convenient, and the attractiveness of non-motorized and public transit alternatives (Buehler 2011). This case study shows that it is possible to shift the travel mode shift of commutes to benefit public health outcomes through urban planning policies, travel demand management incentives and the construction of infrastructure. Managing travel demand is a gradual shift that depends on many different factors, not only urban form.

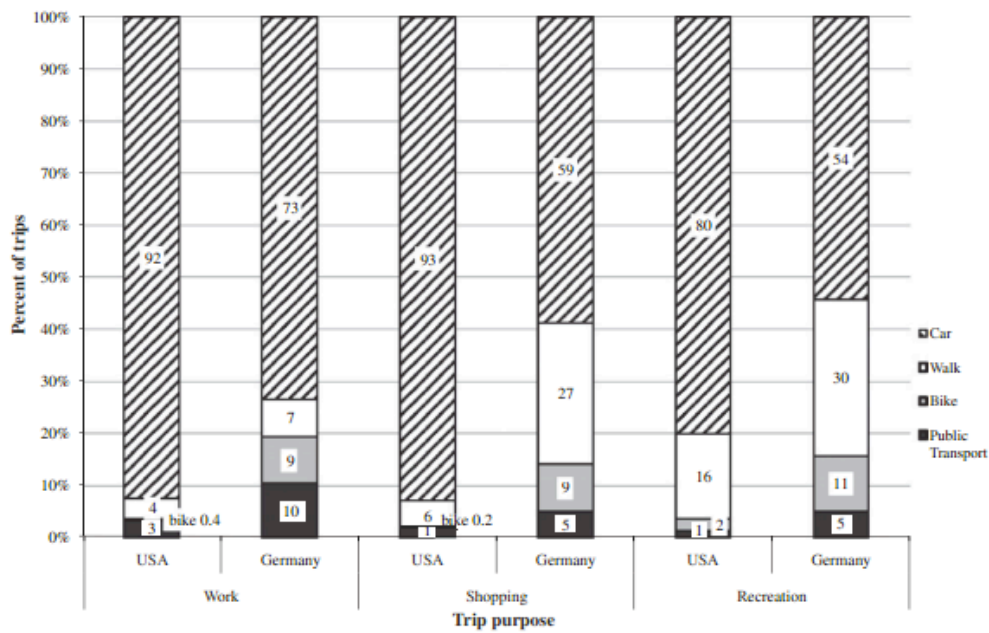


Figure 4: Percentage share of trips in Germany and USA in 2001/2002. Work trips are shown on the far left column. (Buehler 2011)

These findings have implication for sustainable transportation policy initiatives. There is a need for interdisciplinary collaboration between public health experts, government officials, urban planners, urban designers and transportation engineers when creating policies and programs that shape developments and transportation systems of the future, in turn shaping the nature of future commute time and satisfaction. To improve the wellbeing of commuters, travel time should be decreased and various travel mode choices should be available. Public health and population wellbeing should be in the forefront of practitioner's agendas. The most important aspect of urban planning is the people practitioners plan for; therefore the public health implications of their decisions should be an important consideration.

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