The Practicability of Completely Replacing Cars with Mass Transit

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The prospect of a future with flying cars has long caused great excitement and has been a staple of predictions about how people will someday live. However, the truly ideal situation for the future would be to have no cars at all. Contrary to the common view, they are a limited and constricting form of transportation. Additionally considering the constant accidents, the resources cars consume, the pollution they generate, and the amount of infrastructure they require, it was a tremendous mistake to gear the whole transportation system toward large numbers of people having their own vehicles. It would have made much more sense and been much more efficient if the emphasis had instead been placed on mass transit. However, the world can still head in that direction.

This essay will examine why the car—a term that is used here in the sense of any private passenger vehicle—should be eliminated and how this may be achieved. My purpose was not to provide the definitive answer or to formulate a detailed plan for an alternative transportation system but rather to determine the plausibility of such a goal and to explore some of the possibilities. My conclusion is that it is reasonable to believe cars could be replaced by mass transit and that society would be better off if it achieves this.

The Problems with Cars

The most obvious negative side to cars is their propensity for crashing. In 2009, there were almost 11 million motor vehicle accidents in the United States and around 33,808 resulting fatalities, which averages to nearly 100 people killed per day. Among those deaths were 4,100 pedestrians,[1] killed by motor vehicles despite not even having been in one. Looking at these figures and considering the chaos of the road, with so many large, heavy, powerful machines darting all around each other and amid unprotected individuals, driving or even being near moving cars starts to look much too dangerous to be an everyday activity. Traveling by car any

1 United States. Department of Commerce. Census Bureau. *Statistical Abstract of the United States: 2012.* Aug. 2011. Web. 11 Feb. 2015. <http://www.census.gov/compendia/statab/2012/tables/12s1103.pdf>.

significant amount, one will inevitably come upon a wreck on the side of the road or a sheet covering some patch of pavement, surrounded by police cars, fire trucks, and ambulances, but almost everybody feels all right enough about it to just drive on. The average person is so used to being in and around cars that all the horror they cause is normal and acceptable.

One reason for the danger is that it is too easy to get a license and too hard to lose it. Almost anyone can qualify, as shown by how many incompetent and reckless drivers there are, despite how easy it is to get someone killed. After a five-minute road test, the state currently sends people off in multi-thousand-pound machines to mingle at high speed with the virtually countless others on the road. Then, drivers can commit all kinds of extremely dangerous offenses, like speeding or drunk driving, get caught, and still ultimately be allowed to continue driving. In some places, it is harder to get a motorcycle license than a regular driver’s license, but at least the incompetent or reckless handling of a motorcycle is most likely to kill only the rider. Even if they technically stay within the law, many people just do not have good enough judgment to drive, like someone who always goes the maximum permitted speed through residential neighborhoods, and hope a ball does not suddenly happen to roll in front of the car.

However, rather than the issue being mainly individual recklessness, the biggest part of the problem may be that driving is just too inherently dangerous and unpredictable. Things simply get too busy, move too fast, and have too much power behind them for humans, built for walking speed, generally to be suited to handle them. People eventually get into routines and become complacent, and proper practices like signaling turns or coming to a full stop at stop signs go out the window. While driving, in the briefest instant, the smallest mistake, like forgetting to look over one’s shoulder before changing lanes or getting distracted when approaching a red light, is enough to get someone killed. In other cases, things are just completely out of a driver’s control, and it is impossible to avoid an accident, like when another car or a pedestrian enters his path at the last second, and there is no time to stop.

Setting out as a pedestrian is almost like walking into the middle of a shooting gallery. In most instances, it would be considered unacceptably dangerous to have people work in a factory around machinery with exposed blades, belts, and gears all over the place, yet it is acceptable to have them walk among and dodge around massive, rapidly moving transportation machines. Anyone in an area with cars and pedestrians will see plenty of examples of the latter being disregarded and endangered. Drivers coast or blow right through stop signs, including when someone is crossing or about to cross the street. When cars do stop, it is on the crosswalk often enough, making the pedestrian venture deeper into the intersection, and at smaller intersections, the roads being what they are, cars have to block the way of any pedestrians crossing as the drivers watch and inch themselves into oncoming traffic. If a traffic light changes before pedestrians finish crossing, more often than not, the cars just start going around them, sometimes even trapping them in the middle of the road. Cars so often fail to yield the right of way, to pedestrians especially, such as when someone is already crossing and a driver keeps going anyway, forcing the pedestrian to stop and linger in the street. A similar example is cars turning against a walk signal, zooming around the corner disregarding anyone trying to cross, and on a significantly busy road, if the pedestrians do not step out into the street the instant the signal comes on, the drivers waiting to turn will never let them. Almost as bad are drivers that creep around the corner as pedestrians cross, making them feel like they have to hurry up and get out of the way before they get run over. Another serious danger is drivers coming out of parking lots who look in the direction of oncoming traffic to avoid getting hit by another car but who do not bother to look the other way to make sure they do not hit a pedestrian coming down the sidewalk. Private driveways and parking lots form an intersection with the road, essentially the same way that roads do with each other, yet more often than not, they are not regulated by a traffic light or stop sign. In the busier of such locations, simply pulling into traffic is more dangerous than most would care to dwell on.

For the most part, drivers who treat pedestrians as described above are pathetic. They get to be seated comfortably in a climate-controlled car while the pedestrian is fully exposed to the elements and the flow of traffic, yet they are unable to show the slightest courtesy, to show enough regard for other people’s lives to take literally a second to let them finish crossing the street and get out of danger. What is more, a few drivers go out of their way to make pedestrians miserable or even to deliberately endanger them. This is the type who roars through a puddle to douse someone walking along the sidewalk with muddy, greasy water, who yells out a rude comment while zooming by to cowardly avoid any response, or who suddenly accelerates toward pedestrians or makes his tires squeal just to startle them. Such individuals are not fit to be out and about at all let alone driving.

Aside from being treated very badly by drivers, pedestrians have a downtrodden position in general. People block the sidewalks, not only by carelessly parking cars but also with garbage cans and other objects. In the winter, sidewalks are frequently enough left buried in snow or coated in ice, and in the summer, people let their sprinklers spray across them, as if there is any benefit to watering concrete. There are plenty of areas where sidewalks are missing or badly damaged, and so pedestrians wind up either walking on the side of the road and right by passing traffic, winding their way through plants and dirt, or tripping over raised slabs and wrenching their ankles in sunken areas. Usually, there are no safe pathways for pedestrians through parking lots, designed only with cars in mind and disregarding how people will get to and from parked vehicles. Finally, dogs, both in people's yards and being walked, go wild and act menacingly toward any passersby approaching along the sidewalk.

All these issues are due in part to simple disregard. Shoveling snow is a hassle. People want to hit their whole lawn with the sprinkler in one shot and who cares if it goes on the sidewalk too? Pouring concrete is expensive. Drivers just want to get where they are going, and pedestrians are a nuisance that gets in the way and slows things down. Many drivers just do not have patience, which perhaps goes a long way to explaining why there are so many car accidents. Everyone is in such a hurry to get to the next red light. But patience is a critical asset for everyone's safety when driving, and someone who does not have enough of it to let another cross the street has no business operating a vehicle. While at least a large number of drivers seem to consider that public thoroughfares are only for them, pedestrians in fact have just as much right to use the roads, and drivers are not supposed to do whatever they want just because they are in the more powerful position, in a car.

Likely more than impatience, however, such attitudes hint there may actually be contempt for pedestrians. Why else could drivers not wait an extra second to let them by? What difference would it actually make? In addition, regularly walking as well as using mass transit to get around is stigmatized, at least in many places where cars dominate. Such does not really apply to large cities, where mass transit is extensively used, but certainly it does to the suburbs. There, those who use mass transit are basically the ones who cannot afford cars, so right in the beginning, mass transit use is associated with poverty. If you tell someone you arrived somewhere by bus, or especially by walking, there is a good chance they will act like there is something wrong with you, making a kind of surprised look, asking how you could have managed, or condescendingly insisting on giving you a ride back later.

Of course, many pedestrians cause their own problems, like by not following the rules themselves, by jaywalking for example, and that is a concern too. But they are the ones totally exposed to all the danger, while drivers are the ones in much more of a position to get someone else killed. Conversely, many drivers admittedly do show regard for pedestrians, but all it takes is one who does not care to kill or cripple someone. The dangerous situation faced by pedestrians should be a serious concern to everyone because everyone is a pedestrian at some point.

Aside from traffic hazards, it is disturbing to consider that the toxic emissions of hundreds of millions of cars are being discharged into the same atmosphere from which we have to breathe, not to mention the petroleum-tainted runoff from the roads; all the byproducts of manufacturing cars and producing gasoline, motor oil, and other automotive fluids; and ultimately having to dispose of vehicles and related materials. When traffic starts to get dense, the smell of exhaust becomes unmistakable, leaving no doubt that one is inhaling it in significant amounts, and some level of constant exposure is nearly inescapable in the modern world. If people were to find out their drinking water was contaminated with sewage, there would be a tremendous outcry, yet the universal contamination of the air supply gets nowhere near that level of attention. Considering, for instance, that nearly 60 percent of carbon monoxide emissions comes from highway vehicles[2] and that cars generate almost 2/3 of the greenhouse gas emissions from transportation in the United States, with transportation overall generating more than a quarter of such emissions in total[3], curtailing car use would solve a large part of the pollution problem in general.

For the individual driver, major considerations regarding cars include the great expense of fueling, maintaining, and insuring one and the potential liability when something goes wrong; the average person is extremely unlikely to kill someone except in a car accident. All this is in addition to constant, everyday hassles like sitting in traffic or trying to find a parking space, both of which also waste tremendous amounts of fuel; getting directions; and the general stress of driving. So much suffering, expense, and inconvenience could be eliminated if somehow cars could be.

Another thing to consider is all the land tied up by the facilities and infrastructure that predominantly support cars, like roads, parking lots, gas stations, and garages. What if some of the nearly countless acres used for these purposes could instead be used for parks and other things that actually beautify or otherwise improve their surroundings?

To illustrate the scale of the waste, I examined a 1,000 by 1,000 foot section (one million square feet) of Uniondale, Nassau County, New York, just west of the intersection of Front St. and Uniondale Ave., two major roadways. Starting with an aerial photo of the area, I filled each feature related to cars (roads, parking lots, driveways, commercial facilities, and garages) with a different color. I then looked at the number of pixels of each color in proportion to the number comprising the photo and found that just over one third of the land was devoted to cars. This is broken down by category in Table 1 below, while Figure 1 shows how much of the total land devoted to cars is used for each feature. All the amounts are rounded to the nearest whole number as the accuracy achievable using the photo method does not justify providing more precise figures, and the point is illustrated just as well without giving all the decimal places.

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2 *Our Nation's Air: Air Pollution*. Rep. Environmental Protection Agency, Feb. 2012. Web. 13 Feb. 2015. <http://www.epa.gov/airtrends/2010/report/airpollution.pdf>. p. 4

3 United States. Department of Transportation. Federal Transit Administration. *Public Transportation's Role in Responding to Climate Change*. By Tina Hodges. Jan. 2009. Web. 13 Feb. 2015. <http://www.fta.dot.gov/documents/PublicTransportationsRoleInRespondingToClimateChange.pdf>. p. 1

Table 1

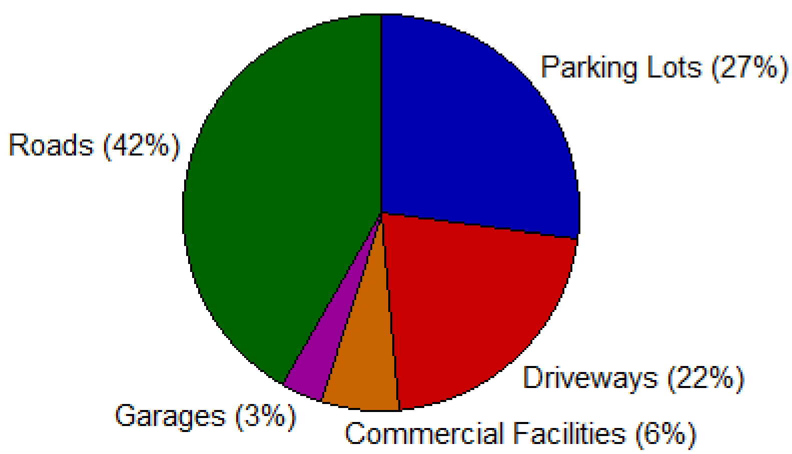
Type	Square Feet Occupied	Percentage of Land Occupied
Roads	141,790	14
Parking Lots	91,484	9
Driveways	73,002*	7
Commercial Facilities (i.e. an auto repair shop)	21,260	2
Garages	11,678**	1
Total	339,214	34***

*This figure includes the apron and the part of the sidewalk cars must cross to reach the driveway.

**Attached garages were not included in this figure because it was generally unclear where the garage ended and the rest of the building began, and even if there were no garage, the building may well have occupied the same footprint anyway.

***This figure is greater than the sum of those above as it was rounded from an original figure of 33.9…

Figure 1



I selected this particular piece of land in part because it is familiar to me, making correct identification of its features much more likely. Moreover, at its center is an empty lot, the value of which could be used to estimate that of the surrounding land, as will be shown to be useful below. This area is also fairly representative in terms of land use for the wider vicinity, being a mix of residential and commercial structures and having examples of all the elements found more broadly: stores, homes, parking lots, major roads, side streets, and so on.

The empty lot measures 4,520 square feet[4], and the county assigns it a fair market value of $114,100[5], or $25.24 per square foot. Using this figure, the value of the land devoted to cars in the

4 "Front St Uniondale NY 11553, MLS # 2734053." Keller Williams Realty, Inc. Web. 9 Mar. 2015. <http://www.kw.com/homes-for-sale/11553/NY/Uniondale/Front-St/3yd-MLSLINY-2734053.html>.

5 Nassau County, New York. Department of Assessment. *Land Records Viewer*; Result for Section 34, Block 477, Lot 247. Web. 6 Feb. 2015. <http://lrv.nassaucountyny.gov/>.

whole million-square-foot area examined is about $8.6 million. Granted, this is somewhat misleading. For instance, if someone no longer needed a driveway, in most cases, the land it occupied could not be sold off, like to put up a building; not much else could be done with the land except planting a lawn or garden, though this is still a better use for it than having yet another patch of concrete or blacktop. Also, many people use their garages for other purposes besides parking their cars, like as a general storage area or workshop, and buses and trucks use the roads in addition to cars, though in many cases the roads would not need to be as broad or as numerous without the latter. However, the point of the estimate is to give some sense of the value of the resources tied up in the current car-based transportation system. Using the land like this is astoundingly inefficient, with a third of it devoted basically just to being able to access the rest.

More conservatively, one could consider only the parking lots, which would be of little further use if cars were ever eliminated and are often big enough to potentially be used for substantial purposes like putting up new buildings. With this, one still gets the significant figure of approximately $2.3 million for the area considered here. Extrapolating this out to the 284.72-square-mile[6] area of the whole county, to get a very rough estimate, about 26 square miles are tied up in parking lots, on the order of $18.3 billion worth of land. Even if with more nuanced calculations, the actual number were revealed to be, say, half the one provided here, it would still be immense. Then try to imagine the value of the land that must be tied up in parking lots across the whole state or country. That vast sum of money is being used now to store cars.

While it would be hasty to say that, because of all this, a scheme to eliminate cars would be profitable or even pay for itself, it is reasonable to think that, if handled correctly, the economic potential of the land freed up would generate at least a significant amount of the wealth consumed. Obviously, reworking the system so extensively would create upheaval in the transportation sector and cost a tremendous amount of money, but this cost would be spread over decades, and the land that would suddenly become available, such as in the hearts of cities, would present a tremendous opportunity for new development. The cost would also be offset by priceless benefits like improved safety and cleaner air. When taking a broader view of things, cost does not really pose a challenge to the case for universal mass transit anyway. After all, how much did it cost to build all the paved roads, highways, bridges, tunnels, parking lots, oil platforms, refineries, and so on that are needed to support cars?

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6 United States. Department of Commerce. Census Bureau. *State & County QuickFacts; Nassau County, New York*. Web. 13 Feb. 2015. <http://quickfacts.census.gov/qfd/states/36/36059.html>.

As they represent a waste of land, cars represent a waste of many resources. The average new car gets 24.1 miles per gallon[7] and can carry about five people. A transit bus gets 4.91 miles per gallon[8] and can carry about 50 people[9]. So while a car may be about five times as fuel efficient, a bus can carry 10 times the passengers; that is, it would take 10 cars filled to capacity, burning approximately .4 gallons of fuel per mile altogether, to carry as many people as one bus filled to capacity, burning about half as much fuel, slightly over .2 gallons per mile. To look at it another way, a car with five passengers would use .08 gallons per passenger per mile, while a bus with fifty would burn .004 gallons per passenger mile. Of course, in both sets of figures, there is significant potential for variation because, for instance, neither vehicle will necessarily be filled to capacity in a real-world situation. However, if anything, this skews the results in favor of buses, since it is less common to see an overcrowded car than an overcrowded bus. And even taking the average occupancy of transit buses, 9.2, the low end of the range of possible figures at that[10], and of cars, 1.08[11], the bus still comes out slightly ahead. Also, mass transit tends to generate less carbon dioxide emissions overall than cars[12], as one would expect if it consumes less fuel.

There is a potential savings in raw materials and labor as well when relying less on cars and more on mass transit. For instance, consider that the average car in the United States weighs around two tons[13] and, again, can carry about five people, while the average transit bus might weigh 32,400[14] pounds and carry 50. This means that, when the vehicles are filled to capacity, for each passenger in the car, there is 800 pounds of material composing it, while for each bus passenger, there is 648 pounds of

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7 Hirsch, Jerry. “Average Fuel Economy of New Cars Rises to Record 24.1 Mpg, EPA Says.” *Los Angeles Times*, 8 Oct. 2014. Web. 13 Feb. 2015. <http://www.latimes.com/business/autos/la-fi-hy-cars-fuel-economy-epa-20141008-story.html>.

8 Figure derived from averaging those for buses that run on diesel and compressed natural gas, which together make up about 97% of transit buses in service, as given in United States. Environmental Protection Agency. Office of Atmospheric Programs. *Climate Leaders Greenhouse Gas Inventory Protocol Offset Project Methodology for Project Type: Transit Bus Efficiency*. Aug. 2008. Web. 13 Feb. 2015. <http://www.epa.gov/climateleadership/documents/resources/transit_protocol.pdf>. p. 14

9 McCoy, Michael, Mila Nelson, John Farrar, and Anne Palatino. *Design Guidelines For Bus Transit How to Make Bus Transit Effective in Your Community*. Riverside Transit Agency, Aug. 2004. Web. 13 Feb. 2015. <http://puff.lbl.gov/transportation/transportation/energy-aware/pdf/rta-design-guidelines-v7.pdf>. p. 19

10 United States. Department of Transportation. Federal Transit Administration. *Study & Report to Congress: Applicability of Maximum Axle Weight Limitations to Over-the- Road and Public Transit Buses*. Dec. 2003. Web. 8 Mar. 2015. <http://caltransit.org/cta/assets/File/FTA%20Study%20on%20Axle%20Weights.pdf> p. 67

11 Figure for average vehicle occupancy in New York specifically and, incidentally, the average for the entire United States (the 50 states, Washington D.C., and Puerto Rico) rounded to two decimal places, as given in U.S. Census, 2000. “State Averages for Private Vehicle Occupancy, Carpool Size and Vehicles Per 100 Workers.” University of South Florida, 2010. Web. 27 Feb. 2015. <http://www.nctr.usf.edu/clearinghouse/censusavo.htm>.

12 *Public Transportation’s Role in Responding to Climate Change*. pp. 2-3

13 Hakim, Danny. “Average U.S. Car Is Tipping Scales at 4,000 Pounds.” *The New York Times*, 5 May 2004. Web. 13 Feb. 2015. <http://www.nytimes.com/2004/05/05/business/05weight.html>.

14 McCoy et al. p. 19

material per person. This difference, over many millions of cars, adds up to millions of tons. One should also consider any commensurate savings in labor hours and energy consumption during manufacturing that may result from making just one larger machine as opposed to five smaller ones. Again, however, the numbers, such as the weights of the vehicles, will vary in the real world, but even when taking the typical occupancies, the bus still remains more efficient in terms of weight by a small margin. Regardless, the point is that mass transit certainly has the potential advantage over cars, even if it is not fully utilized in practice, and that only speaks for the current execution of the idea of mass transit rather than the idea itself.

In contrast to mass transit, which tries to move as many people in as few vehicles as possible, it is pretty questionable to build a transportation system around moving a machine weighing thousands of pounds just to move, in a typical situation, a single human or maybe two, each weighing only 180 pounds or so on average, and then to keep many millions of these machines operating. It becomes even more questionable where shorter distances are involved,[15] like in driving a few blocks to the store. The average trip length, while more than this, is relatively short, about 10 miles[16], and having to move thousands of pounds just to travel on that scale and where just a couple of people are concerned is excessive to say the least. Even on the face of it, basically every individual owning or striving to own a bulky, expensive, and dirty transportation machine, with, in actuality, one car per just about every licensed driver in the U.S.[17], does not make much sense.

While people have been talking about developments like electric cars and hydrogen-powered cars for decades as a way to reduce emissions, not until very recently have hybrids and such been appearing on the road in significant numbers, and the large majority of cars on the road today still have conventional engines in spite of high oil prices and grim predictions regarding global warming. On the other hand, hybrid-electric transit buses, buses that run on natural gas, and trolleybuses have become relatively commonplace, with certainly a greater proportion of buses than cars already running on alternative energy, while the bulk of streetcars, light rail, and a significant amount of commuter rail are electrified. Apparently, mass transit is more amenable to the conversion from gasoline and diesel.

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15 Barnatt, Christopher. 25 Things You Need to Know about the Future. London: Constable, 2012. Print. pp. 157-155

16 United States. Department of Transportation. Federal Highway Administration. *Summary of Travel Trends: 2009 National Household Travel Survey*. By Adella Santos, Nancy McGuckin, Hikari Y. Nakamoto, Danielle Gray, and Susan Liss. June 2011. Web. 22 Feb. 2015. <http://nhts.ornl.gov/2009/pub/stt.pdf>. p. 16

17 *Ibid.*, p. 15

In addition to polluting less overall, buses are safer than cars. On average, there are 40 yearly fatalities among passengers on transit buses[18] for the approximately 20 billion miles ridden per year.[19] With respect to cars, there is an average of 27,708 fatalities among vehicle occupants each year[20] against over 3.2 trillion passenger miles driven[21]. Comparing these two ratios suggests more than a four-times greater risk of death in cars than onboard buses. Another way to make this evaluation would be to compare proportionally the number of fatalities in buses per the number of buses in service to the fatalities in cars per the number of cars, which, as it turns out, would suggest buses are about three times more dangerous. However, this is not a legitimate measure because a considerable number of bus accidents presumably involve cars, since there are many more cars on the road than buses,[22] and looking at the issue in terms of the number of vehicles basically assumes only one type of vehicle on the road is involved in accidents. Examining the issue in terms of passenger miles, on the other hand, considers how many people die versus how much they use each mode of transportation, that is, how often they are exposed to the possibility of a collision in each. Aside from the statistics of car and bus crashes, another point to consider is that buses are probably inherently safer vehicles: bigger, more robust, higher off the ground, and they move more slowly. True, as they pick up and let off passengers, they constantly move in and out of traffic, which exposes them to additional risk of collision, but the danger is largely from cars trying to pass them.

Aside from drivers' impatience and mistakes, design flaws and other mechanical faults in cars are a further cause of accidents. Such issues can be caused by incompetence, cutting corners, or plain corruption on the part of the manufacturer or neglect on the part of the owner, and so the same problems could of course affect vehicles used for mass transit. But since there would be fewer vehicles in a transportation system consisting solely of mass transit, it would be easier to inspect and oversee them than many more cars, and they would also be operated and maintained by professionals, as

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18 Hermann, T. *Mass Transit Crashworthiness Statistical Data Analysis*. Rep. no. FTA-0002. Ed. G. Olivares. National Institute for Aviation Research, 16 Dec. 2005. Web. 11 Feb. 2015. <http://www.fta.dot.gov/documents/Crashworthiness_Report.pdf>. p. 19

19 United States. Department of Transportation. Bureau of Transportation Statistics. *National Transportation Statistics, Table 1-40: U.S. Passenger-Miles (Millions).* Web. 22 Feb. 2015. <http://www.rita.dot.gov/bts/sites/rita.dot.gov.bts/files/publications/national_transportation_statistics/html/table_01_40.html>.

20 Figure averaged from those for 2000–2013 given in "Highway Safety Topics." Insurance Institute for Highway Safety, Highway Loss Data Institute. Web. 9 Mar. 2015. <http://www.iihs.org/iihs/topics/t/general-statistics/fatalityfacts/passenger-vehicles>.

21 *National Transportation Statistics, Table 1-40: U.S. Passenger-Miles (Millions).*

22 135,399,945 cars as of 2006 vs. 61,245 transit buses as of 2012; United States. Department of Transportation. Bureau of Transportation Statistics. *National Transportation Statistics, Table 1-11: Number of U.S. Aircraft, Vehicles, Vessels, and Other Conveyances*. Web. 22 Feb. 2015. <http://www.rita.dot.gov/bts/sites/rita.dot.gov.bts/files/publications/national_transportation_statistics/html/table_01_11.html>.

opposed to just anyone who can pass a road test and has access to a car, so there would be a better chance of catching any issues before they had fatal results.

The Plausibility of Eliminating Cars

There was a time before cars, and people still got around. In fact, they got around without cars for all of human history up to the late 19th century, horses having been the major mode of transportation on land for millennia. Yet despite how indispensable they once were, horses were all but completely phased out decades ago. Imagine saying in 1800 that eventually horses would become basically irrelevant in transportation. Probably even into the 20th century, people would have thought you were insane, maybe even more so than someone proposing that cars be done away with now.

What if, for whatever reason, transportation technology had evolved so that the car never caught on, and we instead got a very extensive mass transit system? Imagine suggesting in such a world that everyone could have their own private vehicle. People would think that was insane as well. How much would it cost to build all those vehicles? Who could afford them? Where would we put them? How could we build enough roads to carry all that traffic? What about all the pollution, congestion, and accidents that would result? And yet we have such a transportation system.

If one tries, it really is not very difficult to imagine a world without cars, which have been commonplace for only a hundred years or so. Not every single individual has one, but such people still manage to get around, while some parts of the world carry on more or less without cars at all. In Venice, there are none in the city proper, and transportation there is by canal and pedestrian thoroughfare[23]. This admittedly is due to the city's unusual situation of being so close to sea level and spread out among many islands, but it still illustrates the point that a city can operate largely without cars. The town of La Cumbrecita, Argentina, to give another example, does not allow cars within its limits, and people get around on foot.[24] In New York City, more than half of workers commute to their jobs using mass transit[25], while in the lower 2/3 of Manhattan, around 3/4 of households do not even have a car,[26] so it does not take very much to envision it becoming altogether carless someday. If mass

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23 "Venice Travel Tips." U.S. News & World Report. Web. 10 Mar. 2015. <http://travel.usnews.com/Venice_Italy/Travel_Tips/>.

24 Comuna De La Cumbrecita. Web. 22 Feb. 2015. <http://www.lacumbrecita.gov.ar/nuestropueblo.html>.

25 United States. Department of Commerce. Census Bureau. *Table S0802: Means of Transportation to Work by Selected Characteristics* (for New York City, NY). American FactFinder, 2013. Web. 22 Feb. 2015. <http://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=ACS_13_1YR_S0802&prodType=table>.

26 *Manhattan Core Public Parking Study*. Rep. NYC Department of City Planning, Transportation Division, Dec. 2011. Web. 22 Feb. 2015. <http://www.nyc.gov/html/dcp/pdf/mn_core/mncore_study.pdf>. p. 8

transit can serve the transportation needs of millions of people in a major city, it is reasonable to believe it can serve such needs completely and in other locales.

The main reason doing away with cars seems impractical is people are so used to them that almost nobody questions their indispensability. Playing into this for some is the plain laziness and self-centeredness involved in wanting always to be able to go immediately from any one point to any other, being too pampered to ever go outside and be exposed to the weather except in the dash from house to car and car to final destination, or being too stuck-up to enter close quarters with the masses.

Then there are the vested interest in cars, like the auto and oil industries, which are profiting from things the way they are and would certainly use their considerable influence to try to obstruct any significant move away from cars. However, their interests are not those of humanity as a whole. One can imagine horse breeders, carriage makers, and blacksmiths reacting the same way a hundred or so years ago.

Eliminating cars would also eliminate a tremendous number of jobs, but as with every major social and technological change, there would be things for people to do in new areas. As will be further addressed, another objection that could be raised against the whole proposal is the plain scale of any project to extensively modify the transportation system; well, somebody would have to do all the work of modifying it. Additionally, people would no longer be so constrained as to where they could find work, while currently, not having a car or not being able to drive usually restricts one to workplaces within walking distance of transit routes, if there are any in a given area. Opening more employment options to more people could ultimately give them more spending power, which would also stimulate the economy at large. As for the expense of replacing cars with mass transit, it would obviously be great, but there would be great savings as well. In the end, fewer facilities, fewer roadways, and fewer individual vehicles would need to be built and maintained. On this note, recall the amount of land that would be freed up as well.

To get the maximum reward from a mass transit system, however, there should also be no fare to ride. Instead, it should be funded the same way most of the road system and the other infrastructure that supports cars is now—through taxes. People do not have to pay a toll just to pull out of their driveways, but generally whenever someone sets out on the bus, there is a fare. Unrestricted transportation would increase the freedom of individuals in general. The expanded ability of all people, regardless of whether they had a driver's license or car, to travel, ultimately perhaps wherever and as much as they please, would present an opportunity whose bounds are difficult to foresee, not only for the enhancement of the individual but also economic. It could expand one's horizons similarly to how libraries, which are also free to use, can now, such as by exposing people to places they might not have visited, and from a business point of view, a greater movement of people inherently has the potential to increase tourism and commerce. Finally, it should be noted that not having to pay fares, especially in cases where payment is made upon boarding, would speed up the process of loading passengers on buses and other vehicles, every advantage in this regard valuable in its own right. In the case of employing mass transit to fully replace cars, it would also make the most sense to pay for it largely through taxes rather than through fares because almost everybody would be using it anyway.

Imagine a business owner, such as a person who runs a store, whose taxes go way up because of the construction of a new, extensive mass transit system in his city. While he would have an extra expense to deal with, he would perhaps be able to sell off land he had been using for a parking lot or put it to better use such as by expanding the store, no longer need to carry the expense and liability of a car, potentially have new customers able to reach him, and get to live in a cleaner, healthier, and safer environment. In such a case, he would have come out ahead in spite of the tax. Of course, all this can be picked apart. How would it all really work in practice? Would the owner really be able to get rid of his car, at least right away? How long would it take to find a buyer for the parking lot? And so on. While the rewards would probably not be fully realized immediately, the main point is that the cost of switching over stands to be offset by immense rewards over the long run.

But considering even mass transit today, one may question why people who do not use it should have any of their tax money go to support it. First of all, mass transit serves everyone in one way or another, even those who have access to a car. The more people who are driving instead of on the bus or train, the more traffic everyone has to contend with. The fewer people driving, the less chance there is of more bad drivers on the road. People who drive have to breathe as well, and fewer cars also translates to less pollution. Finally, mass transit is a convenient backup for people who own cars, as when one’s car breaks down, there is an alternative waiting.

A transportation system at least including mass transit is just something we need to have a modern civilization. Asking why one should have to pay taxes to support mass transit while owning a car is like asking why one should have to pay school taxes while not being a parent. The answer is it would not be pleasant for anyone to live in a society where almost no one was educated and where many would-be students were instead roaming the streets. Neither would it be pleasant to live with nothing but a mess of cars and pavement for a transit system. And to reverse the question, why should someone who does not have a car have to pay taxes that go toward things like highways and bridges?

However everything would be paid for if mass transit fully replaced cars, it is hard to imagine the cost to the individual being greater than that of owning a car. Currently, to operate a small sedan costs $7,930 per year on average[27]. But in New York City, where again, the majority already does use mass transit, the fare is still a comparatively tiny $2.50. Of course, this only covers one ride, including any transfers, but as things stand, in order to equal the expense of owning a car, one would have to make almost nine separate trips on the bus or subway for each day of the year. And this does not consider larger cars, which are even more expensive to operate[28]. Additionally, if the mass transit system were drastically expanded, assuming three separate rides a day as typical, the cost to the individual passenger would have to almost triple even to equal that of owning a car.

To see whether the transition itself from cars to mass transit is likely to work, consider the transition to cars in the first place. Cities built up before modern transportation, with narrow roads designed for people, horses, and wagons, were still in large part able to retrofit accommodations for cars. European cities, many of them hundreds or thousands of years old, often have especially narrow roads, yet cars and all their infrastructure were somehow integrated in most areas. Horse-drawn societies became horseless within a few decades, so why could an auto-dependent society not become carless after a period of time? Cars could be phased out gradually, basically as horses were. People would start to see more transit vehicles and fewer cars in the same way looking at a photo of a street-scene from the turn of the 20th century reveals horses and cars sharing the road. Additional mass transit infrastructure could be built up over the years and more car infrastructure dismantled or repurposed, the cheapest and easiest strategy being conversion to buses, since they can operate largely on the same infrastructure cars do. More incentive could be provided to use mass transit and less to use cars, perhaps a tax credit toward transit fares and an additional tax on buying a car. Limits could be placed on the number of vehicle registrations that may be issued in a period of time, and more and more roadways could be closed to cars and given exclusively to buses.

One issue such suggestions raise is that many people would view the loss of cars as a loss of freedom and independence, even as the infringement of a right, as if society owes them a place, an endless web of roads, on which to operate a private vehicle. However, the autonomy cars seem to afford, of being able to pick oneself up and go anywhere at any time, is largely an illusion. A driver is limited to where the roads go and all the rules that govern their use. The expense of buying and operating a car and the possibility of being held liable in an accident for someone’s death, injuries, or property damage constantly constrains the car owner, while a blizzard, spike in fuel prices, fuel shortage, or mechanical failure can immediately dissolve the liberating effect of having a car. Even

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27 *Your Driving Costs: How Much Are You Really Paying to Drive?* American Automobile Association, 2014. Web. 23 Feb. 2015. <http://publicaffairsresources.aaa.biz/wp-content/uploads/2014/05/Your-Driving-Costs-2014.pdf>. p. 7

28 *Ibid.*

though, in theory, a car lets people go more or less anywhere whenever they want and travel long distances in a workable amount of time, in practice, most are not able to make full use of these advantages because they tend to have to use a significant portion of their time to earn the money that pays for gas, insurance, and other automotive expenses. Being bound to thousands of pounds of steel inevitably weighs a person down, while an extensive and well-operated mass transit system could give all individuals freedom of movement regardless of their situation and without encumbering them like cars do. The current system makes you just as dependent on society as universal mass transit would unless you know how to fix your car, are able to manufacture your own replacement parts, own and maintain all the roadways on which you drive, have an oil well, and can refine the crude yourself into gasoline.

Related to these questions is the romance and nostalgia around cars, though the same feelings were tied to the horse and still are. Nonetheless, they should not dictate what we do with the transportation system, but rather what works best for moving people and goods should be the predominant consideration. It also seems likely that if cars are ever replaced, whatever replaces them will be worked into the culture over time and have emotions attached to it as well, just as took place with cars. And who would have thought people could become as attached to machines as they were to living creatures?

Regardless of what people do with their attitudes about transportation, however, they will eventually be forced, perhaps not to do away with cars altogether, but to rely on them less. The population is growing, and there are constantly more cars on the road. With this, congestion is always increasing, and there is always a need for more roads and related facilities. But we cannot just keep building more and bigger roads forever; there is only so much space. Also, the supply of fuel and of raw materials for car production is not endless, and there is a limit to how much pollution the Earth can absorb while still comfortably supporting civilization.

Even though eliminating cars may not eliminate every issue associated with them, like all traffic fatalities and all pollution, fewer vehicles on the road would mean both fewer opportunities for collisions and fewer emissions. Another way it would make transportation safer is by turning driving in general into more of a profession, specializing it like many other areas of life are, rather than having it as something nearly everyone does, including a lot of people who probably should not at all—ones who are too reckless, too aggressive, too nervous, have poor reflexes, or are big drinkers. Instead, formally and rigorously trained and screened professionals would operate the transit system, and this group would be much smaller than the current pool of drivers, so it could be more easily administered. Considering how dangerous travelling can be and how many are killed in the process, this would certainly be appropriate. Taking vehicles out of the hands of the average person could also reduce the likelihood of them being used deliberately as weapons, like a car bomb in a terrorist attack, while the possibility of things like bus hijackings could be largely removed by isolating the driver from the rest of the interior of the vehicle.

To take all this a step further, if it ever becomes feasible to have self-driving vehicles operating autonomously in large numbers on public roads, which would have the advantage of eliminating most human error in driving and replacing slow human reflexes with the speed of a computer, mass transit vehicles would be the most practical candidate for conversion. Because they follow fixed routes, the computer would only have to know a limited area, and there would be fewer variables for it to handle, unlike cars, whose potential routes are indefinite. Light rail, in fact, can be automated with today's technology, and 48 lines in 32 cities already are[29].

To get a more tangible idea of what it might take to replace cars with mass transit, I set out to measure the number of vehicles at peak on a major roadway. To this end, I observed the traffic on Hempstead Turnpike, one of the biggest roads in Nassau County, just west of its intersection with Uniondale Avenue at a location just under half a mile north of the area examined in the first section of this essay. I watched each of the six lanes individually for five minutes, counting all the vehicles as they passed a fixed point, at which there was no interference from turning lanes, side streets, or driveways. I spent a total of 30 minutes observing the road for each session (the ranges of times, as listed in Table 2, vary slightly owing to any pauses taken to get situated for observing the next lane), spread over the equivalent of each day of the work week, no holidays included, to get an idea of the flow of traffic on the whole section of road over five minutes. I observed the road ten separate times, five during the morning rush hour and five during the evening rush hour.

Being that I was taking the count manually (using a tally counter), trying to limit it to passenger vehicles, that is, to determine on the fly which vehicles should be counted and which should not, would have been problematic. Similarly, my accuracy would have been compromised if I had tried to observe all the lanes simultaneously, which is why I took them one at a time. This, along with observing over different days and times, also gave me the opportunity to spread each series of observations over a longer period to get a broader cross-section of the volume of traffic. In cases where a vehicle happened to change lanes at the point I was observing, I counted it if it was still mostly in the lane currently being observed as it passed the designated point. Table 2 shows the results.

29 *Observatory of Automated Metros, World Atlas Report*. The International Association of Public Transport, 2013. Web. 8 Apr. 2015. <http://www.uitp.org/sites/default/files/cck-focus-papers-files/Annual-World-Report-2013.pdf>.

Table 2

Date and Time of Observation	Total Vehicles for All Lanes
Tuesday, 8/12/14; 7:20 am - 7:54 am	170
Tuesday, 2/17/15; 5:17 pm - 5:55 pm	183
Thursday, 2/19/15; 7:59 am - 8:33 am	210
Thursday, 2/19/15; 4:00 pm - 4:34 pm	220
Monday, 2/23/15; 4:31 pm - 5:04 pm	285
Wednesday, 2/25/15; 8:32 am - 9:07 am	257
Wednesday, 2/25/15; 4:55 pm - 5:28 pm	291
Friday, 2/27/15; 6:47 am - 7:31 am	171
Friday, 2/27/15; 4:30 pm - 5:04 pm	281
Monday, 3/2/15; 8:28 am - 9:02 am	189
Average	**225.7**
Est. Avg. Daily Traffic*	**65,001.6**

*calculated by multiplying the average by twelve to get an estimate of the vehicles per hour (the figure for each session represents an estimate of the vehicles passing on the whole section of road in five minutes) and multiplying that by 24 to get the vehicles per day

Incidentally, my estimate of average, daily traffic volume, 65,002 vehicles (rounded to the nearest whole number) is significantly higher than the state Department of Transportation's estimated average for the same vicinity, between 40,660 and 52,010,[30] which is what one would expect considering my estimate was derived only from rush-hour traffic. But using this worst-case figure and again taking 1.08 for average vehicle occupancy[31], about 70,202 people per day can be said to drive through the area I observed. Using 50 passengers as the average capacity[32], a bus would need to pass a little less than once per minute to replace all the cars.

Currently, at maximum, a bus goes through the area about every 15 minutes in each direction, eastbound and westbound[33]. But while one per minute would obviously be a dramatic increase, it is not inconceivable. Rather than creating an unbroken chain of buses or completely jamming the road with them, each vehicle would be about 1/5 of a mile apart on average[34]. It should be noted first that this is a

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30 2011 Traffic Data Report for New York State. Rep. 25 Sept. 2012. Web. 9 Mar. 2015. <https://www.dot.ny.gov/divisions/engineering/technical-services/hds-respository/Traffic%20Data%20Report%202011.pdf>. p.153

31 "State Averages for Private Vehicle Occupancy, Carpool Size and Vehicles Per 100 Workers."

32 McCoy et al. p. 19

33 "n70/71/72." Nassau Inter-County Express, 18 Jan. 2015. Web. 9 Mar. 2015. <http://www.nicebus.com/NiceBus/media/NiceBus-Schedules/NiceBus-SchedulesApp/NICE-n70-71-72_MapSchedule.pdf>.

34 Calculated using *distance = rate × time*, with the one-minute interval used for the time and 11.7 mph for the rate as given in *Commonsense Approaches for Improving Transit Bus Speeds: A Synthesis of Transit Practice*. Rep. Transportation Research Board, 2013. Web. 13 Feb. 2015. <http://onlinepubs.trb.org/onlinepubs/tcrp/tcrp_syn_110.pdf>. p. 7 (Average bus speeds are broken down by system size in the report; the slowest figure of 11.7 mph is used here.)

much longer distance than currently tends to separate each car on the road. Moreover, fifty passengers per vehicle is by no means the limit to capacity. Large articulated buses can typically hold around 110[35], so if this type were used, the number of vehicles needed would be more than cut in half, reducing the interval to around two minutes. Such would be precedented as, for instance, the B46 bus in New York City runs every two minutes at certain peak times[36]. In fact, up to 120–180 buses per hour has been shown in Portland to be attainable, using a dispatcher and as long as there is enough room for buses to pass each other, while 450 buses per hour could potentially be reached through non-conventional means of deployment and special infrastructure[37]. Finally, to consider the total number of buses required for Hempstead Turnpike, a different one would not be needed for every two minutes of the whole day. If the buses, now twice the distance apart, 2/5 of a mile, operated in a loop down the 16.2-mile length of the road[38], going from one end to the other and then returning, about 41 would be needed for each direction. This is much more efficient than the hundreds or thousands of cars presumably on the thoroughfare at a given time. Why would operating 82 buses be less practical than operating tens of thousands of cars over the course of a day?

One potential objection is the issue of delays created by things like loading and unloading passengers, all the stopping and going, but the estimate of bus speed that was used in the calculations above is an average and thus reflects such delays. There would also almost certainly be a speed increase from what is currently typical for buses, since the elimination of cars would mean dramatically less congestion on the roads as well as a drastic shortening of the time it generally takes to get an opening to pull back into traffic. Another objection that could be raised is that my estimate of the number of buses that would be needed assumes every bus will be filled to capacity, but keep in mind that the previous calculations were made using rush hour volumes, creating some margin for error; that for most of the day, the required capacity would be lower; and that the lack of cars would greatly increase the demand for buses, so they would run closer to capacity than they do now. Also recall that my estimate of traffic volume counted all vehicles on the road, not just cars, which is what the buses would predominantly be replacing, and this inflates my estimate of traffic volume even further. Finally, the increase in the demand for buses that would result if the transition from cars were made would also most likely spur the development of vehicles that have even higher passenger capacities.

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35 Vuchic, Vukan R. Urban Transit Systems and Technology. Hoboken, New Jersey: John Wiley & Sons, Inc., 2007. Print. p. 218

36 "B46 Bus Timetable." Metropolitan Transportation Authority, 31 Aug. 2014. Web. 19 Feb. 2015. <http://web.mta.info/nyct/bus/schedule/bkln/b046cur.pdf>.

37 Vuchic pp. 190, 264

38 2011 Traffic Data Report for New York State. pp. 154–155

It of course would not make much sense to have only Hempstead Turnpike go carless and the rest of the area carry on as usual; in such a case, what about the transition between this carless area and everywhere else? If the switch away from cars were ever made in Nassau County specifically, whatever transit route may be established on Hempstead Turnpike would be integrated into the design of and working in tandem with a much larger system, one specifically set up to act in lieu of cars, so the road would not necessarily even have to meet the same demand it did when it carried cars, if it even still existed.

A Glimpse of a Better Transportation System

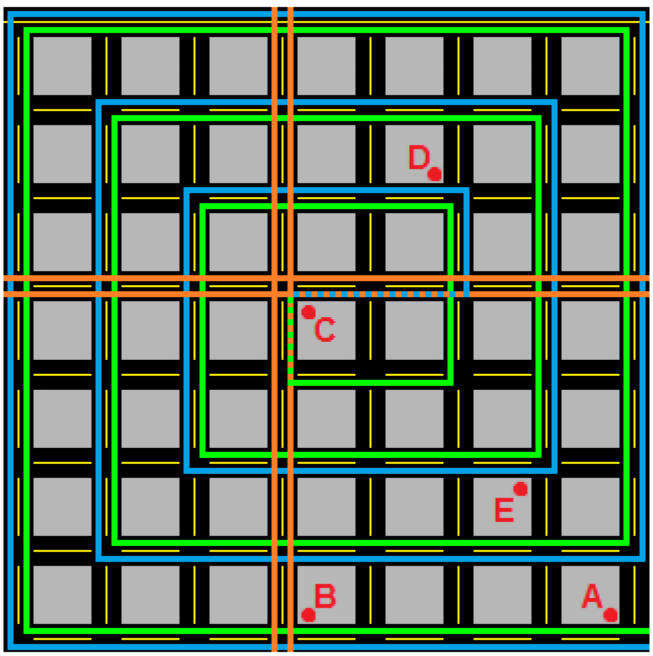
The most unpleasant aspect of taking the bus is having to wait for it. While running buses every two minutes may seem like a lot, it would also have the advantage of removing probably the biggest deterrent to using them. If the wait to catch one were always essentially a matter of just a couple of minutes, such would be trivial; people spend more time waiting for their cars to warm up. Taking this with the expected reduction of traffic if cars are ever phased out, riding the bus would perhaps equal them in terms of travel time.

To improve the speed even further, considering that with so much bus traffic and so many vehicles stopping and going there would certainly be a potential for things to jam up even with the car traffic gone, buses in busier areas could be deployed in what is known as a skip-stop pattern rather than having every bus serve every stop. Consider buses designated A, B, C and perhaps D and beyond. Correspondingly, some stops along a route would be designated A stops, others as B, etc. so that A buses would only stop at A stops, B buses at B stops, and so on. This would help prevent too many buses from stopping at the same spot at once and any bus from having to crawl down the road by stopping and going excessively. In order to balance these benefits against the disadvantage of potentially increasing the distance someone must walk between stops, at least some part of them could be arranged in clusters. Each letter would be far enough from the others so that the buses would have plenty of space and passengers spread among the stops would be deterred from suddenly converging when a bus pulled up to one yet close enough together that it would not be much of a hassle for passengers to walk from one to the other. An additional measure would be to use a mix of express and local buses, the former giving those who had to go a greater distance along the route the opportunity just to skip most of the stops in general and, from a systemic point of view, further reducing the number of vehicles constantly stopping.

While only buses have been the focus up to now, a mass transit system to replace cars would not be limited to that mode of transport. Perhaps the volume of traffic down Hempstead Turnpike and similar roadways would justify augmenting them with streetcars or replacing them with light rail lines, which would be capable of accommodating many more passengers, 125–500 for a light rail vehicle consisting of 1–4 cars, and achieving higher speeds[39]. This would also be the most feasible replacement for highways, which have the highest passenger volumes compared to normal roadways. The bus, on the other hand, would be left for more local travel or for making the areas between those served by light rail accessible.

Possibly, buses could provide transportation coverage to most of the smaller roadways in a city, ones that are not traveled by rail or major bus lines, and without requiring transfers, at least locally, by following spiral patterns through the grid of streets like the one illustrated below.

Figure 2



The green line represents a bus route starting at the edge of the map and winding its way toward the center, the blue line represents a bus route then spiraling back out to the edge. Express and local buses could alternate along these routes, the express service allowing people who need to get deep within the spiral to travel there more quickly. Also to this end, represented by the orange lines, there could be bus routes that cut through the spiral, letting people who need to travel longer distances in

39 Barnes, Kristianna. “Streetcar and Light Rail Characteristics.” FasTracks Regional Transportation District of Denver, 8 Nov. 2006. Web. 3 Mar. 2015. <http://www.rtd-fastracks.com/media/uploads/gl/lrt_streetcar_analysis_formatted.pdf>. p. 8

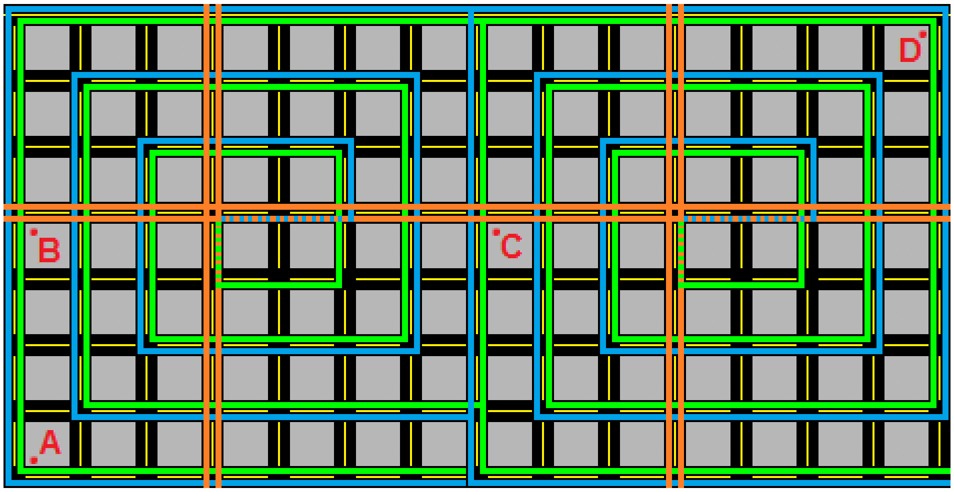
skip some of the spiral's iterations, though at the cost of having to transfer. Notice as well that the orange lines follow roads largely unoccupied by the lines that make up the spiral, preventing interference with them and reducing any congestion. Modified versions of this basic pattern could be employed in cities with more irregular street layouts, either by modifying the spiral to fit the existing road network or just employing more conventional bus routes on a larger scale and having additional routes intersect as many of them as possible. Basically, any system would have to be tailored to the circumstances of where it was implemented, though the same basic ideas would apply.

Consider a person wanting to travel from A to C on the grid. Instead of riding the bus all the way in along the green line, he could transfer from the green line to the orange line at point B. On the other hand, it would probably be easiest for someone wanting to get, say, from point D to E just to stay on the blue line. Imagine even a kind of articulated bus specialized for this system that separates down its joint when it reaches one of the intersections between the routes, with part continuing along the spiral and the other heading down the orange line. Taking the idea further, maybe there could even be a train-like bus, from which cars separate and go their own ways along a route. The sections could reconnect at some point, such as to repeat the process for the return trip. Or perhaps green and blue-line buses could physically dock with orange-line buses, also allowing the transfers to be more or less seamless. If the buses run frequently enough, such would not require either bus to wait a significant amount of time for the other.

People would not necessarily even have to think about how to navigate this system. A central computer could keep track of the locations of all the buses at all times and any issues that occur with them, while using a kiosk at the bus stop, computer program, or smartphone app, passengers could simply enter their destination and, taking into account all current conditions, the optimal route would be plotted for them automatically. This in large part is already possible using websites like HopStop or Google Maps. To take it further, a smartphone, or whatever portable computer, could even give directions in real time, indicating things like when to get off or where to transfer. However, the only information people would really need to navigate, at least more locally, is whether their destination was closer to or further from the center relative to their current location.

An entire city could be covered by a series of spiral bus routes, connected together by straight runs like the orange lines in Figure 2. While the spirals would overlap at their edges, sharing the roads there, each series of buses would keep to its own spiral path. Ideally, the intersection of spirals would be at major roads, not only to better handle the extra traffic caused by the overlap but also because the main point of the spirals is to provide coverage to the streets in between the most traveled routes. By keeping each spiral relatively small and isolated, the rides through each are also kept from being too slow or confusing. If, for example, in the diagram below, a passenger wanted to travel from point A to point D, he could take the green line of the first spiral up to B and transfer to the orange line. At C, he could transfer to the green line of the second spiral and ride it around to point D.

Figure 3



Depending on the particular situation, some of the streets in a grid could even be eliminated and replaced by narrow lanes designated for pedestrians, which would connect the buildings cut off back to the remaining roadways. Ideally, roads and cities would eventually be designed from the beginning for use by mass transit, rather than foremost for cars and with mass transit having to make do, resulting in even more optimal use, a possibility which is explored in the appendix.

Either way, any space freed up could then be filled in with additional buildings or even just trees and parks. To illustrate this, the street on which I live originally had only thirteen houses, yet it is a full-size, two-lane asphalt roadway with sidewalks and curb strips, about 420 feet long and 50 feet wide altogether[40]. It would be a much better use of land if there were just a narrow lane, not routinely traveled by motor vehicles though able to accommodate in an emergency or special situation, bisecting a community garden where the rest of the road used to be. In that case, my neighbors and I would just go down to the corner to get a bus when we had to go somewhere; European cities often have areas where the roads are so narrow they can only be accessed on foot, and yet people live there. Residential neighborhoods would be safer and more pleasant without the traffic, vehicle noise, and pollution.

As for how to transport, for instance, babies or people in wheelchairs, no discussion is really needed as it is already routinely managed with current mass transit. Cars, however, carry more than passengers. If they were phased out and mass transit replaced them, there would need to be a way for

40 As measured in Google Earth

people to transport their cargo. Some take the bus to go shopping, for one thing, and some go to the airport with their luggage by train, but still, one can carry much more personal cargo by car. Part of the issue could be solved by designing buses with overhead or under-seat storage like on an airplane or train. The same way that luggage and other items may be designed now with the size of a car's trunk in mind, they could be designed for the storage available on a bus. However, there would still have to be a way to accommodate larger items. In some areas, buses are equipped with bike racks for cyclists to take their bikes along with them, so perhaps buses could be similarly equipped with compartments to store large passenger cargo.

For larger items still, a public freight system could be implemented to supplement the mass transit system. Some number of buses along a route would be equipped to carry few passengers but a great deal of cargo for people who need to transport more or larger items. More of these would operate in areas where such is likely to be required, like in the vicinity of shopping centers. There could also be vehicles that operate essentially the same way as buses, but instead of passengers, they would carry exclusively cargo: freight buses. Imagine somebody who just bought a chair and now needs a way to get it home. At a bus stop, he would place it on a freight bus analogously to how a passenger would board, and its destination would be noted in some kind of computer system. Then either attendants or an automated mechanism would unload it at the destination. If the owner did not arrive first, there could be facilities near stops served by freight buses to secure it. As for transporting the item to and from the stop, keep in mind that, mass transit being used much more extensively, stops would be much more numerous, carefully constructed, and situated than they are now, so perhaps it would go right from the store or wherever it came to the bus and then right from the bus to the owner's house. In the same way a hand truck may be used to take a large item from a store, through the parking lot, to a person's car, it could be carted right to a bus stop. All this may call to mind a seemingly silly image of someone going to a bus stop with something like a couch or piano, but how many people can fit a couch or piano in the trunk of their car anyway?

The next thing to consider is all the goods currently moved by truck, such as freight transported on tractor trailers or packages carried by private couriers, shipping companies, and the postal service. The easiest solution would be just to leave all this intact. Considering that passenger cars alone make up more than half of all highway vehicles[41], even if only cars were eliminated and most commercial vehicles were still allowed, the advantages of switching over to mass transit presumably would remain very significant. This could be further assured by measures such as designating certain lanes for use by commercial vehicles, restricting them to certain areas, and having more stringent licensing procedures.

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[41] *National Transportation Statistics, Table 1-11: Number of U.S. Aircraft, Vehicles, Vessels, and Other Conveyances.*

However, if the resistance that would gush from the interested companies could be overcome, it is also conceivable to move at least the bulk even of this traffic onto the mass transit system. Regarding the everyday delivery of packages within a town or city, a public courier system—perhaps as a division of the postal service—along the lines of the public freight system already discussed, could be implemented to deliver packages door to door, serving the same purpose as private couriers and shipping companies. As for more exotic measures, Amazon.com is working toward a system for delivering packages by drone and claims such would be able to get customers their orders in less than half an hour[42]. If something like this turns out to be feasible and were implemented on a wide scale, not only could freight traffic be reduced but also the speed and efficiency of the mail system could be dramatically improved compared to ground-based delivery.

As part of these measures, heavy freight could be returned to rail, along with intercity passenger travel, where both largely had been before the Interstate system was built anyway. A further option is a return to airships, which would have many advantages. Since the craft move more slowly and literally float rather than using a mechanical system to keep them in the sky, as opposed to airliners, a catastrophic, high-speed crash is not very likely. In addition, even when punctured, airships can stay aloft for extended periods[43], and using helium instead of hydrogen, there would be no risk of a Hindenburg-type conflagration. Airships also use much less fuel than airliners and thus generate much less pollution, as well as having lower operating costs. While a major drawback to airships is that they are more sensitive to the weather, handling in non-ideal conditions has improved since their golden age.[44]

One example of a modern airship is the Aeroscraft, which was constructed in 2013 as a nearly half-scale prototype. Unlike its predecessors, it requires no ballast, no airport, and no ground crew to assist with the landing. It is also faster, with a top cruising speed of 130 mph. A full-size version would have a carrying capacity of 66 tons[45], which could conceivably translate to hundreds of passengers, all of which makes it seem like a potential alternative both to airliners, at least when high speed is not the foremost concern, and trains. One can envision airship routes connecting every city in the world with comparatively little new infrastructure needing to be added, nothing as extensive as runways and rail lines at least.

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42 "Amazon Prime Air." Amazon.com. Web. 28 Feb. 2015. <http://www.amazon.com/b?ie=UTF8&node=8037720011>.

43 Collins, Roger. "The Airship: Cruise Liner of the Future or One More Dream?" *The New York Times*, 4 Feb. 1994. Web. 6 Mar. 2015. <http://www.nytimes.com/1994/02/04/style/04iht-frequent.html>.

44 *Ibid.*

45 Emspak, Jesse. "Massive Airship Off to a Flying Start." *Discovery News*. 5 Feb. 2013. Web. 6 Mar. 2015. <http://news.discovery.com/autos/military-vehicles/massive-airship-flying-start-1302051.htm>.

Ultimately, if people were more concerned about getting to their destinations safely rather than quickly, transportation would not be so deadly, since lower speeds would mean less violent collisions, and there would be less incentive to cut corners in other areas if everything were not always a rush to the finish. To take a train ride across the entire continental United States now takes about three days, and what is so bad about that?

Another potential measure is using pneumatic transfer tubes, like are seen at some bank drive-throughs, to deliver at least part of the mail and small parcels. In the mid to late 19th century, cities all over the world in fact implemented pneumatic tube systems to supplement their postal services.[46] Such systems could be slowly built up, and over time, perhaps pneumatic tubes could in time be run underground between every building in a city, even between cities, as water, gas, and sewer lines are now, or alternatively strung on poles like wires.

One of the major challenges would be a effective routing system. Perhaps each item in the tubes could have an RFID tag affixed to it, which would be detected by sensors in the tubes to determine its location. As it went through the network, it would pass through a series of roundhouse-like devices, directing it closer and closer until it made its way right into a person's house. Items would enter the devices from one tube, be rotated toward the tube that would take them toward their destinations—the route calculated based on the RFID data—and finally released. Rather than going through postal facilities to be sorted, mail would pass right from sender to recipient. Something like this could make mail delivery close to instantaneous, at least over shorter distances, rather than requiring slow, bulky trucks to go street to street.

Also, instead of relying on physical mail, we could rely more on electronic communication, a trend that is well underway even as things stand. It does make more sense, rather than putting information on a physical object, like writing on a piece of paper, and sending the object, to just send the information, as in the case of an e-mail travelling as electricity through wires. Ever-improving communications technology also makes it possible for more people to telecommute, and on-line shopping has already replaced a significant amount of travel to physical stores, though increasing the need to transport packages at the same time. To take things further, it may eventually be practical in many cases to just send 3D computer models of objects and to produce them physically right in the home on a 3D printer as the technology becomes cheaper and more practical. On a small scale, at least among enthusiasts, this is already taking place.[47]

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46 Doctorow, Cory. "Pneumatic Tube-based Postal Systems of the Late 19th Century." Boing Boing, 11 Jan. 2009. Web. 3 Mar. 2015. <http://boingboing.net/2009/01/11/pneumatic-tubebased.html>.

47 Barnatt, Christopher. "3D Printing." *ExplainingTheFuture.com*. 30 Nov. 2014. Web. 3 Mar. 2015. <http://explainingthefuture.com/3dprinting.html>.

Aside from vehicles that carry packages, there are those that serve other special purposes. Among these are vehicles used to service cars, such as tow trucks, tanker trucks, and car carriers. This class of vehicles would be needed dramatically less if cars were ever eliminated, so they are not so much of an issue. Another example, however, is vehicles commonly used in construction, like bulldozers, cranes, cement trucks, and flatbed trucks. Ultimately, equipment needed on a construction site could just be brought there as it is now as long as there are still some kind of roads; nonetheless, viewing such machines simply as more trucks that have to drive on the roads like any other vehicle is the wrong way to think of them. Vehicles such as bulldozers and cranes are not used for transportation but for performing particular tasks and thus should be thought more of as cargo in a discussion of transportation and dealt with similarly to how very large cargo winds up being handled. Likewise, vehicles such as cement or flatbed trucks are really just specialized cargo transporters and again would just be dealt with along the lines of how vehicles for moving cargo come to be dealt with. Another thing to keep in mind is that these machines were built to operate on roads dominated by cars. In the future, they may evolve into forms suited to operate amid a mass transit-dominated infrastructure.

Next there are vehicles like a plumber’s or electrician’s van or a phone or cable company truck, each of which is generally filled with tools and supplies. Regarding how to incorporate their function into the system, one option, yet again, is to do nothing and let them just continue to use the roads, perhaps with additional regulations as mentioned previously. Another, as again could be done with cargo in general, is to incorporate them into a public freight system. In a world without cars, people would come to have entirely different modes of operating. Rather than hauling many more tools and equipment around all the time than will be used for a particular job, plumbers, electricians, and such will become more systematic in targeting the required supplies and determining exactly what is likely to be needed ahead of time, perhaps with the aid of a preliminary survey of the site via webcam or a computer-assisted analysis, based on information gathered on the current job and statistics of past ones. In many cases, such may bring the required supplies down to a level manageable on mass transit. Or perhaps certain supplies will be gathered on demand. For instance, a plumber would call for them by computer as he turned out to need them on a job site, and they would be flown in on Amazon-like drones. Even as it stands now, there are instances where a plumber will not happen to have the right fitting or gasket on the truck and have to go get it or come back another day anyway, and how much fuel must be wasted constantly hauling around hundreds of pounds of supplies? Finally, people with occupations that require travel from job to job with certain amounts of items but not necessarily truckloads of them, like computer technicians, could be more readily transitioned to using mass transit and the cargo capabilities built into it.

Another type of vehicle to consider is garbage trucks, though people would still need their trash removed regardless of the state of cars. A potential alternative, however, is automated vacuum collection, in which garbage is dumped in chutes instead of trash cans and ultimately drawn away to a processing facility via pneumatic tubes to be compacted and removed for final disposal. Such a system is already used on Roosevelt Island in New York City,[48] and automated vacuum collection has also been widely employed in hospitals. A major advantage is that trash collection is made closer to instantaneous, improving sanitation and aesthetics, rather than having to leave waste festering on the curb for collection where it can also interfere with the flow of traffic.[49] Further regarding the transportation system, automated vacuum collection also removes the need for trucks to go street by street collecting garbage.

As for snow removal, snow plows and salt spreaders would not necessarily have to change, since the roads would need to be cleared regardless of what types of vehicles were running on them. However, there may be ways to achieve this without having special machines take to the streets. Perhaps the buses themselves could be fitted with plows, the way trains can be now, to clear at least some of the snow. If the energy to do so could be generated economically enough, maybe the snow could just be melted as it fell rather than having to clear it and find somewhere to put it after the fact, such as with some kind of radiant heating system imbedded in the roads. Such a system may at least handle more modest snowfall. As for railways, perhaps the rails could be made thicker but have a void running down their cores through which hot water would be piped to melt the snow, at least in short stretches. In practice, heated lines for rubber-tired trains have already been employed in Paris[50]. For all this, access to geothermal energy, where there is naturally a supply of hot water, may be ideal.

Among the advantages to heating the roads rather than plowing them is that they would always be completely clear instead of treacherous or impassible in between plowings and with residual ice and snow afterward; the snow would not gather on them in the first place and water would not be allowed to get cold enough to freeze. A heating system also would not tear the roads up the way the plows do and would reduce the problem of freezing and thawing cycles jacking cracks open.

As for emergency vehicles, such as fire trucks, police cars, and ambulances, these would be left alone. In many cases, since so much traffic will have been removed from the roads, emergency vehicles

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48 Campbell-Dollaghan, Kelsey. “The Not-So-Crazy Plan to Solve NYC’s Trash Woes With Pneumatic Tubes.” Gizmodo. 18 Sept. 2013. Web. 14 May 2015. <http://gizmodo.com/the-not-so-crazy-plan-to-solve-nycs-trash-woes-with-pn-1342822457>.

49 Luiten, Peter H. “Vacuum Systems for the Collection of Solid Wastes.” Columbia University, 1976. Web. 14 May 2015. <http://www.seas.columbia.edu/earth/wtert/sofos/nawtec/1976-National-Waste-Processing-Conference/1976-National-Waste-Processing-Conference-39.pdf>.

50 Vuchic p. 386

could be given their own dedicated lanes. This is likely to greatly improve response time and overall safety, since emergency vehicles would no longer have to dodge and zoom past all the other traffic on the road. Concerning minor, non-life-threatening medical emergencies, the kinds of cases where people now drive themselves to the hospital or have someone drive them, a vehicle could be employed that would be a kind of hybrid of an ambulance and a taxi, somewhat like an ambulette or paratransit vehicle but less assuming. Someone who, for instance, got a sprained ankle or a cold, could call for an ambulance-taxi, and it would come and take him directly to his doctor or a hospital. In this sense, it would work essentially the way taxis do now, except it would be fast and reliable. However, unlike ambulances—or taxis for that matter—it would follow the normal rules of the road. And more than a taxi, perhaps it could have a place for the injured person to lie down or even be equipped to provide minor first aid and pain relief, serving the sick and injured much better than a car does today. Another important function of ambulance-taxis would be to keep people who are potentially contagious off of normal mass transit and out of close quarters with others. Moreover, the ambulance-taxi service could be extended to accommodate people in sudden, serious, non-medical emergencies like transporting relatives in the event of a death in the family.

If the cost of healthcare ever gets under control, perhaps there could also be a return to doctors making house calls. This would keep people who may infect others at home and spare them the extra suffering of having to travel to the doctor and sit in the waiting room while sick. From purely a transportation perspective, it would also be more efficient to have just the doctor traveling around to different patients than many patients traveling to the doctor.

In an emergency on a wider scale, there is sometimes a need to evacuate a densely-populated area. When relying on cars, this is impossible without a significant early warning because the roads become jammed with so many vehicles attempting to use them. A large, dedicated mass transit system, however, could have an "evacuation mode" ready to be implemented whenever it is needed, in which all transportation resources are devoted, in a coordinated fashion, to moving people out of an area.

To get a picture of some of the above proposals, again consider Hempstead Turnpike. For each direction, perhaps one lane would be devoted to passenger and freight buses or a light rail line, one to emergency vehicles and ambulance-taxis, and one chiefly to any remaining commercial vehicles and dedicated freight traffic.

Figure 4

As illustrated in Figure 4, the bus lanes are on the far sides of the road, so the buses, obviously, can pull over easily to let passengers on and off. The emergency lanes are on the inner part to insulate them the most from interference from other traffic. The commercial lane is in the center to act as a kind of buffer, such as a place where an emergency vehicle or bus can pass another in its own lane; this would be especially useful in cases where there was no shoulder. The orange lane marking indicates a bus lane, alerting drivers in the commercial lane that, if they cross it, they will be in a bus lane, and likewise with blue for the emergency lane. Commercial drivers would basically just have to know to stay between the orange and blue lines. Perhaps symbols could be painted in the lanes at some interval too, as depicted: an image of a bus, predictably, for the bus lane, a truck for the commercial lane, and a Star of Life for the emergency lane.

Another essential part of the system would be bike paths and pedestrian walkways. Human-powered transport would be made safer, more comfortable, and more convenient and otherwise encouraged as much as reasonably possible. One step would be providing benches, water fountains, rain shelters, and, at least in more heavily-traveled areas, public restrooms at reasonable intervals, set up for pedestrians specifically as opposed to the ones for "customers only," in addition to bus stops consisting of small, heated cabins. Pedestrians would also be totally isolated from motor vehicles, such as with barriers to physically separate the road from the sidewalk. Devices like the gates at rail crossings could be placed where pedestrians need to cross a roadway, only allowing them through when sensors confirmed there was no threat from traffic. Such gates could also be employed at bus stops, opening only as the bus pulled up. Where there is enough room to build them, bridges or tunnels could allow pedestrians to bypass intersections and other hazardous locations altogether. Perhaps the sidewalks could be fully elevated, letting pedestrians avoid the roads completely. Such would be costly, but the horror of people being rammed by and crushed under motor vehicles would basically be forever eliminated, and all kinds of expensive and elaborate infrastructure has constantly been built for cars largely without a similar objection. Such measures would also improve the flow of traffic, since they would at least reduce occasions in which vehicles had to stop for pedestrians.

A system more centered on walking and biking would not only take some of the burden off motorized transport and reduce road congestion and overcrowding on mass transit but also be healthier for the individual—especially amid the improved conditions—by encouraging exercise. The slower pace brought about by a lifestyle involving walking and biking as major modes of transport might even make life less stressful and thus healthier in that respect as well.

In busier areas, however, walking could be augmented with moving sidewalks. Consider a series of them running parallel to each other. The ones on the edges would move the slowest, and each sidewalk toward the center would be moving faster, increasing passengers' speed by some interval each time they moved inward. This would allow people to step on at any point, transition themselves up to a rapid pace, and then transition back down to step off. Currently, someone riding a typical moving sidewalk while not walking on it travels at around two mph, and though the devices have been demonstrated to be workable at speeds up to over seven mph, if one limits the discussion to moving sidewalks that have been shown to be practical in the real world, Toronto Pearson International Airport employs one that accelerates each passenger individually to around five mph.[51] Imagining a huge moving sidewalk deployed across the width of Manhattan[52], a passenger on board could "walk" across the whole island in around 24 minutes, faster and much less strenuously than by walking on a normal sidewalk and without having to wait for a bus or subway, but if electing to walk at a normal pace[53] while onboard, the trip could be made in about 15 minutes as opposed to around 45 by conventional walking alone.

Remote and rural areas could also have mass transit systems; however, because ridership would be much lower, the vehicles, sized according to typical passenger volume, would run as a hybrid between buses and taxis. Instead of operating on a regular schedule at the long intervals low usage would require, they would run on demand, and rather than being point-to-point like a taxi, the routes and stops would be fixed like they are for buses, with different vehicles assigned to different routes. As a rural service area is likely to be very broad, this would save the drivers from having to navigate through all of it and be more conducive to near-instantaneous service; the vehicle would always be within a fixed distance and along a known route. Also, plotting a trip from origin to destination would work the same as in a conventional bus system.

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51 Freemark, Yonah. "Paris' Experimental High-Speed Moving Walkway Is Abandoned." *The Transport Politic*, 21 May 2009. Web. 3 Mar. 2015. <http://www.thetransportpolitic.com/2009/05/21/paris-experimental-high-speed-moving-walkway-is-abandoned/>.

52 About two miles as measured in Google Earth

53 This assumes a walking speed of 2.8 mph, averaged from the range of typical walking speeds of 1.2–1.3 m/s given in Srinivasan, Manoj. "Optimal Speeds for Walking and Running, and Walking on a Moving Walkway*." Chaos: An Interdisciplinary Journal of Nonlinear Science 19 (2009).* Web. 10 Mar. 2015. <http://movement.osu.edu/papers/CHAOS_2009_Srinivasan_MovingWalkway.pdf>. p. 3

To actually use the bus-taxis, a person arriving at a stop would press a button to signal for a vehicle, and the nearest one for that route would be alerted to proceed to that stop. If malicious false signals became an issue, one alternative would be to require a PIN. A bus-taxi could even be signaled via computer or smartphone so that the passenger would not actually have to go to the stop until the vehicle was about there, though unlike current Dial-a-Ride services, an advance reservation would not be required. Next, a display at the stop, phone, or computer would advise the passenger where the nearest bus-taxi was and give an estimated wait time. After picking up the passenger and dropping him off at his stop, also picking up along the way any additional passengers who signaled, the bus-taxi would wait once it was empty again until someone else signaled. When a vehicle got to the end of the line, it would cycle back in the opposite direction, repeating the same process. As with normal bus services, passengers could transfer from one route to another as well just by signaling for another bus-taxi at a point where routes intersect. By entering one's ultimate destination into the system, this could even be automatic, with boarding the first bus-taxi triggering the ones needed subsequently to stop when appropriate. Finally, shuttles from various bus stops could connect the system to the nearest city and the broader transportation network.

Figure 5

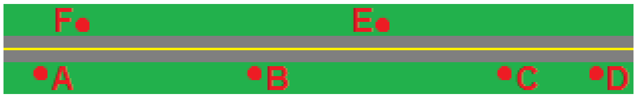

Figure 5 depicts a country lane, and the points represent various bus-taxi stops along it, to link, for instance, people on various farms and settlements. Consider that a passenger, wanting to get to point C, arrives at point A and signals for a bus-taxi. After that person is picked up, in transit between A and C, another passenger signals from B, wanting to get to D. Ultimately, both are dropped off at their stops, and the bus-taxi then waits at D for another call. Later, a passenger at E signals and wants to be dropped off at F, so the bus goes ahead and picks him up at E and drops him off at F.

Where demand is greater, multiple bus-taxis could operate on the same route. Where it is less, the issue of needless wear and tear and fuel consumption of a bus driving around but not picking up any passengers would still be resolved, though there would be the issue of the driver's idle time. However, this would not necessarily be any worse than the driver of a typical bus being idle between runs or a taxi driver looking for a fare. One solution, moreover, would be to give the drivers other tasks related to the transit system while not driving, like clerical and computer work that would normally be done in an office, to perform from a console in the car.

While all the functions of passenger cars could more or less be duplicated with mass transit, obsessing over achieving this would probably be the wrong approach. Instead, perhaps the mentality of wanting to go directly from one point to any other point immediately and on demand should change and this luxury should in be part sacrificed to make larger improvements elsewhere. When society traded in horses for cars, it paid for the increase in speed and versatility with the carnage of high-speed collisions and soaring air pollution. Maybe now, in the face of overpopulation and global warming, it is the right time to trade some of the benefits back in for more safety and cleaner air. What it may come down to is people's mode of life will have to adapt to any limitations of the new system. Rather than spending too much effort trying to make mass transit do everything cars can, the goal for the transportation system should be to move as many people as possible over as wide an area as possible safely, efficiently, and quickly.

Redesigning the transportation network would also allow other improvements to be made to the infrastructure more economically. If things were being opened up anyway—like as rail lines were being installed and extra roads were being removed—perhaps power, telephone and other wires could be buried little by little as the opportunity presented itself in areas where they are currently strung on poles. This may also be conducive to installing the pneumatic tube and radiant systems discussed earlier. Notwithstanding the cost of underground service, it makes more sense to have lines below the street rather than up in the air at the mercy of the weather and mingling with tree limbs that may fall on them, not to mention the ugliness of leaning poles and drooping wires accompanying every roadway. It is also much safer to have linemen working a little below ground level than way in the air.

Another tangential effect of the new transportation system would be that the reduction or elimination of emissions would make domed cities more feasible, since the buildup of air pollution and having to ventilate it adequately would not be as much of a concern. Building domes over cities has a number of possible advantages. An obvious one is to keep rain out: no more getting caught in downpours, soggy shoes, flooding, raincoats and umbrellas, leaky roofs and windows. Also, rain running off the outside of the dome could potentially be collected and used for drinking water and irrigation inside the city. Perhaps such a dome would make buildings cheaper to produce as well, since they would no longer need to be fully climate controlled, let alone as watertight.

In 1979, the construction of a dome stretching over a mile to cover the town of Winooski, Vermont was seriously considered in response to the oil crisis. The project was expected to result in as much as a 90% reduction in heating costs and to eliminate the need to heat buildings individually. Another desired effect was to keep the region's harsh winters and the snow they brought out of town. The project was considered feasible engineering-wise and only stopped by political opposition that led

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Appell, David. "Doomed Dome: The Future That Never Was." h+ Magazine, 30 Sept. 2009. Web. 3 Mar. 2015. <http://hplusmagazine.com/2009/09/30/doomed-dome-future-never-was/>.

to a termination of funding[54]. To look at it another way, and extending my previous point that roads, parking lots, and the like are a poor use of land, cities right now consist of self-contained buildings, with all the volume between them more or less wasted, so it makes sense to try to contain the entire city and to make more use of all the space within.

Transportation in the Distant Future

One possibility for an advanced future transportation system is a kind of aerial tram-elevator hybrid. A mesh of cables would be suspended from masts over an entire city, and gondolas would autonomously ride upon it. There could even be multiple levels of cable meshes to accommodate more traffic. Unlike an elevator or tram, however, the gondolas would be self-propelled, perhaps picking up electricity from the cables, which would be fixed, since the route of each gondola would be highly dynamic. Passengers would enter a gondola at the foot of a mast and each input their destination. After a gondola was filled to capacity or a specified time from the first passenger entering had elapsed, it would rise up the mast and then fly over the city via the cables to reach each destination. Alternatively, the gondolas could stay at the tops of the masts, and the passengers could ride up on separate elevators. The capacity of each gondola would be set perhaps somewhat higher than what that of a Dial-a-Ride vehicle operating in the city would have been, as for both, the time it takes to reach all the passengers' destinations is a limiting factor, with the cable system, however, enjoying a speed advantage compared to ground-based vehicles, as will be further explained.

Regarding the navigation of the cable mesh, perhaps it would be possible to build four-way switching mechanisms for all the cable junctions, reminiscent of the switches used at the junctions of overhead trolley wires. Alternatively, mechanisms for changing direction could potentially be incorporated into the gondolas. While one was underway, upon contact with any point where a change of direction had to be made, an onboard computer system, working in tandem with a series of redundant sensors, would trigger part of an array of grips anchoring the gondola to shift its point of attachment from mast to cable, cable to mast, or cable to cable, depending on where the gondola was trying to go. The sensors would then confirm when a new connection was made, trigger the release of the remaining part of the previous one, and the grips that comprised it would finally join the new connection. Each gondola would always be grabbing onto a mast or the cables with multiple grips, and these would be mechanically interlinked in a way that made it impossible for them all to be released at the same time.

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54 *Ibid.*

As an emergency precaution, depending on how high they traveled, perhaps the inside and outside of the gondolas could be fitted with large airbags. If somehow a cable broke or a gondola otherwise fell, accelerometers would trigger the airbags' inflation, cushioning both the gondola's impact with the ground and the passengers' impact with the gondola. Maybe even a parachute could work alongside or in place of this system, which would also make things safer for anyone on the ground below.

Using cables as opposed to rails would allow much more versatility as to the placement of lines. For one thing, they would not have to be limited more or less to following the streets but could be strung above preexisting buildings, passengers conducted right over them. Not having to worry about any obstructions on the ground would allow transportation to more closely approximate the optimal path between destinations, a straight line. A computer would calculate the best possible route, getting each passenger as efficiently as possible to each destination, as well as coordinate the whole network of gondolas to reduce interference between vehicles. The system being centrally controlled would vastly improve the flow of traffic, since the movements of each gondola could be accounted for in the movements of every other. After everyone had alighted from a gondola, it would be directed to the nearest mast with an empty spot or whatever empty mast had the most people waiting for a gondola. Perhaps empty gondolas could be arranged at the masts so that as soon as one left, another would take its place.

Returning to Figure 2, consider a transportation network as described above implemented over the map, that four passengers boarded at point A, a person bound for each of the points B through E. The gondola may follow a route taking it to E, B, C, and D respectively, dropping a person off at each point. The biggest advantage of this system would be its potential speed, as again, obstacles on the ground would not affect it, and it would also use much less land than roads, the bases of the masts the only things in contact with the ground. With a system like this, once it became highly developed, perhaps roads would not be necessary at all. I can imagine some future incarnation of the cement truck or crane grappling itself onto a cable and soaring around a skyscraper under construction, pouring concrete or lowering beams onto any point on the whole structure.

Transportation may even evolve into more of a utility, like water or telephone, linking every structure as they are linked now by pipes and wires. Perhaps vehicles could actually enter buildings and travel through them like elevators do today so that passengers could enter some kind of pod and, via overhead cables and large, underground tubes, be routed to any floor in any other building in a city. With this, all structures would be equipped with transportation as they are now equipped with telephones, people routed from location to location like phone calls.

Eventually, perhaps the cables could be dispensed with, and bus-like vehicles, maybe clusters of pods bound for the same general area, would literally fly around a city, hopping between portals in buildings or raised platforms throughout the area rather than riding between stations. Such vehicles could travel completely uninterrupted between the busiest locales, with routes changing in three dimensions to conform to demand and traffic patterns at the moment, no longer limited to the reach of physical infrastructure. Such is at least more feasible than the common conception of a flying car, since there would be fewer vehicles crowding the air, and everyday drivers would not have to be trained to safely operate them.

Later still, intra-city transportation as we know it, outdoor travel between points on the ground, may even fade away. Taking the concept of the domed city to the next level, what are now areas full of discreet buildings could eventually meld into one gigantic structure, making use of all the volume that now goes largely to waste but then would no longer have to be reserved for roadways. Perhaps such a structure would be full of broad tubes for conducting occupants in pods to all sections like a building's plumbing now circulates water.

Smaller Changes for the Near Future

Converting from cars to mass transit would obviously be a huge undertaking that would take decades to complete, if it were to happen at all. Still, some benefits, of at least a less car-centric culture, could be enjoyed now with comparatively modest changes. If mass transit were more pleasant to ride, if people did not have to wait so long at transit stops, be packed into dirty and overcrowded buses and train cars, and deal with multiple slow transfers or excessive walking between stops, more may be encouraged to use it.

A specific way to make things more comfortable would be to employ tiered seating in buses. Instead of having seats arranged in pairs with one right next to the other, one of the seats in the pair could be raised six inches or so. Without taking up any more floor space, this would help prevent passengers from being pushed right against each other, since their laps would be at different levels. Currently, people tend to avoid sections on some models of bus that are raised above the rest, probably because being there makes them feel conspicuous, but a difference of six inches should not matter very much. Raising the window seat instead of the aisle seat may also alleviate this potential issue, since the former is less conspicuous to begin with, more off center and somewhat insulated by the side of the bus, and raising the aisle seat may make it harder to get to and from the window seat and make it feel too confined anyway. On the same note, seating arrangements on the bus in which passengers face each other should be done away with because, again, they tend to make people feel awkward and uncomfortable.

The extremely rude act of taking up an extra seat, like by putting a bag on it, while otherwise there is standing room only, should be explicitly banned with conspicuous signs posted to announce this, and drivers should chastise passengers who do it anyway. Let anyone who is too good to sit next to someone else pay two fares. Action should also be taken to reduce any loitering around transit stops, which would prevent unnecessary extra crowding and reduce the nuisance for actual passengers. Another issue is that when boarding buses on crowded routes, people basically trample each other when the bus arrives to get on early and grab a seat. While this is a sign that more or higher-capacity buses are needed, a way to at least alleviate the symptom would be to put up a pair of barriers at the stop, to which the bus would pull up, in order to force people to line up orderly, or at least make it more awkward and conspicuous for the thoughtless to cut the line.

Today, bus riders signal the driver to let them off by activating a chime. An improvement would be to enable people waiting at a stop to activate the chime also, by remote control. They would press a button when they got to the stop, and the bus would receive the signal when it got within a certain distance. This feature would lessen the annoyance of a bus flying by a stop in cases where the driver did not notice anyone there. In addition, it could potentially make things safer by giving drivers more advance notice that somebody needed to be picked up, rather than having to stop and pull over abruptly at the last second.

The design of bus stop canopies should be addressed too. For one thing, they should be equipped with as much seating as reasonably possible, rather than simply, in many cases, a single small bench. A more pressing concern is their safety. Some designs of bus stop canopy are enclosed on three sides, with the open side almost up to the curb and facing the street. If a car were about to crash into the structure, anyone waiting inside would not even have a chance to get out of the way, blocked in on all sides by either the car or the canopy. While such an accident may not be commonplace, I have seen enough damaged or demolished canopies over the years to make the prospect unsettlingly palpable. To increase safety in this regard, bus stops should be positioned further from the road or the canopy should at least be open on two sides—the one facing the road, for boarding the bus, and the one either opposite the road or facing the direction of traffic, as a potential escape route. Placing the opening on the side facing away from the direction of traffic, however, would increase the chance of a passenger who dodged the initial collision being hit by debris or the car as it continued on after impact.

The safety of pedestrians in general is also something that should be better addressed right now. Crosswalks should be placed more frequently on long stretches of road that currently lack them, so pedestrians are not encouraged to jaywalk by otherwise having to do a lot of extra walking just to reach one. Walk signals should last longer, and the turn signal should always be delayed enough to give pedestrians a chance to get through before cars start coming around the corner. Sidewalks should be added wherever possible in areas with pedestrian traffic that lack them, and people should stop planting trees on the curb strip, and least ones that get very big, since the roots almost always wind up destroying the pavement. Sidewalk obstruction, including sprinklers spraying onto the sidewalk, cars sticking out across it from a driveway, and snow, garbage, or other debris being piled up on it, should be taken more seriously. Such obstructions are not only a needless inconvenience for pedestrians but potentially a danger as they encourage or pretty much force pedestrians to go into the street to get around, which they should not have to do in the first place as the sidewalk is there for them anyway. Large parking lots should also be traversed by pedestrian-only zones, so people can more safely get to and from their cars.

An additional measure is that dogs should be banned from the sidewalks. Dog owners are often negligent about cleaning up after them—not always, and maybe not even the majority of the time, but enough to need to watch one’s step. When a person gets near someone walking a dog, more often than not, the dog starts barking, growling, and tugging at its leash to get at the passerby. In most cases, this may just be annoying or possibly unsettling, but where larger dogs are concerned, it is a potential danger because they can break free, or drag the owner right along, and hurt someone. Nobody benefits from allowing dogs on the sidewalk except dog owners, so why should their choice to have a dog be a nuisance and at times a threat to everyone else? No one should have a dog without enough property to accommodate it comfortably or access to a park designated for dogs. If a law banning them from the sidewalk were ever implemented, so that people would not have to give up their pets, perhaps those who already own dogs could be grandfathered in, or the law could be set to take full effect not until 10 or 15 years in the future. Some allowances could also be made, such as for people to go from their car to their vet’s office.

Another significant drag on the desirability of the alternatives to driving is how they are viewed. While people’s attitudes are what they are, open discrimination against those who rely on mass transit could be combated. Many job listings, for example, say things like “no public transportation,” “must have car,” or more euphemistically, “must have reliable transportation.” This is reasonable if the position at issue is something like pizza delivery guy or field technician, where performing the job itself currently requires a car in most cases, or if there is just no way to get to the workplace using mass transit. Otherwise, as long as the employee gets to work and arrives on time, the mode of transport is none of the employer's business and to pry into it infringes on the worker's privacy. It is simply uncalled for to so broadly discriminate and penalize someone just for not having a car.

There are social concerns to take into account as well, as this practice disincentivizes mass transit and encourages more cars on the road when the opposite is clearly in the broader interest. In addition, such employers are indirectly discriminating against the poor, who are less likely to own a car as well as, ironically, the group most likely to need a job, and minorities, who often make up a large proportion of mass transit ridership. Employers should not be allowed to do this in the same way they are not allowed to explicitly discriminate against someone's race or religion.

The most important measure that could be taken regarding the current transportation system, however, is a crackdown on drivers who put other people in danger. The police should more frequently be deployed in a way that puts them in a good position to catch those who, for instance, fail to yield the right of way as required by law or block crosswalks. Like the cliche goes, there is never a cop around when you need one. As for speeding, why should people feel the need to go fast at all? Aside from penalizing current speeders, maybe the speed limits over the whole transportation system should be ratcheted down. While people will get to their destinations more slowly, accidents may not be as catastrophic.

Nowadays, a significant issue is talking on a cell phone or texting while driving and the harm such distractions cause. However, rather than worrying about banning or restricting these things specifically, when anything is to be banned or restricted in this regard, the law should simply say that, while people are driving cars, they cannot do anything except drive: no cell phone, eating, drinking, smoking, playing with the radio, reading maps, or doing make up—only driving. The issue is that it is almost impossible to effectively enforce a law on what takes place inside millions of private vehicles, but that gets back to the core of the problem with cars in the first place.

And of course, any kind of prohibition raises concerns of personal freedom. In some cases, such as requiring people to wear seatbelts, these concerns may be legitimate; after all, if someone gets splattered all over the dashboard or thrown through the windshield, that is his problem. Concerning distracted driving, however, the safety of everyone else on the road is at issue, so bringing up personal freedom is ridiculous except to say that people who step out their front door have the right not to be run down. As far as anyone should be concerned, part of the deal in applying for a license and using public roadways is accepting the rules that allow everyone to have relatively safe and equal access to them. Driving is a dangerous, demanding, fast-paced activity that needs one's full attention, and there are a lot of people who stand to get killed otherwise.

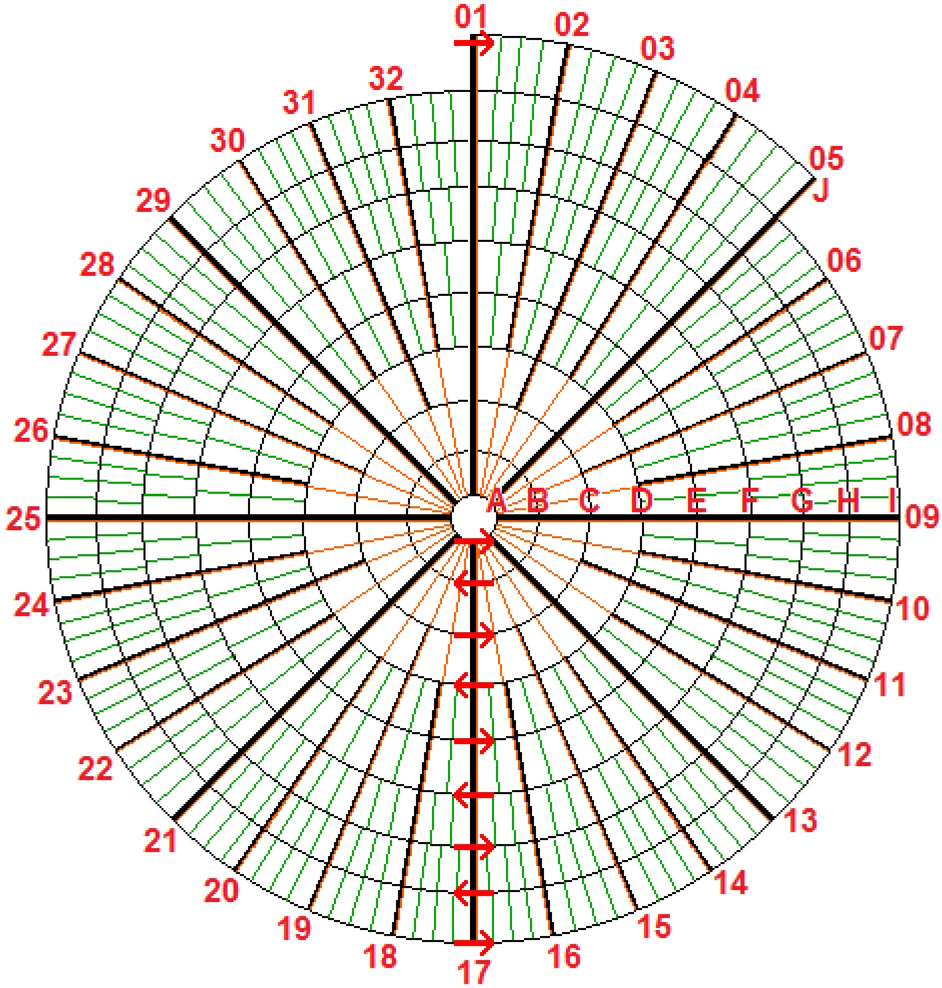
Gross violations of traffic law, like drunk driving and extreme speeding should result in an immediate, permanent loss of one's driver's license: no exceptions, no leniency. Why should the lives of everyone on the road be put at further potential risk just to avoid overly inconveniencing reckless, careless drivers? Someone willing to take those kinds of risks with everyone else's life does not deserve to be trusted any further with a license or any other consideration. When such an act of extreme recklessness causes an accident, and somebody dies, forget about vehicular homicide or manslaughter. Such a driver is so careless that it should just be treated like premeditated murder. It is one thing to happen to get distracted at a critical moment or to lose control on a patch of ice, but it does take some form of premeditation against the lives of others to decide to go 100 mph down a highway or to attempt to drive a car while unable even to walk straight when it is so obvious and so well-known how serious the risks are. Accidents happen, and sometimes they cannot be helped, but collisions that result from such extreme negligence as that kind of speeding or drunk driving do not count as accidents by any stretch. As already put forward, however, the deeper problem is giving the ability to operate a vehicle to just about anyone, including those who have whatever mental defect makes them capable of such reckless behavior in the first place.

Regardless of how far one believes it should be taken, people should be thinking more at least of reducing automobile dependency and expanding mass transit before we have to face even more of the ill-effects of cars and their excessive use. This should be a major priority, with cars being the cause of so much suffering and pretty much any shift toward mass transit reducing things like traffic and emissions. Ideally, instead of continuing to pave the earth over and constantly ballooning the number of pollution generators driving around, we could try to develop a reasonable transportation system.

A total transition would not be quick or easy to achieve, but it is both possible and desirable as well as a noble goal for the future. If universal mass transit became reality, the world would reap so many benefits, including more open spaces and greater freedom of movement. Rather than putting so much into developing a better passenger car, the goal should be to make mass transit so cheap, efficient, and reliable that no one would even want one.

All the same, maybe the fundamental problem is feeling it necessary to move around a trillion pounds of human even when what people need can be brought to them instead. And the most productive and efficient end would be to make transportation altogether less important, to move information instead of people and things wherever possible. With that, maybe we could learn to better appreciate where we are instead of so often looking to be somewhere else.

Appendix: A City for Mass Transit



The illustration above depicts one example of how a city designed for mass transit as its sole means of transportation could be laid out. The circular form allows it to cover the most area with fewer sharp turns and intersections. Possibly, circles would also allow for the smoother flow of traffic by not having so many drastic changes of direction, and the constant curves could make things safer, not only because of this but also by helping to keep drivers alert; they would constantly have to guide their vehicles around the curves, as opposed to traversing just long, straight runs.

Referring to the diagram, the concentric rings are one-way streets, the direction alternating one to the other, as indicated by the arrows. Having each road one-way would take less space than having to accommodate both directions of traffic with each road and give pedestrians less reason to try to cross the street, like by having to catch a bus going the opposite direction on the other side. When needing to go in the opposite direction, another ring by which to do so is always nearby. Each ring would be its own separate, continuous bus route, with buses constantly circling around each one, except the innermost ones, which would be short enough to be walkable. The space between each ring would be about the same as the width of the current average city block. A transit hub at the very center would send buses out to the whole city, and around the hub, buses would circulate to reach from one section of the city to another.

Each of the straight black lines is also a roadway, whose purpose would be to conduct traffic between the rings, and they will be referred to here as avenues. Certain ones, represented by the heavier lines, would be express routes and elevated to avoid most of the intersections with the rings. This would allow higher volumes of traffic to move to and from the city center with less interference. The avenues represented by the thinner lines, however, would intersect every ring to accommodate more local traffic. At the circumference of the city, patches of pavement at the ends of all the avenues would allow buses to turn around easily and loop back toward the city center. A typical ride from one point of the city to any other would consist of taking a bus along a ring to the nearest avenue, transferring to a bus there to reach the intersection nearest the destination, and taking another bus around that ring to the destination itself. Of course, fewer transfers would be needed if the origin or destination were already near any of these points, and buses would be running so frequently that even multiple transfers would be little inconvenience.

Elevated pedestrian walkways, indicated in orange on the diagram, run parallel to the avenues with stairs or elevators at each intersection so that there is no reason for a pedestrian to ever be in the street. More conventional sidewalks would also run along the roadways, though they would be protected from traffic by barriers. Further out from the center, as the distance between avenues got wider, walkways would cut between rings at ground level, depicted in green on the diagram, allowing pedestrians to continue to easily skip between them, rather than having to walk excessively far to reach an avenue.

The city layout lends itself to a simple, intuitive naming scheme, which reflects the ease of movement inherent to the city. As appears on the diagram, the rings would be assigned letters, starting at the center, ascending as one moved outward, and the avenues would be assigned numbers, ascending clockwise from the 12:00 position—the north. One could give locations by the intersection of ring and avenue, like saying E12, which would mean E Ring at Avenue 12, similar to something more conventional like “W 45th St. and 7th Ave.” but more predictable. Not only could one use this as a kind of coordinate system, but also just by knowing a particular location, one would basically always know how to get to any other, without even needing to know the direction. Someone wanting to go from E12 to H32, for example, would know to ride around E Ring to Avenue 32 because each avenue traverses all the rings and then to take Avenue 32 outward to H Ring because that is how the rings are lettered—out from the center. If the ring on which a person were situated had traffic flowing in the wrong direction for taking the shortest route to the desired avenue, it would just be a matter of skipping to the next ring.

Adding decimals to the coordinates could add more specificity, so that, for example, E12.2 would refer to a location on E Ring 20 percent of the way from Avenue 12, clockwise toward Avenue 13, being that the avenues are numbered clockwise. Finally, to indicate exact lots and buildings, the curb on each side of the roads could be painted a different color, blue (b) and gray (g) for instance, providing one more notation, to indicate the side of the road and complete a full address, such as E12.2b or E12.2g. The elevated avenues or a partial ring coming into play might complicate navigation somewhat, but even then, it would just be a matter of getting off a transit vehicle at the nearest possible intersection to the destination and transferring onto the next line.

Urban density would be greatest at the city center, where the avenues would be more tightly packed owing to the circular layout, allowing for the movement of a greater number of people in a given area. Higher densities are ideal because such allows the transportation system to be more efficient, having to move people and goods over shorter distances. Enterprises requiring the movement of large amounts of freight would be designated to the outer rings, to keep any trucks and such from interfering with passenger travel deeper in the city. Farmland would surround the city starting on its immediate outskirts, and crops could even be processed in facilities in the outer rings, supplying food to the city's inhabitants without having to transport it long distances. As the population grew, and more space was needed, the density could be increased from the center and additional rings or portions of rings could be added on the outskirts, as seen on the top right of the diagram. Different cities could all be connected together by a web of high-speed rail lines.

Variations on the concept include augmenting the at-grade roadways with streetcars and replacing the elevated avenues with monorails or aerial tramways. On that note, perhaps all the roads could be replaced with a cable-based system along the lines of that discussed in the section *Transportation in the Distant Future*, allowing the construction of further buildings beneath the cables, with masts placed at some number of what are intersections between roads in the diagram. Another option is to put most mechanized transport underground in the same circular layout, likewise leaving more space for buildings above. Yet another variation on the design would be to have a continuous road spiraling out from the center, rather than concentric rings, which would give an alternative means of traveling closer to or further from the center, though this would perhaps be confusing to navigate. It should also be noted that a circle-shaped city would be more conducive to having a dome built over the entire thing, a possibility explored in *A Glimpse of a Better Transportation System*, both having the same footprint.