

Transportation

Human and goods transportation alternatives in the U.S. are mainly long-distance airplanes and ships; long-distance and metro trains; long-distance and local busses; long-distance and local automobiles, trucks and motorcycles; taxis and ride-sharing; walking; bicycles and animal powered transportation.

U.S. transportation systems are 92% based on fossil fuel energy, the #1 contributor to climate change, and a mass polluter and poisoner of life. All systems based on fossil fuel and nuclear energy, or electricity produced by them, do not count enormous external costs borne by the environment, society, other life species, and Earth's life support systems, via climate change, pollution and health impacts, so they are artificially inexpensive. Adding to transportation those fairly and appropriately applied costs would hugely increase transportation costs for all but bicycle, animal and pedestrian transportation.

Air, train, ship, bus, taxi and walking have the benefit of freeing travelers from operating vehicles, providing opportunities for social interaction and other uses of time, like sleeping, reading, working, talking, relaxing, looking out of the windows, meditating, or consuming information or entertainment.

With most transportation, costs are often about a third more affordable to wealthier business people, because they can often write off their transportation expenses on taxes, than to citizens who cannot.

Air

In the U.S., we have 9 million commercial flights and 800 million people getting on planes every year, about 7,000 aircraft in the skies any given moment, and 2.25 million airplane passengers every day.⁴¹² Air ticket pricing schemes are wildly variable.⁴¹³ Do 2 people on the same flight pay the same price? Airlines divide people and experiences into classes, in sections, with allegiance, etc. to maximize profit. Air transport produces 5% of global GHGs, noise pollution, and harms via high atmosphere exhaust.⁴¹⁴ Globally, 9 billion passengers fly in airplanes in a year.⁴¹⁵ U.S. airlines ship freight 80 billion ton-miles,⁴¹⁶ the most harmful form of freight transport, if we can't wait, or don't care about the environment.

Airports are common, but often not well integrated into local transit systems, relying instead on dirty, inefficient, auto and bus local transport connections. People typically don't count costs for time lost to inefficient, expensive, fear-driven-and-driving airport security systems; time and money getting to and from airports; or airport costs often borne by the public, which makes air travel seem cheaper than it is. U.S. airports have a \$40 billion funding gap for airport maintenance and improvements in the next 10 years (4% of FADS), and 24 of the top 30 major airports may soon experience "Thanksgiving-peak" traffic volumes at least a day a week.⁴¹⁷ Otherwise, air travel and transportation systems are functional.

Ship

Transportation of goods by ships works well, but international ships are Earth's most polluting vehicles, causing 3% of global warming, 400,000 deaths and 14 million childhood asthma cases a year, globally.⁴¹⁸

The U.S. has 925 ports, handling 99% of overseas trade, on more than 80,000 vessel loads a year, about \$4.5 trillion in economic activity, about a quarter of the U.S. economy, responsible for 23 million jobs. Systems for loading and unloading ships and transferring their cargo to trains and trucks need upgrades. A third of ports report problems with that, reducing efficiency by about a fourth in the last 10 years.⁴¹⁹ The U.S. needs to invest about \$66 billion (6% of FADS) to upgrade port infrastructure.⁴²⁰

609 U.S. registered ships carry passengers, total capacity 192,000, mostly ferries and cruise ships.⁴²¹ Ships, barges and boats operate on rivers, inland waterways and lakes. Barges, our most fuel-efficient way to move goods, can move 60% of our grain exports 4 times farther than trucks on a gallon of fuel. 20% of domestic petroleum products, 20% of coal and 600 million tons of cargo a year, 14% of all domestic freight, are moved through 25,000 miles of inland waterways, with 250 locks in 39 states. Most dams and locks in this system are far beyond their 50-year design life, and half of vessels are delayed one to two hours with lock issues. Investment of \$37 billion (3% of FADS) is needed for them.⁴²²

Railroad

Long distance freight train systems in the U.S. deliver 5 million tons of freight a day over 140,000 miles of track and 100,000 bridges, almost all privately owned. It works pretty well, and it's the 2nd most fuel-efficient way to ship cargo, after ships and barges,⁴²³ 4 times more efficient than trucks. It invests 19% of revenues, 6 times the average manufacturer.⁴²⁴ Train freight shipments will increase 40% by 2040.⁴²⁵

U.S. long distance passenger train systems carried 98% of all the U.S. intercity passengers, in 1916.⁴²⁶ Since, government support for oil, gas, autos, roads, highways, Interstates and airports have changed the economics of travel, moving us to cars, busses and planes. Passenger trains have little government support to own or maintain infrastructure, lower prices, or promote or improve services.⁴²⁷ They are often poorly perceived, because they do not serve many locations and are often not reliably on time. The U.S. President wants to eliminate most.⁴²⁸ Rail accounted for 0.6% of passenger miles in 2017.⁴²⁹

Amtrak, the U.S. passenger rail system, operates on a 20,000-mile rail network serving 500 communities and 30 million passengers a year. That may sound like a lot, but it's less than 4% of the number of passengers on airplanes in the U.S. Half of all Amtrak passengers ride on a single 450-mile route, between Boston and Washington, DC, which is capacity constrained, in part because almost \$30 billion of work needed on that route alone has been deferred (3% of FADS).

Amtrak owns 600 miles of its 20,000 mile railroad network, 1/2 of 1% as much as private freight railroads, so it has to share tracks with freight and/or commuter trains on 90% of its network.⁴³⁰ Even where viable train connections exist, many people do not choose to use them, because we are acculturated to choose less efficient auto or air travel. Few high-speed rail lines exist. Few trains are powered by clean electricity, which can be operated with much lower environmental and health costs.

Metro/Subway Train

100 years ago, the U.S. had public transit systems that were the envy of the world. Today, outside a few major urban centers, they're barely on life support.⁴³¹ Per year, North America has the fewest rail passengers of any world region, with 3.7 billion of the 53 billion passengers worldwide, and lots of those are in Canada and Mexico. Yes, the U.S. is a big, sprawled out country, but so is Canada, and it has highly functional public transit systems in all of its major cities, while most U.S. cities do not.⁴³²

Many of ours were purchased by auto and oil interests and dismantled, because they could make more money through car and fuel sales if metro trains no longer existed.⁴³³ But, mostly, ours have been mismanaged and have failed, because they didn't coordinate between train and bus systems, stopped running trains and buses as often to save money, and service quality fell to the point that people didn't want to use them, especially with competition from automobiles, before big traffic, and with urban planning that pushed people out to suburbs, where public transportation did not follow them.⁴³⁴

Now, there are only 15 subway or metro train systems in the whole U.S. They carry a third of all public transit passenger trips, including all U.S. urban and rural bus systems.⁴³⁵ A third of all mass transit users in the U.S. use the New York City system,⁴³⁶ which is comprehensive, fast and runs trains frequently. Most others don't serve areas of cities or regions, so they're not comprehensive local transportation solutions, forcing people to also use cars or taxis, or to engage the complexity and dysfunction of coordinating with poorly coordinated bus systems. Virtually all major cities have mass transit in Europe.

In many U.S. metro train systems, passenger demand exceeds design capacity, creating crowded trains and reliability problems that cause people to choose cars and other methods of local transportation, causing lost fares and neglected maintenance, resulting in a downward spiral of decaying performance. Population growth in most urban areas exceeds metro/subway train system capacity growth, so performance will likely continue to degrade. What do you think causes the U.S. to do this so poorly?

In existing metro train systems, 15% of maintenance facilities, 17% of signal, communications, power and fare collection systems, 35% of tracks and 37% of train stations are not in a good state of repair, and \$100 billion dollars in maintenance is needed to fix that (9% of FADS).⁴³⁷ Doesn't bode well for them?

80% of U.S. households are in urban areas, but only half report being able to get to a grocery store via public transit, including local bus options.⁴³⁸ People are forced into cars and traffic, because we don't have viable alternatives. That harms those who cannot afford cars and taxis, and everyone.

Where electric trains exist, they are generally not powered by electricity from renewable resources. Metro rail systems are often artificially unfeasible, because they're not allowed cheaper surface routes, monopolized by roads and automobiles, and are forced into expensive underground construction, greatly increasing difficulty and expense. Where metro rail systems exist, they are valuable, appreciated and well-utilized by the public, but metro trains in the U.S. typically don't adequately meet public needs.

Local and Long-Distance Bus

U.S. bus systems are often limited and slow, competing for road use with other vehicles, and affected by ever increasing traffic, but generally have the least environmental impact per person of all road travel. There are a total of 271,000 miles of bus route travel in the U.S., out of 18 million miles of road.⁴³⁹ So, busses run on only 1.5% of U.S. roads.⁴⁴⁰ No wonder they're not used much?

The U.S. has relatively few long-distance luxury bus operations, available in many other countries, which include modern busses, comfortable sleeping, entertainment and network connectivity.

As part of large socio-economic class disparity, long-distance busses are primarily used by the poor, because they're the most affordable form of long-distance transportation. That creates a perception that long-distance busses are low class, slow, inefficient, unpleasant and not preferred. That likely reduces participation by those who can afford higher class alternatives.

Two-thirds of busses are run on gasoline or diesel, and a fifth use compressed natural gas, which harms the environment. Relatively few are powered by electricity or hydrogen, which could operate with lower greenhouse gas and other air and noise pollution costs. They are often viewed by the public as low-class transportation, but they're usually cheap. Generally, U.S. local bus travel is slow, inefficient, unpleasant and not preferred. Only 10% of U.S. adults report taking a transit train or bus in a week.⁴⁴¹

Car, Truck and Motorcycle

The U.S. has an extensive system of 4.2 million miles of public Interstate, state and local highways, and 14 million miles of other roads, for a total of 72 million lane miles of roads.⁴⁴² Those are big numbers. That is the equivalent of a 301-lane-wide very, very high-way between the Earth and moon, so far.⁴⁴³ U.S. roads grow at 0.4%, adding 288,000 miles of road, 1.2 more lanes to the moon, annually.⁴⁴⁴

A lot of the highway infrastructure is poorly maintained, with 1 in 5 miles of pavement in poor condition, 60 of those lanes, and \$825 billion in deferred maintenance,⁴⁴⁵ 71% of FADS, 7 times what Feds spend on education a year. Conservatively using that ratio of deferred maintenance costs to other roads, there's \$2.75 trillion (238% of FADS)⁴⁴⁶ in deferred maintenance on other roads. Combined, \$3.6 trillion (309% of FADS) is needed to fix existing highways and roads. The U.S. Government would have to spend all money it has discretion to spend for 3 years for that. A third of urban roads are in poor condition.⁴⁴⁷

Poor road conditions cost U.S. vehicle operators \$120 billion annually in increased vehicle wear and tear (11% of FADS). The Federal Highway Administration estimates a return of \$5.20 in improved safety, lower vehicle maintenance costs, fewer delays, less fuel consumption, lower road and bridge costs, and lowered emissions from better traffic flow for each \$1 spent on road and bridge improvements.⁴⁴⁸

All our vehicles on 18 million miles of U.S. roads create land, water, air, light and noise pollution that impact millions of square miles of natural and human environments, all of the life around that land, and all life everywhere. Together with fences, they create difficulties and dangerous hazards for wildlife, domestic animals, bicyclists and pedestrians, artificially dividing and separating natural environments, and destroying animal migration and ranging abilities. 1 million animals die each day on U.S. roads.⁴⁴⁹

The U.S. also has more than 600,000 bridges. 40% are more than 50 years old, and another 15% are between 40 and 49 years old. The average bridge is 43 years old, and most have 50 year expected lives. Almost 10% of bridges are already structurally deficient, and there are 188 million trips across those bridges every day. One in ten bridges have restrictions on weight or speed causing inefficiencies, like forcing trucks to follow different routes that waste time and fuel, and increase environmental harm. More than one in eight U.S. bridges not counted as structurally deficient are functionally obsolete. (They do not meet current standards or traffic demand, increasing traffic as choke points.) Already, \$120 billion in backlogged bridge repair is not being addressed in the U.S. (11% of FADS).⁴⁵⁰

U.S. society is spending lots of money for infrastructure to support its vehicles with highways, roads, bridges, parking and related paved surfaces. In 2018, private and public federal, state and local government spending was \$188 billion (16% of FADS) for that, \$2.7 trillion from 2002 through 2018.⁴⁵¹ We spent \$500 billion on the 47,000-mile Interstate highway system, in 2016 dollars.⁴⁵²

In 2016, there were 267 million motor vehicles in the U.S., more than 1 per adult, with 8.8 million big tractor trailer trucks, 3.5 for every 100 adults.⁴⁵³ 17 million new cars were sold in 2017, and 11.3 million cars and trucks were produced in the U.S. In traffic, bumper to bumper, those new-built cars would stretch 33,800 miles, like 11.5 lanes of traffic from the Statue of Liberty to the Golden Gate Bridge.⁴⁵⁴ Existing and new sold cars, plus 18-wheeler trucks from the year before, would stretch 975,700 miles,⁴⁵⁵ like 326 lanes of bumper to bumper traffic going from the Statue of Liberty to the Golden Gate Bridge,⁴⁵⁶ or bumper to bumper traffic 4 lanes wide from the Earth to the moon, in 2017.⁴⁵⁷ Is that crazy?

U.S. auto manufacturers account for 3% of GDP, or \$600 billion,⁴⁵⁸ auto maintenance and support is 0.7%, or \$140 billion,⁴⁵⁹ trucking is 0.8%, or \$155.5 billion,⁴⁶⁰ auto insurance is 0.6%, or \$115 billion,⁴⁶¹ roads are 0.8%, or \$188 billion, and oil & gas is 8% of GDP,⁴⁶² \$1.6 trillion. So, for a nice round number, 10% of GDP, \$2 trillion dollars a year, 10% of the total value of what all of us do as a society in the U.S., is spent on driving around cars, trucks and motorcycles in the U.S.? It's some gigantic number like that.

For U.S. median households, we spend \$9,049 every year on transportation, our third highest expense, after housing and taxes. Median after tax income is \$64,175. We spend 14% of that on transportation. We work 7 weeks a year, just to pay for transportation.⁴⁶³ Multiplied by our 83 million households,⁴⁶⁴ we collectively spend 11.7 million household years to pay for our transportation, per year. Expensive?

In 2016, 550,000 (9% of) businesses, with 722,000 (9% of) business locations, with 10,650,000 (8% of all) people employed, paid \$535 billion in (8% of all) U.S. wages provided the professional infrastructure to make our auto, truck and motorcycle transportation system work in the U.S.⁴⁶⁵ Is that efficient?

218 million U.S. people have driver's licenses.⁴⁶⁶ There is little public effort to produce good driving. Driver's licenses are issued at very low cost, with little screening. People travel 3 trillion miles a year on U.S. roads,⁴⁶⁷ equal to 625 million trips to the moon.⁴⁶⁸ At 60mph, that's 50 billion human-hours.⁴⁶⁹ Imagine the potential for other and better uses of that time, for all the people doing that driving!

Auto and truck travel involves real wear and tear on drivers, who confront increasing stress and fatigue from requirements of safely operating vehicles. Poor driving is a systemic problem, leading to accidents, and associated financial loss, death, stress, frustration and traffic, which harm health. Death and injury on roads are serious risks, killing 35,000 people a year,⁴⁷⁰ injuring 2.5 million,⁴⁷¹ like 1 in 100 adults.⁴⁷² People are more likely to die from car accidents than any other kind of accident, except poisoning,⁴⁷³ which rose to #1 during the recent U.S. despair-related drug overdose epidemic. A dangerous system?

Metropolitan areas, cities and towns are predominantly designed around roads and cars, with everything spread out, so, practically, vehicles are needed to get to most anything. Because of that, people spend huge amounts of time driving, to and from work, to and from school, out to buy most of what they consume, out for entertainments, out for most anything. Moms spend hours a day shuttling kids around. Many of those experiences where most live are unpleasant, because of growing traffic. U.S. people spend 293 hours, more than seven 40-hour work weeks a year, driving in cars.⁴⁷⁴ So, we average 7 weeks a year working to pay for transportation, and 7 weeks a year driving around in vehicles, or 14 weeks, 3.5 months a year on this transportation solution? Would you rather do something else?

Roads and other vehicle accommodations often occupy at least half the land in cities, 62% in L.A.,⁴⁷⁵ killing soil by cutting it off from air and light, preventing aquifers from filling, leading to their collapse, and increasing rain runoff and pollution entering water systems, eliminating positive environmental impacts of nature, trees and plants, separating physical spaces, and making the experience of being a person or other life form in or out of a car unpleasant, difficult, dangerous, and stressful. City designs essentially force people into cars, because alternatives are much worse. Any better uses for that land?

City driving is often unpleasant, frustrating, stressful, demanding, time-consuming and dangerous. Vehicles isolate us from life and natural environments, creating health, psych and emotional problems. Noise, light, air, water and land pollution health and environmental impacts of this system are horrific. Drivers and pedestrians are increasingly distracted by electronic devices, creating many problems.⁴⁷⁶

Traffic is a huge problem. More than 40% of urban roads are congested, costing \$160 billion a year in lost time and fuel (14% of FADS, almost 1.5X what the U.S. government spends on education in a year), wasting more than 3 billion gallons of fuel,⁴⁷⁷ which just burns up and harms natural systems without doing any good, enough fuel for 625,000 trips to the moon in a hybrid car getting 50mpg. Traffic is getting worse. Parking solutions are often inadequate, frustrating and expensive. The average person spends 17 hours a year looking for parking, about \$345 in wasted time, energy and emissions, and people collectively spend \$20 billion a year overpaying for parking, in fear of getting parking tickets.⁴⁷⁸

In 2017, 773,139 vehicles were stolen, 1 motor vehicle theft reported every 40.9 seconds in the U.S.⁴⁷⁹ 13 million vehicles are in accidents in a year.⁴⁸⁰ Does that produce bad energy in vehicle owners?

Independence as a vehicle operator is highly valued in the U.S. Many billions of dollars have been spent conditioning and indoctrinating people to automobiles, making them a major embedded aspect of U.S. culture. People identify with their vehicles, and often our personal and emotional states are partially dependent on our cars. Vehicles are marketed and perceived as reflections of personality and status, so they're central to self-esteem and ego. The auto industry spends \$5 billion/year on TV ads for that.⁴⁸¹

Motor-cycles and -bikes are few compared to cars, even if they're cheaper and have less environmental impacts, in part because of risk and negative social conditioning. Cities are choking on auto and truck transportation, and citizens and other species are suffering because of it. Pedestrian areas, parks and other spots we can be in cities where cars aren't are scarce, contributing to nature deficit disorders.

Taxis as vehicles for hire for local transportation should be a viable alternative to self-driving. However, they are typically perversely incentivized through licensing and other fees and regulations. A taxi medallion in New York City is about \$200,000 now, but they were around \$1.2 million not long ago.⁴⁸² It's not uncommon for a taxi to the airport to cost 5 times as much as driving there in a private vehicle, as much as renting a car 3 or 4 days. They're usually fossil fuel powered, with uncounted external costs. Riders are inconvenienced with the same traffic and road problems as other drivers sharing those roads. When taxis are used, though, they do displace and reduce private vehicles, which is positive.

Ride-sharing, vehicle-sharing and vehicle-for-hire solutions are promising disruptive alternatives to each having to own, insure, maintain and operate cars. They allow a net reduction in numbers of vehicles owned and on roads, improving functionality, reducing traffic and lowering direct and ignored costs, but they also take resources away from public metro and bus transportation systems, harming them.⁴⁸³

Innovations include electric cars, with promise for reducing air pollution impacts if they use clean electricity, which they mostly don't now, and self-driving cars, which may improve some systemic problems related to auto and truck transportation. They do fit into the cultural infatuation with cars, but they do little to address underfunded road and bridge infrastructure or traffic related problems. Truck transportation is currently the most viable and efficient method for transporting goods locally.

Generally, auto transport systems in cities and metro areas are fundamentally flawed and unsustainable. They don't work at the scale of most cities and metropolitan areas, with most people forced into cars by lack of viable alternatives. They occupy far too much land, separating spaces, people and animals from each other, and they emit catastrophic air, noise, land, light and water pollution, harming nature and nature's ability to sustain itself. They make the experience of being a living being in a city difficult and unpleasant, and they are steadily and consistently getting worse. Is that your experience?

Bicycle, Pedestrian and Animal

U.S. cities typically have few good systemic routes for safe, efficient and pleasant bicycle, animal or pedestrian travel. Bicycles and pedestrians are afterthoughts next to auto transportation, and walking and bicycling are often dangerous because of a lack of separation from cars. Bicycles are typically forced to share streets with cars. Bicycles and pedestrians are slowed by street intersections managed for cars.

Bicycling and walking have outstanding physical health benefits in healthy environments. Only half of U.S. people get enough physical activity. However, polluted air, noise, blinding headlights, lack of nature, lack of rights of way, lack of respect from drivers, danger, lack of sidewalks, lack of pedestrian signals, lack of bicycle routes, all contribute to an unpleasant and unhealthy experience for pedestrians and bicyclists in cities. 16% of roadway fatalities are pedestrians or bicyclists. In 1969, 48% of children in grades K-8 regularly traveled to school on foot or bike; by 2009 only 13% did.⁴⁸⁴ Electric motorcycles and bicycles have great potential, especially if charged with green electricity, and are growing rapidly.⁴⁸⁵

Transportation powered by animals has been virtually eliminated in the U.S., except for recreation.

Need for Change in Transportation Systems

- U.S. transportation systems are 92% based on fossil fuels, the #1 contributor climate change, and they are poisoning life, and don't count enormous external costs borne by the environment, society, other species, and Earth's life support systems, so they are artificially inexpensive.
- Transportation costs are often about a third less for businesspeople, who write them off on taxes.
- 2.5 million people are in airplanes in a given day in the U.S., contributing to 5% of global warming; we need to spend \$40 billion on airports; we expect way more air congestion and delays; and U.S. airlines ship freight 80 billion ton-miles, the most harmful form of freight transport.
- Transportation of goods by ships works, but international ships are Earth's most polluting vehicles, causing 3% of global warming, 400,000 deaths and 14 million child asthma cases/year, globally.⁴⁸⁶
- The 925 ports in the U.S. handle 99% of our overseas trade, \$4.5 trillion in economic activity, almost a fourth of the U.S. economy, and we need to invest \$66 billion in them.
- Barges are our most fuel-efficient way to move goods, but most dams and locks in our inland waterway systems are beyond their 50-year design life, and we need to spend \$37 billion on them.
- Trains are the 2nd most fuel-efficient way to ship cargo, 4 times more efficient than trucks, and that system works pretty well, with shipments expected to increase 40% by 2040.
- Trains carried 98% of all U.S. intercity passengers, in 1916; down to 0.6% of 2017 passenger miles. Half are on a single Boston to DC 450-mile route, which is capacity constrained, and \$30 billion of needed work on that route's been deferred. They're often poorly perceived, don't serve many locations and are often not reliably on time. The U.S. President wants to eliminate most.
- 100 years ago, we had great public transit systems. Now, there are 15 subway or metro train systems in the country, and a third of their passengers are in New York, which is comprehensive, fast and runs trains often. Most lack capacity and coverage, with congestion and reliability problems that drive people into cars, and they're \$100 billion dollars behind in maintenance.
- Only half of people in the U.S. can get to a grocery store via public transit, including local bus.
- Busses, the most efficient systems for transporting people, run on only 1.5% of U.S. roads.
- Only 10% of U.S. adults take a transit train or bus in a week, though 80% live in metro areas.

- We've built roads to stretch 301 lanes-wide to the moon, and spend \$120 billion on them, adding a lane to the moon, per year, with 1 in 5 miles in poor shape, 60 of those lanes, and \$3.6 trillion in deferred maintenance, which costs us \$120 billion annually in increased vehicle maintenance. They create land, water, air, light and noise pollution that impact millions of square miles of our environments, all life around that land, and 1 million animals die each day on them.
- 55% of our 600,000 bridges are near the ends of their lives, creating risks and inefficiencies, with \$120 billion in backlogged bridge repair that's not being addressed.
- We have 284 million passenger cars in the U.S., more than 1 per adult, and 8.8 million 18-wheeler trucks, 3.5 for every 100 adults, which could create 326 lanes of bumper-to-bumper traffic from the Statue of Liberty to the Golden Gate Bridge, or 4 lanes wide from the Earth to the moon.
- Every year, we use 10% of GDP, \$2 trillion dollars, 10% of our businesses, business locations, people employed and payroll on driving around on roads in cars, trucks and motorcycles.
- U.S. median households spend \$9,000 every year on transportation, our third highest expense, after housing and taxes, work 7 weeks a year to earn that, and spend 7 weeks a year sitting in cars, 3.5 months a year for or in vehicles.
- There's little effort to create good driving. We drive 3 trillion miles a year, like 625 million stressful, time-consuming and dangerous trips to the moon, killing 35,000 people, injuring 2.5 million, 1 in 100 adults a year. That's the most likely accident we'll die in, except for poisoning.
- Metro areas, cities and towns are inefficiently designed around roads and cars, using half the land in cities, with things spread out, so we basically are forced to drive in vehicles.
- That harms the environment, killing soil, draining aquifers, adding rain runoff and water pollution, eliminating positive impacts of nature, trees and plants, separating physical spaces, and making it unpleasant, difficult, dangerous, and stressful to be a person or other life form, in or out of a car.
- Traffic is a huge and increasing problem. 40% of urban roads are congested, costing \$160 billion a year in waste, wasting 3 billion gallons of fuel, which burns up and does harms but no good, enough for 625,000 trips to the moon in a 50mpg car. Parking is often difficult and expensive.
- A motor vehicle is stolen every 41 seconds, and 13 million vehicles are in accidents in a year.
- Billions of dollars are spent every year hooking us on motor vehicle transportation and ownership.
- Motor-cycles and -bikes are few compared to cars, even if they're cheaper and cleaner.
- Taxis are systematically made more expensive than necessary, inciting people to own or rent. Ride-sharing, vehicle-sharing and vehicle for hire solutions are promising disruptive alternatives.
- Innovations like electric cars, motorcycles and bicycles offer less pollution, if they're charged with renewable energy, but they don't help much with expensive infrastructure and traffic. Hydrogen!

Could you come up with a more inefficient and harmful system if you tried hard? Does this make sense? Great changes are needed in how almost all transportation systems work, and how we each think about and interact with them? Looking out through the traffic snarls and dirty air at the ugliness of our cities seems to make that obvious, as a human being, honestly feeling and using common sense?

We may not be able to fix these systemic problems ourselves, but we do have the power to choose our own thoughts and ways of living and getting around. Be less of a part of these problems! Get rid of combustion engine vehicles! Walk, run or ride a bike when you can! Get an electric bicycle! Live closer to work and the places you want to do things! Use shared or rented transportation options! Travel less! Ride trains more! Use public transportation! Don't buy into ideas that your self-worth is in your car! Don't look at car advertisements! Make fewer shopping trips! Write letters! Share info! Change!

Endnotes

- ⁴¹² *2017 Infrastructure Report Card: Aviation*, American Society of Civil Engineers (ASCE), <https://www.infrastructurereportcard.org/cat-item/aviation/>
- ⁴¹³ "Understanding Airline Ticket Prices: Why a Seatmate's Airfare Costs More or Less than Yours", Rick Seaney, Fare Compare, September 17, 2018, <https://www.farecompare.com/travel-advice/understanding-airline-ticket-prices-why-your-seatmates-airfare-cost-more-or-less-than-yours/>
- ⁴¹⁴ "Fly or drive? Parsing the evolving climate math", John Wihbey, September 2, 2015, Yale Climate Connections, <https://www.yaleclimateconnections.org/2015/09/evolving-climate-math-of-flying-vs-driving/>
- ⁴¹⁵ "What effect is global aviation having on the environment?", Nahda Abdalla, Phys.org, August 29, 2018, <https://phys.org/news/2018-08-effect-global-aviation-environment.html>
- ⁴¹⁶ A cargo revenue ton-mile is one ton of revenue cargo (freight or mail) carried for one mile, Sources: "Air Cargo Summary Data (All): October 2002 - February 2019: Summary Table of Cargo Revenue Ton-Miles* (in millions)", U.S. Department of Transportation: Bureau of Transportation Statistics, <https://transtats.bts.gov/freight.asp>
- ⁴¹⁷ *2017 Infrastructure Report Card: Aviation*, American Society of Civil Engineers (ASCE), <https://www.infrastructurereportcard.org/cat-item/aviation/>
- ⁴¹⁸ "The urgency of curbing pollution from ships, explained", James J. Winebrake and James J. Corbett, The Conversation, April 12, 2018, <https://theconversation.com/the-urgency-of-curbing-pollution-from-ships-explained-94797>
- ⁴¹⁹ *2017 Infrastructure Report Card: Ports*, American Society of Civil Engineers (ASCE), <https://www.infrastructurereportcard.org/cat-item/ports>
- ⁴²⁰ "U.S. Ports Need \$66 Billion for Infrastructure", MarEx, May 17, 2017, The Maritime Executive, <https://www.maritime-executive.com/article/us-ports-need-66-billion-for-infrastructure>
- ⁴²¹ "Vessel - Revised (2/8/2018)", Bureau of Transportation Statistics, <https://www.bts.gov/content/vessel-revised-282018>
- ⁴²² *2017 Infrastructure Report Card: Inland Waterways*, American Society of Civil Engineers (ASCE), <https://www.infrastructurereportcard.org/cat-item/inland-waterways>
- ⁴²³ "Fuel Efficiency: Modes of Transportation Ranked By MPG", <https://truecostblog.com/2010/05/27/fuel-efficiency-modes-of-transportation-ranked-by-mpg/>
- ⁴²⁴ "Freight Rail's Investments Generate Huge Returns for America", Association of American Railroads, Accessed May 13, 2019, <https://www.aar.org/article/freight-rails-private-investments/>
- ⁴²⁵ *2017 Infrastructure Report Card: Rail*, American Society of Civil Engineers (ASCE), <https://www.infrastructurereportcard.org/cat-item/rail>
- ⁴²⁶ "Historical Statistics of the United States", U.S. Census, 1957, https://www2.census.gov/library/publications/1960/compendia/hist_stats_colonial-1957/hist_stats_colonial-1957-chQ.pdf
- ⁴²⁷ "Why Trump wants you to be afraid of high speed trains", Zachary B. Wolf, CNN, Updated February 17, 2019, <https://edition.cnn.com/2019/02/16/politics/high-speed-trains-trump/index.html>
- ⁴²⁸ "Dismantling a National Transportation Network: The faulty assumptions behind proposals to preserve passenger rail service only for the Nation's wealthiest travelers", Content Coordinator October 19, 2017, National Association of Railroad Passengers (NARP), <http://www.infrastructureusa.org/dismantling-a-national-transportation-network/>
- ⁴²⁹ "U.S. Passenger-Miles", U.S. Department of Transportation: Bureau of Transportation Statistics, <https://www.bts.gov/content/us-passenger-miles>
- ⁴³⁰ *2017 Infrastructure Report Card: Rail*, American Society of Civil Engineers (ASCE), <https://www.infrastructurereportcard.org/cat-item/rail>
- ⁴³¹ "Why Did America Give Up on Mass Transit? (Don't Blame Cars.)", Jonathan English, Citylab, August 31, 2018, <https://www.citylab.com/transportation/2018/08/how-america-killed-transit/568825/>
- ⁴³² "Why US public transportation is so bad — and why Americans don't care: How American mass transit measures up against the rest of the world's.", Aditi Shrikantaditi, Vox, September 26, 2018, <https://www.vox.com/the-goods/2018/9/26/17903146/mass-transit-public-transit-rail-subway-bus-car>
- ⁴³³ "What Ever Happened to Public Transportation?", John Robbins, July 2, 2010, Updated May 25, 2011, The Huffington Post, https://www.huffingtonpost.com/john-robbins/what-ever-happened-to-pub_b_633585.html
- ⁴³⁴ "Why Did America Give Up on Mass Transit? (Don't Blame Cars.)", Jonathan English, Citylab, August 31, 2018, <https://www.citylab.com/transportation/2018/08/how-america-killed-transit/568825/>
- ⁴³⁵ *2017 Infrastructure Report Card: Transit*, American Society of Civil Engineers (ASCE), <https://www.infrastructurereportcard.org/cat-item/transit>
- ⁴³⁶ "What Ever Happened to Public Transportation?", John Robbins, July 2, 2010, Updated May 25, 2011, The Huffington Post, https://www.huffingtonpost.com/john-robbins/what-ever-happened-to-pub_b_633585.html

⁴³⁷ 2017 Infrastructure Report Card: Transit, American Society of Civil Engineers (ASCE), <https://www.infrastructurereportcard.org/cat-item/transit>

⁴³⁸ 2017 Infrastructure Report Card: Transit, American Society of Civil Engineers (ASCE), <https://www.infrastructurereportcard.org/cat-item/transit>

⁴³⁹ "Frequently Asked Questions", American Road and Transportation Builders Association, Accessed May 14, 2019, <https://www.artba.org/about/faq/>

⁴⁴⁰ 18,000,000 total miles of road / 271,000 miles of bus routes

⁴⁴¹ 2017 Infrastructure Report Card: Transit, American Society of Civil Engineers (ASCE), <https://www.infrastructurereportcard.org/cat-item/transit>

⁴⁴² "Highway Statistics 2017: Public Road Length - 2017 (1)", U.S. Department of Transportation: Federal Highway Administration, <https://www.fhwa.dot.gov/policyinformation/statistics/2017/hm16.cfm#foot1>
"Frequently Asked Questions", American Road and Transportation Builders Association, Accessed May 14, 2019, <https://www.artba.org/about/faq/>

⁴⁴³ 72,000,000 road lane miles / 238,855 average miles between Earth and Moon

⁴⁴⁴ 72,000,000 road lane miles * .4%

"Frequently Asked Questions", American Road and Transportation Builders Association, Accessed May 14, 2019, <https://www.artba.org/about/faq/>

⁴⁴⁵ 2017 Infrastructure Report Card: Roads, American Society of Civil Engineers (ASCE), <https://www.infrastructurereportcard.org/cat-item/roads>

⁴⁴⁶ 14,000,000 miles of other roads * (\$825 billion / 4.2 million miles of highways)

⁴⁴⁷ "America's Third World Roads: Broken and Dangerous", Blaire Briody, June 22, 2011, The Fiscal Times, <http://www.thefiscaltimes.com/Articles/2011/06/22/Americas-Third-World-Roads-Broken-and-Dangerous>

⁴⁴⁸ 2017 Infrastructure Report Card: Roads, American Society of Civil Engineers (ASCE), <https://www.infrastructurereportcard.org/cat-item/roads>

⁴⁴⁹ "Animals and cars: One million animals are killed on our roads every day: When animals meet cars, the cars win", Mark Bekoff Ph.D., Psychology Today, July 21, 2010, <https://www.psychologytoday.com/us/blog/animal-emotions/201007/animals-and-cars-one-million-animals-are-killed-our-roads-every-day>

⁴⁵⁰ 2017 Infrastructure Report Card: Bridges, American Society of Civil Engineers (ASCE), <https://www.infrastructurereportcard.org/cat-item/bridges>

Date	Federal Highway & Street	State and Local Parking	State and Local Automotive	State and Local Highway & Street	State and Local Pavement	State and Local Bridge	Private Automotive	Private Parking	Total
2018	\$1,037	\$929	\$941	\$91,365	\$56,460	\$29,075	\$7,656	\$1,152	\$188,615
2017	\$1,139	\$590	\$609	\$87,715	\$53,838	\$29,167	\$8,217	\$1,109	\$182,384
2016	\$843	\$550	\$675	\$91,698	\$55,222	\$30,841	\$7,506	\$988	\$188,323
2015	\$547	\$799	\$844	\$89,719	\$53,268	\$31,578	\$5,528	\$759	\$183,042
2014	\$473	\$443	\$500	\$84,014	\$50,511	\$29,234	\$4,829	\$667	\$170,671
2013	\$642	\$621	\$696	\$80,611	\$46,282	\$28,813	\$4,639	\$371	\$162,675
2012	\$671	\$797	\$940	\$79,721	\$47,566	\$27,051	\$4,834	\$534	\$162,114
2011	\$919	\$680	\$842	\$78,370	\$47,953	\$25,546	\$4,272	\$478	\$159,060
2010	\$1,109	\$675	\$770	\$81,308	\$51,434	\$24,222	\$3,548	\$514	\$163,580
2009	\$802	\$1,032	\$1,141	\$81,254	\$55,187	\$22,075	\$4,536	\$915	\$166,942
2008	\$738	\$1,251	\$1,425	\$80,424	\$52,838	\$23,691	\$5,640	\$1,366	\$167,373
2007	\$792	\$942	\$1,013	\$75,456	\$47,678	\$22,828	\$6,282	\$1,353	\$156,344
2006	\$536	\$1,012	\$1,152	\$71,033	\$45,933	\$20,058	\$5,527	\$1,060	\$146,311
2005	\$633	\$1,356	\$1,490	\$63,157	\$45,178	\$14,244	\$5,614	\$975	\$132,647
2004	\$943	\$1,357	\$1,502	\$57,351	\$40,273	\$13,149	\$5,235	\$813	\$120,623
2003	\$724	\$1,561	\$1,600	\$56,252	\$39,295	\$12,980	\$5,039	\$1,073	\$118,524
2002	\$692	\$1,693	\$1,715	\$56,659	\$40,963	\$11,743	\$5,808	\$1,264	\$120,537
⁴⁵¹ Total	\$13,240	\$16,288	\$17,855	\$1,306,107	\$829,879	\$396,295	\$94,710	\$15,391	\$2,689,765

Source: "Construction Spending: Historical Value Put in Place", U.S. Census Bureau, https://www.census.gov/construction/c30/historical_data.html

⁴⁵² "Happy 60th Birthday, Interstate Highway System!", Laura Hale, InfrastructureReportCard, June 29, 2016, <https://www.infrastructurereportcard.org/happy-60th-birthday-interstate-highway-system/>

⁴⁵³ "Number of U.S. Aircraft, Vehicles, Vessels, and Other Conveyances", U.S. Department of Transportation: Bureau of Transportation Statistics, Accessed May 14, 2019, <https://www.bts.gov/content/number-us-aircraft-vehicles-vessels-and-other-conveyances>

⁴⁵⁴ "State of the U.S. Automotive Industry 2018", American Automotive Policy Council", August 2018, <http://www.americanautocouncil.org/sites/aapc2016/files/2018%20Economic%20Contribution%20Report.pdf>

⁴⁵⁵ (267 million old + 17.4 million new sold cars) * (33,800 miles/11.3 million new cars) + (8.8 million trucks * 75 feet)/5,280

⁴⁵⁶ 975,683 miles * 11.3/33,800

⁴⁵⁷ 975,683 miles / 238,855

⁴⁵⁸ "State of the U.S. Automotive Industry 2018", American Automotive Policy Council", August 2018,

<http://www.americanautocouncil.org/sites/aapc2016/files/2018%20Economic%20Contribution%20Report.pdf>

⁴⁵⁹ "U.S. automotive repair and maintenance industry gross output from 2008 to 2017 (in billion U.S. dollars)", Statista,

<https://www.statista.com/statistics/382352/gross-output-of-automotive-repair-and-maintenance-industry/>

⁴⁶⁰ "TET 2018 - Chapter 2 - Transportation's Contribution to the Economy", U.S. Department of Transportation: Bureau of

Transportation Statistics, <https://www.bts.dot.gov/transportation-economic-trends/tet-2018-chapter-2-contribution-economy>

⁴⁶¹ "Producer Price Index by Industry: Premiums for Property and Casualty Insurance: Premiums for Commercial Auto Insurance (PCU9241269241263)", Federal Reserve Bank of St. Louis, <https://fred.stlouisfed.org/series/PCU9241269241263>

⁴⁶² "Oil & gas industry accounts for 7.6% of U.S. GDP", Talk Business & Politics staff, Business Energy, August 1,

2017, <https://talkbusiness.net/2017/08/oil-gas-industry-accounts-for-7-6-of-u-s-gdp/>

⁴⁶³ "How does the average American spend their paycheck? See how you compare", Matthew Frankel, The Motley, USA Today,

May 8, 2018, <https://www.usatoday.com/story/money/personalfinance/budget-and-spending/2018/05/08/how-does-average-american-spend-paycheck/34378157/>

⁴⁶⁴ "Number of households in the United States in 2018, by type (in millions)", Statista,

<https://www.statista.com/statistics/242254/number-of-us-households-by-type/>

Number of Firms, Number of Establishments, Employment, and Annual Payroll by Enterprise Employment Size for the United States All Industries: 2016					
NAICS CODE	NAICS DESCRIPTION	NUMBER OF FIRMS	NUMBER OF ESTABLISHMENTS	EMPLOYMENT	ANNUAL PAYROLL (\$1,000)
211	Oil and Gas Extraction	5,760	7,330	122,140	\$15,295,715
213111	Drilling Oil and Gas Wells	1,795	2,097	53,837	\$4,159,486
213112	Support Activities for Oil and Gas Operations	8,727	10,871	227,241	\$16,911,702
2373	Highway, Street, and Bridge Construction	8,940	9,760	275,012	\$21,284,183
32411	Petroleum Refineries	96	197	64,874	\$8,062,241
32412	Asphalt Paving, Roofing, and Saturated Materials Manufacturing	591	1,576	25,065	\$1,745,202
32419	Other Petroleum and Coal Products Manufacturing	317	394	14,809	\$1,130,883
324191	Petroleum Lubricating Oil and Grease Manufacturing	239	294	11,670	\$901,530
324199	All Other Petroleum and Coal Products Manufacturing	80	100	3,139	\$229,353
32621	Tire Manufacturing	335	482	51,098	\$2,979,472
326212	Tire Retreading	263	372	6,255	\$252,148
32622	Rubber and Plastics Hoses and Belting Manufacturing	189	264	18,845	\$885,772
336	Transportation Equipment Manufacturing	9,601	11,683	1,504,272	\$100,523,711
3361	Motor Vehicle Manufacturing	282	337	198,039	\$17,074,780
3362	Motor Vehicle Body and Trailer Manufacturing	1,593	1,880	143,649	\$6,791,318
3363	Motor Vehicle Parts Manufacturing	4,005	4,948	560,200	\$29,959,902
4231	Motor Vehicle and Motor Vehicle Parts and Supplies Merchant Wholesalers	16,298	23,882	397,905	\$22,140,756
42385	Service Establishment Equipment and Supplies Merchant Wholesalers - Motor Vehicle	840	1,898	12,782	\$686,259
441	Motor Vehicle and Parts Dealers	80,810	118,201	1,972,103	\$90,115,927
447	Gasoline Stations	65,532	111,076	947,856	\$19,112,760
45431	Fuel Dealers	4,627	8,210	72,013	\$3,361,461
484	Truck Transportation	109,558	124,320	1,460,598	\$68,761,180
485	Transit and Ground Passenger Transportation	17,319	20,247	515,992	\$14,560,811
4871	Scenic and Sightseeing Transportation, Land	704	753	11,865	\$371,314
4884	Support Activities for Road Transportation	10,434	11,362	89,473	\$3,044,120
4885	Freight Transportation Arrangement	14,735	20,780	266,153	\$14,876,312
4889	Other Support Activities for Transportation	1,616	1,754	17,241	\$622,395
52412	Direct Insurance Carriers (Auto, Truck and Motorcycle Derived at 20%)	761	3,987	125,726	\$10,743,213
52413	Reinsurance Carriers (Auto, Truck and Motorcycle Derived at 20%)	30	90	2,654	\$529,684
52421	Insurance Agencies and Brokerages (Auto, Truck and Motorcycle Derived at 20%)	24,482	26,885	142,167	\$9,521,607
52429	Other Insurance Related Activities (Auto, Truck and Motorcycle Derived at 20%)	1,639	2,349	55,954	\$3,452,844
524291	Claims Adjusting (Auto, Truck and Motorcycle Derived at 20%)	646	845	7,589	\$583,619
524292	Third Party Administration of Insurance and Pension Funds (Auto, Truck and Motorcycle Derived at 20%)	540	939	40,745	\$2,269,555
524298	All Other Insurance Related Activities (Auto, Truck and Motorcycle Derived at 20%)	466	566	7,619	\$599,670
5321	Automotive Equipment Rental and Leasing	4,039	16,384	167,083	\$7,034,847
611692	Automobile Driving Schools	2,319	2,467	14,497	\$298,657
8111	Automotive Repair and Maintenance	146,563	159,882	892,007	\$31,712,096
81293	Parking Lots and Garages	3,003	12,442	145,133	\$2,895,448
	Total Auto, Truck and Motorcycle Industries	549,774	721,902	10,645,100	\$535,481,933
--	Total All Industries	5,954,684	7,757,807	126,752,238	\$6,435,142,055
	Total Auto, Truck and Motorcycle Industries - %	9%	9%	8%	8%

SOURCE: 2016 County Business Patterns

For information on confidentiality protection, sampling error, and nonsampling error, see <http://www.census.gov/programs-surveys/susb/technical-documentation/methodology.html>.

For definitions, see <http://www.census.gov/programs-surveys/susb/about/glossary.html>

465 release date: 12/18/2018

Source: "2016 SUSB Annual Data Tables by Establishment Industry December 2018: U.S., 6-digit NAICS [1.0 MB]", U.S. Census, <https://www.census.gov/data/tables/2016/econ/susb/2016-susb-annual.html>

466 "Road Accidents in the U.S. - Statistics & Facts", Statista, Accessed May 14, 2019, <https://www.statista.com/topics/3708/road-accidents-in-the-us/>

467 2017 Infrastructure Report Card: Roads, American Society of Civil Engineers (ASCE), <https://www.infrastructurereportcard.org/cat-item/roads>

468 3 trillion miles / 238,855 average miles between Earth and Moon

469 3 trillion miles / 60 mph

470 2017 Infrastructure Report Card: Roads, American Society of Civil Engineers (ASCE), <https://www.infrastructurereportcard.org/cat-item/roads>

471 "Number of road traffic-related injuries and fatalities in the U.S. from 1990 to 2015", Statista, <https://www.statista.com/statistics/191900/road-traffic-related-injuries-and-fatalities-in-the-us-since-1988/>

472 2.5 million injured / 250 million U.S. adults

473 "Accidents or Unintentional Injuries", Centers for Disease Control and Prevention, <https://www.cdc.gov/nchs/fastats/accidental-injury.htm>

-
- ⁴⁷⁴ “Americans Spend an Average of 17,600 Minutes Driving Each Year”, Tamra Johnson, September 8, 2016, AAA, <http://newsroom.aaa.com/2016/09/americans-spend-average-17600-minutes-driving-year/>
- ⁴⁷⁵ “Transportation Land Valuation: Evaluating Policies and Practices that Affect the Amount of Land Devoted to Transportation Facilities”, Todd Litman, January 16, 2012, Victoria Transport Policy, p9, <https://www.vtpi.org/land.pdf>
- ⁴⁷⁶ “Texting while driving viewed as a problem in cities across the US”, Hoang Nguyen, YouGov, November 19, 2018, <https://today.yougov.com/topics/technology/articles-reports/2018/11/19/texting-while-driving-viewed-problem-cities-across>
- ⁴⁷⁷ 2017 Infrastructure Report Card: Roads, American Society of Civil Engineers (ASCE), <https://www.infrastructurereportcard.org/cat-item/roads>
- ⁴⁷⁸ “Drivers spend an average of 17 hours a year searching for parking spots”, Kevin McCoy, July 12, 2017, USA TODAY, <https://www.usatoday.com/story/money/2017/07/12/parking-pain-causes-financial-and-personal-strain/467637001/>
- ⁴⁷⁹ “Facts + Statistics: Auto theft”, Insurance Information Institute, Accessed May 16, 2019, <https://www.iii.org/fact-statistic/facts-statistics-auto-theft>
- ⁴⁸⁰ “Road Accidents in the U.S. - Statistics & Facts”, Statista, Accessed May 14, 2019, <https://www.statista.com/topics/3708/road-accidents-in-the-us/>
- ⁴⁸¹ “U.S. Automotive Advertising - Statistics & Facts”, Accessed May 16, 2019, <https://www.statista.com/topics/1601/automotive-advertising/>
- ⁴⁸² “Episode 643: The Taxi King”, Nick Fountain, NPR, May 23, 2018, <https://www.npr.org/sections/money/2018/05/23/613776997/episode-643-the-taxi-king>
- ⁴⁸³ “Disruptive Transportation: The Adoption, Utilization, and Impacts of Ride-Hailing in the United States”, October 2017”, Regina R. Clewlow and Gouri Shankar Mishra, UC Davis Institute of Transportation Studies, https://itspubs.ucdavis.edu/wp-content/themes/ucdavis/pubs/download_pdf.php?id=2752
- ⁴⁸⁴ “BICYCLING & WALKING in the United States 2016: Benchmarking Report”, Alliance for Biking and Walking, <file:///C:/Users/James'/Downloads/Benchmarking%20Report%202016.pdf>
- ⁴⁸⁵ “Electric motorcycles are already here — and more are likely on the way”, Kellie Ell, CNBC, August 6, 2018, <https://www.cnn.com/2018/08/05/electric-motorcycles-are-already-here-and-likely-more-are-coming.html>
- ⁴⁸⁶ “The urgency of curbing pollution from ships, explained”, James J. Winebrake and James J Corbett, The Conversation, April 12, 2018, <https://theconversation.com/the-urgency-of-curbing-pollution-from-ships-explained-94797>