The Maglev America Project – Our Highways to the Future

A Proposal for a Privately Financed National Maglev Network for Passengers and Freight, an Alternative to the Government Funded, High Speed Intercity Passenger Rail Program

U.S. National Maglev Network (1st Wave in blue, 2nd Wave in Green and 3rd Wave in red)

Maglev Network	States In Network	Population of States in Network (millions)	Population Living Within 15 Miles of Maglev Stations (millions)	Route Miles in Network
First, Second and Third Waves Completed	48 plus Toronto, Montreal & Vancouver	315 (includes Toronto, Montreal & Vancouver)	232 (includes Toronto, Montreal & Vancouver)	28,800
74% of population in States live within 15 Miles of a Maglev Station				

Interstate Maglev Project/Maglev 2000
708 East Broad St.
Falls Church, VA 22046

www.magneticglide.com

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Executive Summary

The inevitable transport system for the U.S. is the new advanced superconducting magnetic levitation (Maglev-2000) system invented by Drs. James Powell and Gordon Danby, the inventors of the 1st generation superconducting Maglev system in 1966, the first new transport system since the airplane. Their superconducting Maglev system was developed by Japan Railways, and its passenger train holds the World speed record of 361 mph. In April, 2000 Powell and Danby were awarded the prestigious Benjamin Franklin Medal in Engineering (recipients include Tesla and Steinmetz) by the Franklin Institute of Philadelphia for the development of this new transportation system.

President Obama as a candidate spoke of advanced guided surface transport as part of his vision to relieve traffic congestion, improve energy conservation, reduce pollution and create jobs. Many of his speeches before and after the election referred to the Maglev systems in Japan and China culminating in his high speed rail speech on April 16, 2009, when he said, "*What we need, then, is a smart transportation system equal to the needs of the 21st century. A system that reduces travel times and increases mobility. A system that reduces congestion and boosts productivity. A system that reduces destructive emissions and creates jobs. . . . Now, all of you know this is not some fanciful, pie-in-the-sky vision of* "rebuilding America." In several speeches, before and after the election, President Obama spoke of connecting cities with faster rail service, "*the future. It is now. It is happening right now. It's been happening for decades. The problem is it's been happening elsewhere, not here.*" (http://www.readinessresource.net/maglev/2000.html)

The real problem is the President's vision has been distorted and its promise broken. Inside the Washington beltway, high powered lobbyists have tilted the playing field to favor importing steel-wheel copies of the European high speed rail systems and to forego the opportunity to lead the world in transport by developing and demonstrating America's own advanced superconducting Maglev high speed guided monorail system to share with the World.

Furthermore the Administration's planned High Speed Intercity Passenger Rail Program is not fair to most of America's citizens. High Speed Rail routes will only be in a few areas and will only "serve few and be funded by all" through subsidies from American taxpayers.

European style high speed rail is not practical for America. For example, in France with its very well developed and admired high speed rail system, on average, a citizen only travels 400 miles per year (a little more than 1 round trip per year) on the country's high speed rail system. In contrast an average French citizen drives 7600 miles on the highway. France is a small country with high population density, and finds it practical to build a high speed rail system. A U.S. high speed rail system would not be economically practical and even if it were built with more debt and taxes, it would not take a significant amount of traffic off of America's congested highways and airways. Statistically, the average American drives 10,000 miles a year and flies almost 3,000 miles a year, and travels by Amtrak only 18 miles a year.

In a recent article by Dr. Yoshiyuki Kasai, the Chairman of Japan Railways, the operator of the fastest and most extensive high speed steel wheel rail system in the World, and the constructor of Japan's Maglev line and operator of the Maglev Test Facility at Yamanashi, recommends that *"the most effective future train system for the United States would be a maglev transit line. If such a network was in place, people in New York would be able to participate in an early-morning meeting in Washington without the bother of having to go to and from airports at both ends. Likewise, transcontinental maglev services could supersede aviation networks."*

Dr. Kasai recognizes that Japan's steel wheel High Speed Rail (HSR) is a fully mature technology, and any advances in its technology will only be marginal. In contrast, Maglev technology is still evolving. The 1st generation German (i.e. China) and Japanese Maglev systems are still too expensive and limited in capability and revenue potential to be implemented in the U.S. Like HSR, they must be government subsidized. In effect they are like the pre-World War II DC-3 airplanes. If passenger air travel had remained at that level, instead of evolving to modern jet airliners, air travel today would be an oddity.

Given the urgency of overarching global energy, environment, and economic security issues coupled with worsening quality of travel in the U.S. and the compelling need to create millions of sustainable jobs, the U.S. Government should proceed immediately to testing the performance, construction and operating costs of Powell and Danby's new advanced 2nd generation (Maglev-2000) superconducting Maglev system and certifying the Maglev-2000 vehicles as public carriers.

Powell and Danby's Maglev-2000 system has the power to levitate and propel vehicles that carry passengers, passengers and their autos, freight, and highway freight trucks on roll-on, roll-off Maglev ferry vehicles at ultra high speeds (300 + mph). The Maglev-2000 vehicles can electronically switch at high speeds and do not require the mechanical and cumbersome mechanical movement of guideway to leave the mainline for station stops. Importantly, Maglev-2000 vehicles can uniquely travel in a levitated mode on existing railroad tracks and railroad infrastructure that have been adapted, at very low cost, about $6 million per 2-way mile for Maglev use. At ultra high speeds the Maglev-2000 vehicles safely travel on elevated guideway beams. **This "monorail" system can be built at very low cost, much less than the German and Japanese Maglev and less than the construction cost of new high speed capable alignment of steel-wheel, steel-rail high speed railroads, similar to those used by European and Japanese high speed rail systems that some have proposed for the U.S.**

The Maglev-2000 guideway system's low construction cost and very low operating and maintenance costs coupled with high revenue freight carrying capability will pay back the routes that compose a National Maglev Network in less than 5 years. The National Network could be built using private investment and would not require government funds and subsidies. In contrast, High Speed Rail will require government funding to construct routes plus large continuing operating subsidies amounting to many hundreds of Billions of dollars.

A National Maglev Network built along the rights-of-way of federally assisted highways and on the railways as they enter built-up urban areas (first suggested in 1990 by the late Senator Patrick Moynihan of New York) could be completed in 20 years in 3 waves of construction. In contrast to the High Speed Intercity Passenger Rail program, the National Maglev Project will serve all 48 States not just the 31 States served by the proposed 13 HSIPR Corridors. The Maglev network will interconnect 174 Large Statistical Areas (Table 20 U.S. Statistical Abstracts) and directly serve 232 million people living within 15 miles of a Maglev station.

Typical trip times on the Maglev Network, compared to traveling by highway driving would be:

San Diego to Seattle	4 hrs 30 min vs 25 hrs 15 min
San Francisco to Los Angeles	1 hr 45 min vs 9 hrs 40 min
Portland to San Francisco	2 hrs 30 min vs 12 hrs 45 min
Los Angeles to Las Vegas	1 hr vs 5 hrs 30 min

In addition to much shorter trip times by Maglev, the cost of travel by Maglev would be significantly less for passengers, highway trucks and personal autos as compared to existing transport modes:

Passengers	5 cents per passenger mile (PM) on Maglev, compared to 40 cents per PM for driving by auto, 15 cents per PM by air and 50 cents per PM by High Speed Rail
Highway trucks	10 cents per ton mile by Maglev compared to 30 cents per ton mile by highway
Personal autos	30 cents per mile by Maglev transport compared to 40 cents per mile by highway

Costs
Total government funding is limited to $600 million over 5 years for upfront demonstration and certification activities (about 40 cents per person per year or $1 dollar per household per year for 5 years). After that, freight capability enables building the entire national network with private financing.

Benefits
At a 75% intercity truck transport utilization factor, the net transport savings received by the National Maglev Network would be well over 300 Billion dollars annually, or about $1000 per person per year and generating 15% Return on Investment for the bondholders.

The Societal and Environmental Benefits of the National Maglev Network:
First, safety and health.

Traveling by Maglev will be much safer than by highway. Today, over 5000 deaths per year and 100,000 serious injuries are due to trucks. Highway deaths and injuries will soar in the years ahead as the roads become much more congested. Taking trucks and autos off the roads and carrying them by Maglev will save many thousands of lives and serious injuries per year. Moreover, the damage done to peoples' health by pollutants and micro particulates in heavily traveled areas will be greatly reduced. As an auxiliary benefit, many Billions of dollars now spent because of these deaths, injuries, and damaged health will be avoided.

Second, linked national security and economic productivity.

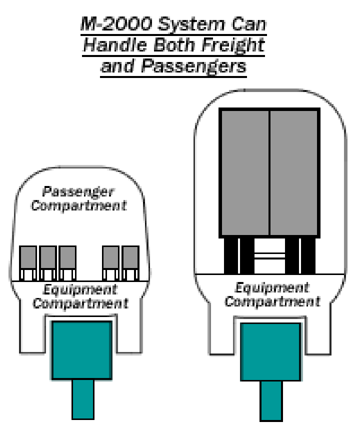
As a nation, we cannot be secure if our economic productivity is weak, while the US cannot be secure if it depends on unstable foreign sources for critical materials, such as oil. The National Maglev Network will substantially reduce oil consumption – 70% of US oil consumption is currently used for transport. Building the National Network will provide millions of new US jobs, for both domestic and export application of Maglev. Moreover, reducing the cost of domestic transport and enabling more efficient, faster delivery of people and goods inside the US will increase economic productivity and make our exports more competitive.

Third, environmental benefits.

Maglev emits no pollutants and greenhouse gases, is much more energy efficient than current modes of transport, and is very quiet with no rail, braking or engine noise.

In summary, the Maglev America Project is practical, uses existing technology, and will provide America with tremendous social and economic benefits. The 28,800 mile long National Maglev Network can be completed by 2030 AD. Built by private investment, it will not require government subsidization for construction and operation.

All that is needed for the US Government to bring the National Maglev Network into being is to fund a facility to test and certify the 2nd generation superconducting Maglev system described in this proposal. The funding required is extremely modest, about 600 million dollars over a 5 year period. This amounts to a per capita funding of only $2 per American – about the cost of one hotdog. For this investment, the transport savings for the average American will amount to about $30,000 over a 30 year period.



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"This land is your land

This land is my land

From California to the New York Island

From the Redwood Forests to the Gulf Stream Waters

This Land was made for you and me" -- Woody Guthrie

Woody's great folk song got it exactly right. It is our land, with everybody an equal partner in its well being. It doesn't belong exclusively to the rich and the powerful or the big corporations. America's land, water, air, trees, and animals – they belong to all of us.

If Woody came back today, he would be outraged at what has been done, and what is being done now, to America's environment and people. The Gulf Coast oil disaster is only one example of trashing our environment for corporate profits. How about cutting off the tops of mountains in Appalachia to remove the coal underneath, and dumping the waste into local streams, polluting the water? How about thousands of acres of toxic ash from coal power plants that leak into our ground water and flood our farms when it breaks out of storage ponds? How about tons of PCBs dumped into the Hudson River bed? What about the 7 Billion tons of carbon dioxide that America pours into the atmosphere every year, contributing to global warming and ocean acidification? What about the 40,000 deaths and hundreds of thousands of serious injuries on our highways every year, which cost us hundreds of Billions of dollars annually? What about the health damage and shortening of lives due to pollutants and micro particulates emitted by the cars and trucks on our highways?

While Woody would be outraged about the damage done to America's environment and people, he would be absolutely terrified at what's ahead if we do not act soon to prevent it.

Let's focus on transportation. It is absolutely critical to our national security and standard of living. Without our oil fueled cars, trucks, planes, trains, and ships, we would be back in the 1700's with horses, wagons, rafts and sails. What lies ahead if we stick with oil fueled transport? The realities are pretty scary.

Reality #1 Conventional oil will be extremely scarce and expensive
World oil production has plateaued at about 90 million barrels per day, and soon will start to decline. The demand for oil from developing countries like China and India is rapidly increasing, causing them to compete very strongly for the ever scarcer and more expensive oil. Today, the average American consumes 25 barrels of oil per year, while the rest of the 6.7 billion people in the World average only 3.6 barrels per year. When their consumption increases by only 30% to 4.7 barrels per year, America's oil share goes to zero. $10 a gallon at the pump? We should be so lucky!

Reality #2 Synfuels from coal, oil shale, tar sands, natural gas, etc. are the only way we can continue to use our internal combustion engine powered autos, trucks, airplanes, trucks and ships.
Expecting biofuels to meet our liquid fuels need is not practical. Today, hundreds of millions of people go hungry because there is not enough arable land to feed them. By 2050 there will be 9 billion people in the World, not the 7.0 billion there are today. Soil

fertility is degrading, water tables are dropping, the ocean is acidifying, drought areas are increasing – we will be fortunate if we can avoid mass famine, let alone make biofuels.

Today, America has 300 million people and 300 million acres of farmland, approximately 1 acre per person for food production. We consume 600 gallons of gasoline and diesel fuel per person per year. For our autos and trucks to produce ethanol from corn with a net energy equal to the 600 gallons per year of gasoline and diesel fuels would require 7 acres per person, almost the whole area of the continental 48 states. We don't have the land! Biofuels can only supply a very small fraction of our transport fuel needs.

Hydrogen fueled cars and trucks? A fantasy! Not only does it take an enormous amount of electric energy to make enough hydrogen to equal the fuel value of gasoline and diesel we burn today – 1000 new nuclear reactors, each of 1000 megawatts generation capacity – the safety and security problems are unsolvable. Imagine driving 70 mph in bumper to bumper traffic, with each car's hydrogen tank – either gaseous hydrogen at 5000 psi, or liquid hydrogen at 420 degrees Fahrenheit below zero – having the explosive force of 500 pounds of TNT if it escapes in an accident, mixes with air, and detonates. Not only would the car it's in explode, but also neighboring cars.

Even worse, imagine a terrorist stealing a hydrogen fueled car, attaching a small penetrator device to the hydrogen tank that punches a hole in the tank, and detonates the resulting hydrogen-air mixture. The penetrator device could probably be bought on the black market. The terrorist could park the car in an underground garage, a shopping mall, or a busy city street. When the tank detonated, the shredded parts of the car would kill everybody in the vicinity, and cause a spreading cascade of explosions in neighboring hydrogen fueled cars. With time out for a lunch break, the terrorist could set off 2 or 3 cars a day.

Synfuels from coal, tar sands and oil shale are practical and affordable and have been produced in a number of countries for many years. For many years, Canada has produced one million barrels of syncrude daily from the tar sands in Alberta.

World leaders call for an 80% reduction in global carbon dioxide emissions by 2050 AD. This is impossible if we continue with oil fueled transport. An 80% reduction corresponds to reducing the present World emissions of 25 Billion tons per year down to only 5 Billion tons annually. If the World transitions to synfuels, and its average per capita transport usage in 2050 AD is ½ that of today's value, transport emissions alone would be 60 Billion tons per year.

If this happens, there will be no hope of stopping massive global warming, the ocean will acidify to the point that most marine life dies, and most of the World's species will go extinct, probably including humans.

Reality #3 The World must transition soon to electric transport, based on electric autos, trucks and 2d generation Maglev.

Electric autos and trucks would be used for short local trips. The new Chevy Volt automobile, for example, will be able to go 40 miles between recharges. 2nd generation Maglev can transport passengers, autos, trucks and freight for long distances, at high speeds to convenient, easily accessible stations near their final destinations. Autos and trucks will simply drive off the Maglev vehicle and go by highway to their destinations, passengers will use public or private transit.

High Speed Rail (HSR) is currently being touted as America's path for future transport, but it is an unsustainable proposition. It requires massive government subsidies for construction and operation, and is very expensive for travelers. It cannot carry trucks, autos, and freight, only passengers. It will not meet our future transport needs. Today, the average American takes a round trip on Amtrak every 24 years. Even in countries like France and Japan with fully developed High Speed Rail service, HSR provides only a small fraction of transport needs. The per capita HSR travel in France is only 400 miles annually, about 1 round trip per year. The per capita annual driving distance in France is 7,600 miles, 20 times greater than the HSR travel distance. The average American drives 10,000 miles annually. Even if the traveler were to equal the French HSR distance, which is very unlikely given the much lower population density and much greater size of the United States, compared to France, HSR would do virtually nothing to meet America's future transport needs.

If we want to prevent environment catastrophe from synfuels, America must very soon begin the transition to electric autos and Maglev. To carry out this transition, we have proposed the program called the Maglev America Project (MAP), which we describe below. The necessary technology already exists, and the required materials and manufacturing methods are commercially available. MAP is best described in terms of the answers to the following questions.

1. What is the Maglev America Project?

2. Why is it important?

3. Where and when will it be built?

4. What are its costs and benefits?

To answer the first question, the Maglev America Project (MAP) will construct a 28,800 mile network of high speed Maglev routes that interconnect all of the 174 metropolitan areas in the U.S. with populations of 250,000 persons or greater, as determined by the U.S. Census Bureau. All 48 States in the lower continental U.S. will be served by MAP. 74% of the 304 million persons in the U.S., plus 10 million more in the Canadian cities Toronto, Montreal, and Vancouver, will live within 15 miles of a convenient Maglev station, from which they can travel at 300 mph to any other Maglev station in America. Passengers, highway trucks, passengers with their personal autos, and freight containers will all travel on the National Maglev Network.

MAP will be America's new "Interstate Highway" system for the 21st Century, with the advantages that it will be faster, cheaper and environmentally much better than our present Interstate Highway System. It will drastically reduce our dependence on foreign oil consumption, substantially reduce greenhouse gas emissions, save many thousands of lives now lost on the highways each year, prevent hundreds of thousands of serious injuries, improve public health by eliminating pollution and micro particulates from cars and trucks, and brake dust from commuter and light rail operations, reduce congestion and eliminate delay due to adverse weather. Plus, it will be much more comfortable to travel by MAP – no road, rail, braking, or engine noise, no bumpiness and lots of very comfortable sitting room for the traveler. It will save many hundreds of hours of commuting time, be extremely reliable, and much less stressful than traveling on our existing transport systems. In MAP, people will travel at high speeds to convenient, easily accessible stations near their final destinations. Autos and trucks will simply drive off the

Maglev vehicle and go by highway to their destinations; passengers will use public or private transit, or they may drive off their own cars that travelled with them.

The answers to the second question, “Why is the Maglev America Project important?” is simple. There are only two transport options for America in the decades ahead. Either we continue with our present oil fueled transport vehicles, using synfuels from coal, tar sands, oil shale, and natural gas, etc., or we transition to electric transport with the National Maglev Network.

Synfuels will lead to environmental catastrophe, maybe not within the lifetimes of America’s older citizens, but very likely within the lifetimes of our young children. Do we really not care what happens to them? Judging from the collapse of many ancient societies that over exploited and wrecked their environments, like the Mayans and others, very often the existing population doesn’t care. We hope that today, America and the rest of the World does care, and will chose to transition to electric transport before it’s too late.

In choosing electric transport, it is important to realize that besides ensuring a sustainable society and avoiding environmental disaster, there will be major economic, social, and personal benefits in doing so, with the benefits far outweighing the transition costs.

Answering the third question, “Where and When will it be built?” requires more detail. The short answer to When? is “as soon as possible.” We have laid out a program to test and build the 28,800 mile National Maglev Network, with all segments completed in 20 years from Start. On an emergency basis it could probably be built faster, probably in half the time. The important thing is to start now, and not procrastinate.

The MAP project is laid out in phases, with each phase taking 5 years. The first phase involves finishing the development and certification of the 2nd generation Maglev-2000 system. No technology breakthroughs are needed. The materials and manufacturing methods for the various components of the Maglev-2000 system are already proven and suitable for large scale production. What is needed is to assemble and test full scale prototype vehicles at operational conditions, certifying their safety and reliability, so that implementation of the actual system can begin. The research in Maglev has already been done, and its feasibility has been proven. The next step is engineering improvements for greater capability.

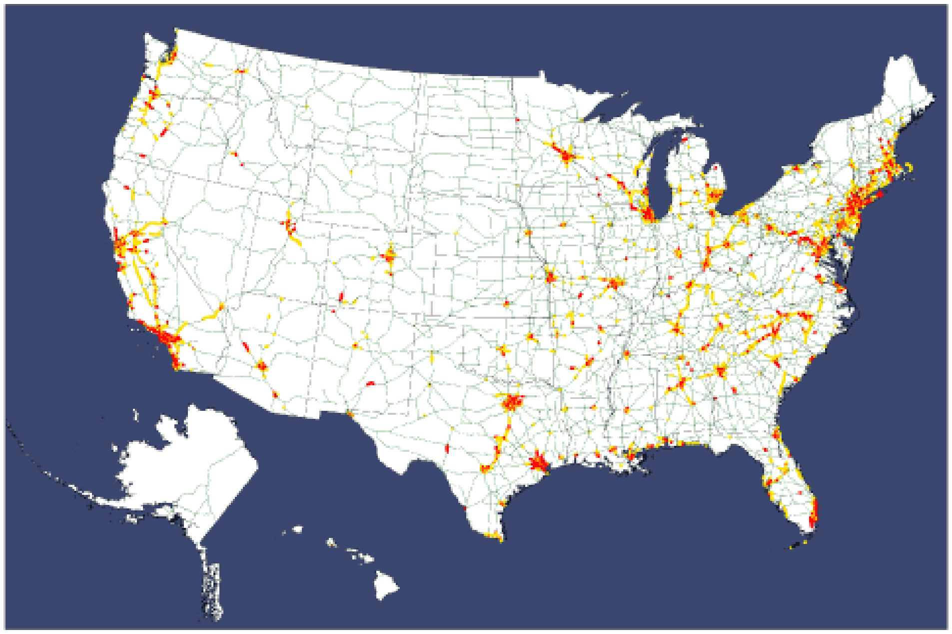
Assuming Phase 1 would be completed by 5 years. Planning for the subsequent construction phases 2, 3, and 4, obtaining environmental and regulator approval, working out arrangements with private investors, who would put up the funds for construction of the Maglev Network, etc., would be carried out in parallel with the testing and certification activities in Phase 1.

Before proceeding with a description of the next 3 Phases of the MAP program, which would construct the Maglev Network, it is helpful to discuss the nature of the highway traffic increases that the Federal Highway Administration anticipates over the next 25 years.

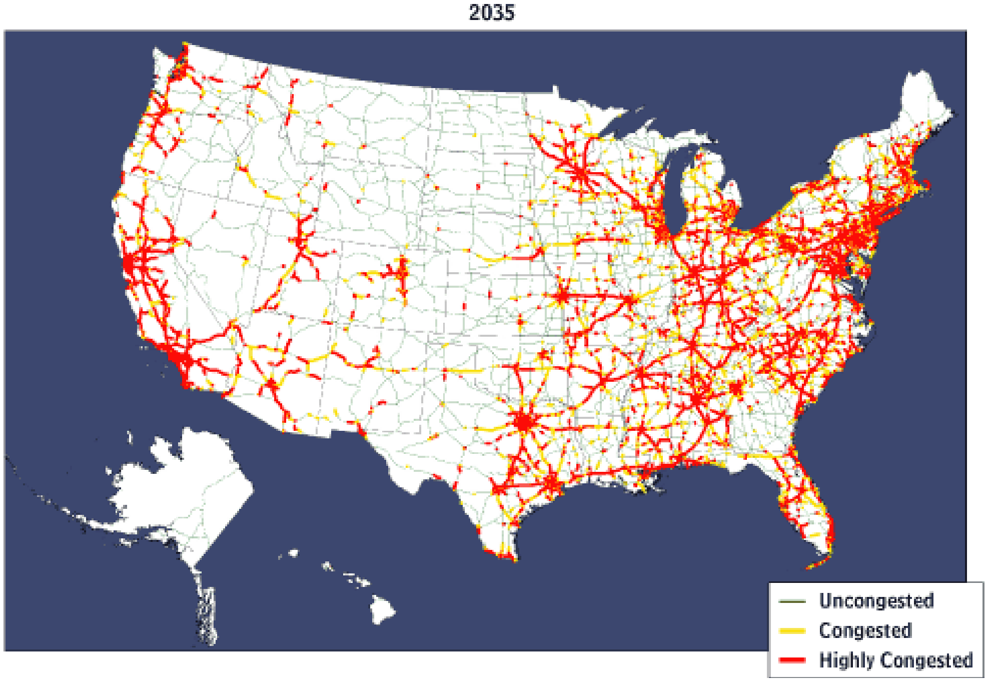
First, the U.S. population, some 287 million people in 2002 AD, currently 310 million people in June, 2010, is projected to increase to 390 million by 2035 AD, an increase of over 100 million people in just 33 years. This and the increase in GDP will put enormous stress on America’s present highway system, as illustrated in Figures 1A and 1B.

Figure 1A and 1 B
Peak-Period Congestion on the National Highway System

2002



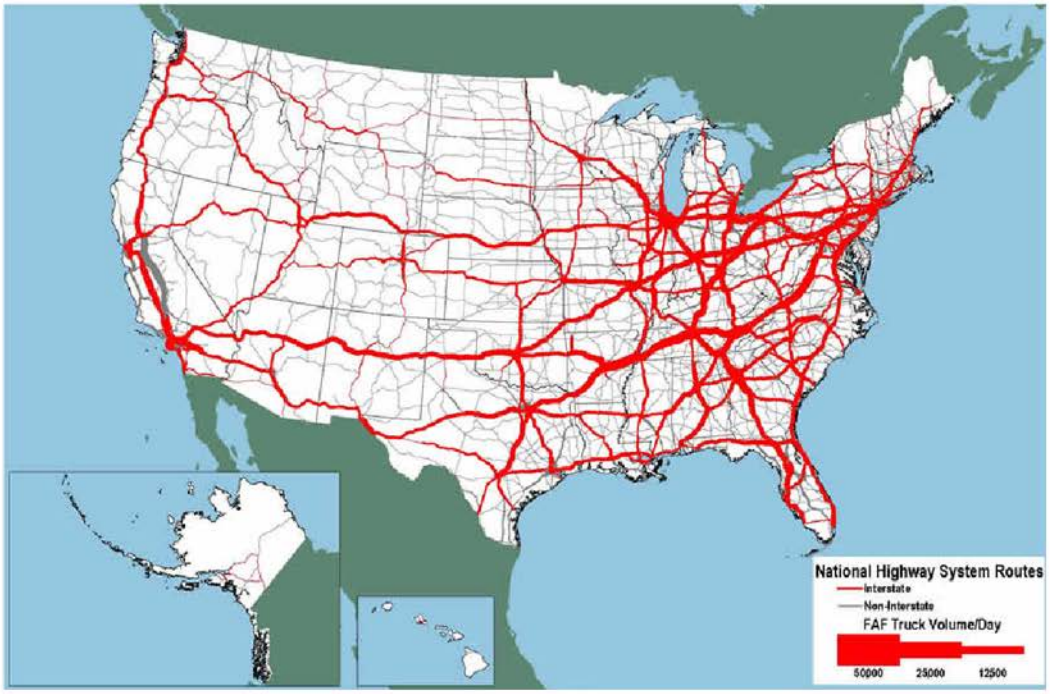
2035



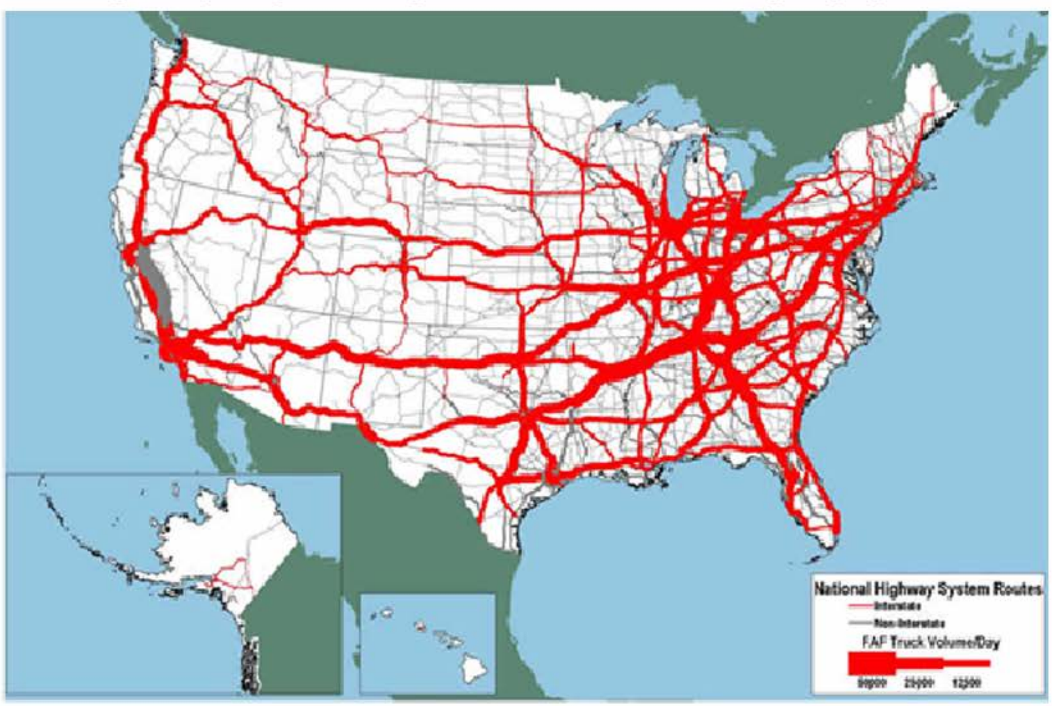
In 2002 only a small fraction of the U.S. Interstates were highly congested (The Federal Highway Administration definition of highly congested is that the ratio of traffic flow to traffic capacity is greater than 95%, resulting in slow bumper to bumper movement). By 2035 AD, a large fraction of the U.S. Interstates in the more densely populated states will be highly congested.

Average Daily Long-Haul Freight Traffic on the National Highway System: Comparison of 2002 with 2035
Figure 2A and 2B

Average Daily Long-Haul Freight Traffic on the National Highway System 2002

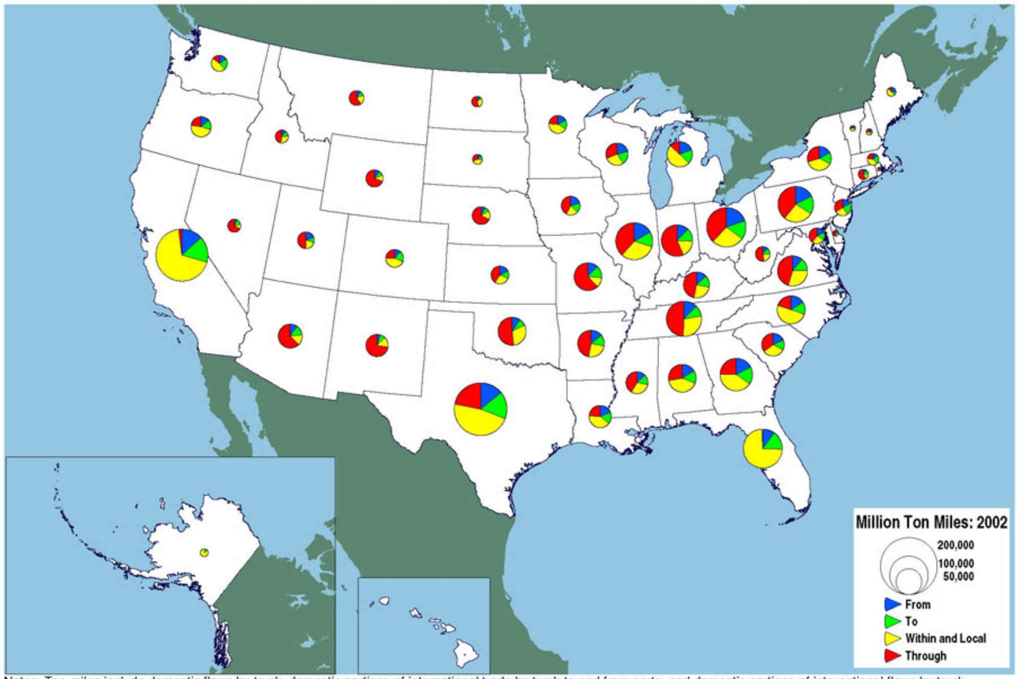


Average Daily Long-Haul Freight Traffic on the National Highway System 2035



Ton-Miles of Truck Shipments by State: 2002 Map and Data Table

Ton Miles of Truck Shipments by State: 2002



Notes: Ton miles include domestic flows by truck, domestic portions of international trade by truck to and from ports, and domestic portions of international flows by truck to and from Canada and Mexico. See www.ops.fhwa.dot.gov/freight/freight_analysis/nat_freight_stats/tmts/2002.htm for method of calculation.

Sources: Ton miles between places over 50 miles apart: U.S. Department of Transportation, Federal Highway Administration, Office of Freight Management and Operations, Freight Analysis Framework, version 2.3, August 2009. Ton miles between places less than 50 miles apart (Local): Ibid., and U.S. Department of Transportation, Research and Innovative Technology Administration, Bureau of Transportation Statistics and U.S. Department of Commerce, Census Bureau, 2002 Commodity Flow Survey, July 2009

In 2002, there were only a few highway sections where the truck flow approached 20,000 vehicles per day. By 2035, again due to the increase of 100 million in the US population, and the increased GDP, there are many highway sections where the truck flow is considerably greater than 20,000 vehicles per day. In some segments, truck traffic flow is approaching 50,000 vehicles per day. Think of a flow of 40,000 vehicles per day in a 2 way highway. That's equal to 1 truck passing you every 4 seconds if you stand beside a highway lane, and a truck every 2 seconds if you count the truck on the other side of the highway.

Ever wonder how much damage those trucks do to our highways, and how much we have to pay every year to repair the damage? According to a Highway Research Board study, one legal heavy (40 ton) truck does as much damage to the highway as 9600 automobiles (1). Think of 40,000 trucks per day in 2035. That's as much damage as 384 million automobiles would cause to the highway you are standing next to.

How much does it cost to repair the highway damage done by trucks? According to another DOT study (2), one heavy truck mile of travel costs $0.41 per year to repair the damage. In the U.S. in 2007, total heavy combination travel was 145 billion truck miles (3). At 41 cents damage per truck mile, that's 60 billion dollars every year, just to fix the highway damage that trucks cause!

Want to further understand how much Americans pay for truck transport? In 2001, America's total expenditures for truck freight transport by highway trucks were 457 Billion dollars.(4) Of this, 309 billion dollars went for intercity truck transport with the other 148 billion for local truck transport. How much would that be today, with inflation and a bigger population? In 2001, the U.S. population was 285 million, today, in 2010, its 310 million.(5) The GDP deflator corrects for inflation, so that products and services can be expressed in constant dollars, not current ones that decrease in value as time goes on. In 2010 the GDP deflator is 1.21, taking 1.21 2010 dollars to buy the same things with one 2001 dollar.(6) The ratio of 2010 population to 2001 population is 310/285, or 1.09. Accordingly, correcting for inflation and the greater US population would take 457 x 1.09 x 1.21, or 603 Billion dollars for truck transport in 2010 at the same real GDP per capita.

That's a lot of money, but there's still more to come. Of the 43,000 highway traffic fatalities in the U.S. in 2004, 5200, or 12%, were killed in crashes involving large trucks. An additional 116,000 people were injured in the crashes. (7) Besides the human costs of these deaths and injuries, there are enormous economic costs, projected at more than 200 billion dollars annually. At the fraction of 12%, this amounts to more than 25 billion dollars annually.

Adding the costs of highway transport, highway damage, and deaths and injuries, the total cost of highway trucks is approximately 700 billion dollars annually. And that doesn't include the cost of health damage from the pollutants and micro particulates emitted by Diesel trucks. Studies estimate that people living in high truck traffic areas suffer extensive health problems – lungs, hearts, etc. – with their lives shortened by as much as 2 years. It is difficult to quantitatively project these health costs, but they clearly are enormous, many more billions of dollars.

So, America pays a high cost for truck transport – approaching a trillion dollars per year, today, and well over a trillion dollars annually by 2030 AD, as measured in today's dollars. The projected U.S. population in 2030 will be 373 million, compared to 310 billion per day, and the real GDP per capita, which has grown by 30% over the last 20 years 1990 to 2010, will hopefully keep growing.

Lots of boring numbers, to be sure, but they deliver a very serious message:

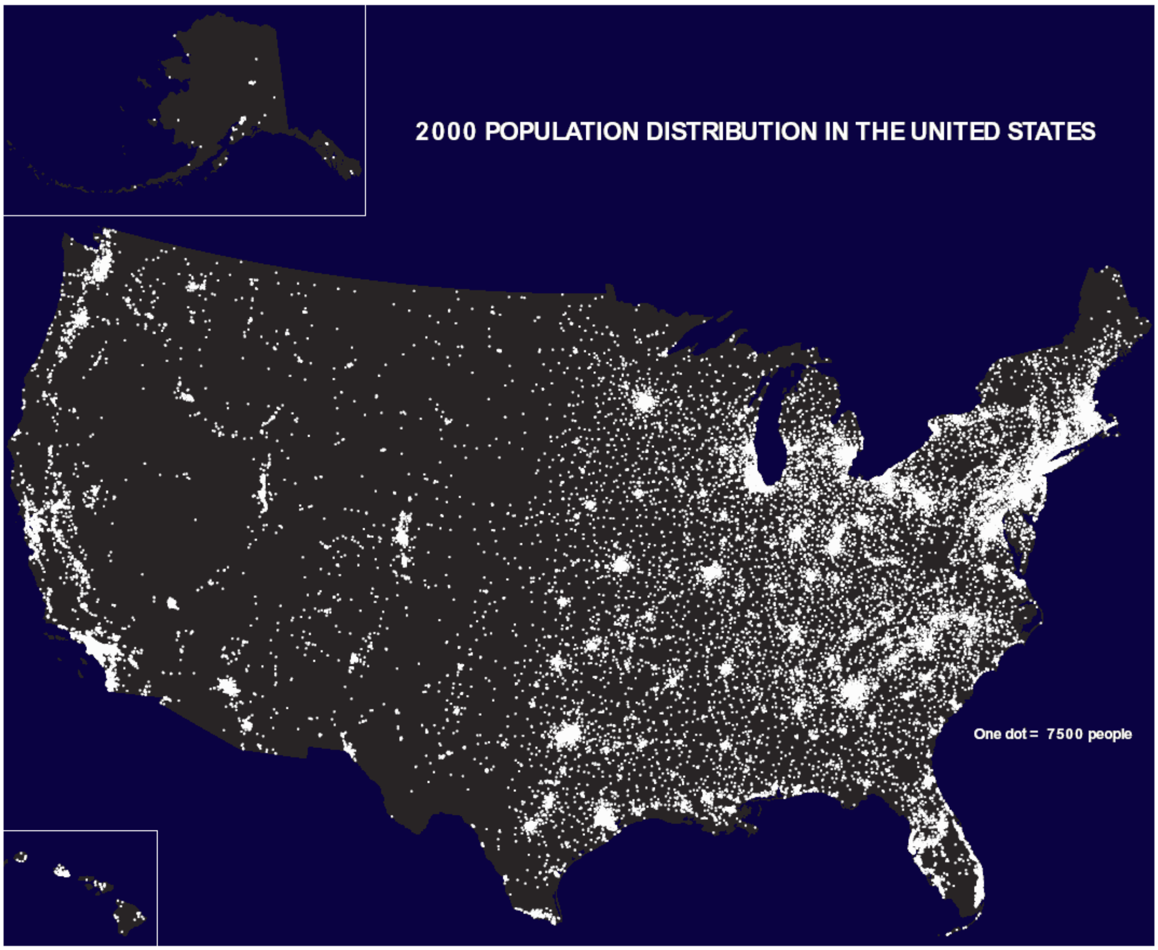
Message #1. We must have very large amounts of truck freight transport to sustain our standard of living. Railroads, while much cheaper per ton mile, simply cannot do the job. Even though railroad costs per ton mile are $1/10^{th}$ of that of truck transport, they do not carry high value freight. Despite the much higher costs per ton mile for truck transport, America spends 10 times as much on trucks for freight hauling as it spends on railroad freight.

Message #2. Unless we find a practical way to get a large portion of truck traffic off the highway, in 2030 America will spend an enormous sum on truck operating costs and highway damage, along with a great cost in fatalities, injuries, and damage to the health of its population. Moreover, the greatly increased congestion delays and its costs, which are not included above, will cripple our national productivity.

Message #3. There is a way, to accomplish Message #2 – transport of highway trucks by Maglev. Transport costs are much less and highway damage, fatalities, injuries, and health problems are greatly reduced. Moreover, our oil use will be greatly reduced, and greenhouse gas emissions curtailed.

Very important is the amount of truck shipments correlated by State, as illustrated in Figure 3. The states with the greatest ton-miles of truck shipments are California, Texas, Florida, Illinois, Indiana, Ohio, Pennsylvania, Tennessee and Georgia. This data, together with the truck flow data in Figures 2A and 2B, guides where the Maglev routes should be located.

Also very important is where the U.S. population is located. As shown in Figure 4, most of the principal population centers are distributed along the East, West and Gulf Coasts, and in the States bordering the Great Lakes.



Phase 2, termed the "First Maglev Wave"; would be built in 5 years, starting at the beginning of 2016. Figure 5 shows the East and West Coast Networks built in the first Maglev wave. The first wave would serve 26 States in the lower 48 Continental U.S., plus Vancouver, Montreal, and Toronto in Canada. Total population in the States served is 227 million. Of this population, 146 million would live within 15 miles of a Maglev Station, from which they could reach any other station in the East and West Coast Networks in a few hours.

A total of 6230 Maglev route miles is built in the first wave. This corresponds to 25,000 people per route mile who live within 15 miles of a Maglev station. At a construction cost of 25 million dollars per 2-way route mile, the construction cost per person directly served – "directly served" means living within 15 miles of a Maglev station – is only $1000 dollars. As discussed later, this is an extraordinarily attractive deal. Not only do the Maglev riders not have to pay for the construction of the Maglev routes – they will be privately financed – but they will save at least $1000 dollars per year in transport costs by riding Maglev. Over a 30 year period, they will save $30,000 and not have to subsidize the Maglev Network. Compare that to building a High Speed Rail Network. The population served would be much smaller, and those riding the proposed High Speed Intercity Passenger Rail Network would pay much more than other modes. Plus, all U.S. taxpayers would subsidize the Rail Network, even though most would not be able to use it, which would be very unfair.

Figure 5: First Maglev Wave to be Completed 10 Years from Start

Maglev Network	States In Network	Population of States in Network (millions)	Population Living Within 15 Miles of Maglev Stations (millions)	Route Miles in Network
East Coast/Midwest Network	45 MN, WI, IL, IN, OH, PA, NY, MA, VT, NH, MN, ME, RI, DE, MD, VA, DC, NC, SC, GA, FL plus Toronto & Montreal	175.8 (includes Toronto, Montreal)	102.9 (includes Toronto, Montreal)	4,224
West Coast Maglev Network	CA, NV, OR, WA & Vancouver, Canada	50.9 (includes Vancouver)	43.5 (includes Vancouver)	2006
Total for First Maglev Wave (Both Networks)	26 States Plus Toronto, Montreal & Vancouver	226.7	146.4	6230
65 % of population in States Served by the Networks live within 15 Miles of a Maglev Station				

Figure 6 shows the second Maglev Wave, which would be built starting in 5 years at the end of the 10th year and completing at the 15th year of the program. Three transcontinental routes would be built to connect the East and West Coast Maglev Networks, plus 5 North-South routes.

The number of states in the National Maglev Network would increase to 45, plus Vancouver, Toronto, and Montreal in Canada. 310 million people would live in the States and Canadian cities served by the Network, with 210 million people directly served – that is, living within 15 miles of a Maglev station. 12,600 Maglev route miles would be built in the second Wave, bring the total to 18,600 miles. 65% of the total population in the served States and Canadian cities would live within 15 miles of a Maglev station.

Figure 6: Second Maglev Wave to be Completed 15 years from Start.

Maglev Network	States In Network	Population of States in Network (millions)	Population Living Within 15 Miles of Maglev Stations (millions)	Route Miles in Network
First Wave Plus Second Wave	45 (Iowa, Nebraska & S. Dakota not in Network) plus Toronto, Montreal & Vancouver	310 (includes Toronto, Montreal & Vancouver)	210 (includes Toronto, Montreal & Vancouver)	18,630
74 % of population in States served by the Network live within 15 Miles of a Station				

Figure 7 shows the third and final 5 year Maglev Wave, which would be built starting at the 15th year, and proceeding through the 20th year from program Start. A 4th transcontinental Maglev route would be built along U.S.-40, plus various routes to provide more efficient interconnections between the routes built in the 1st and 2nd Maglev Waves. The 48 US States, plus Vancouver, Toronto, and Montreal, would now be served by the 28,800 mile National Maglev Network, with a total population of 315 million people. Of that 315 million, 232 million of the population served, would live within 15 miles of a Maglev station.

Figure 7: Third Maglev Wave to be Completed 20 years from Start

Maglev Network	States In Network	Population of States in Network (millions)	Population Living Within 15 Miles of Maglev Stations (millions)	Route Miles in Network
First, Second and Third Waves Completed	48 plus Toronto, Montreal & Vancouver	315 (includes Toronto, Montreal & Vancouver)	232 (includes Toronto, Montreal & Vancouver)	28,800
74% of population in States live within 15 Miles of a Maglev Station				

In general, the smaller Metropolitan areas, e.g., those with a population of a few hundred thousand people, will have 1 or 2 Maglev stations that serve their area. The larger areas, e.g. Seattle, Dallas, Chicago, Los Angeles, New York, etc., will have multiple stations that serve their area, with the number of stations depending on the size of the metropolitan area. Each station will be connected to all of the other Maglev stations in the high speed intercity Maglev Network.

Inside a given metropolitan area, Maglev will also provide local transport service, using existing RR trackage that has been adapted for Maglev travel. The adaptation is simple and cheap, consisting of attaching thin panels that contain loops of ordinary aluminum conductor to the RR cross ties. Maglev vehicles can then be magnetically levitated above, and propelled along, the existing RR track to serve local stations in the metropolitan area.

Conventional trains can continue to use the RR trackage, given appropriate scheduling. The cost of adaptation is small – only about 6 million dollars per 2-way mile. Adaptation of existing RR tracks for Maglev travel can be quickly carried out without interfering with or disrupting existing conventional train schedules, and without expensive disruption of existing infrastructure.

Construction of the high speed 2nd generation Maglev-2000 intercity guideway would be simple and quick, with a minimal amount of field construction, in contrast to High Speed Rail and the 1st generation Maglev systems. High Speed Rail requires a very deep, on the order of 14 feet in depth, very stable, very straight and level on-grade roadbed. This involves a great deal of field construction, which is highly disruptive. Moreover, the on-grade roadbed must be fenced off from access, like the High Speed Rail lines in Europe and Japan.

The elevated guideways for the 1st generation Japanese and German Maglev systems do not require fencing, but do require extensive and expensive field construction, with considerable disruption to existing nearby infrastructure.

In contrast, the Maglev-2000 guideway beams are prefabricated in factories, and shipped to the construction site by truck, rail, or along an already operating guideway. The prefabricated 100 foot long beams already have the aluminum loop panels and other equipment attached to them at the factory prior to shipment.

At the construction site, pre-poured concrete footing for the piers that support the guideway beams have already been put in place. When the prefabricated beams and piers arrive at the construction site, they are quickly erected by conventional cranes onto the pre-poured footings, and the various electrical connections between the beams carried out.

The Maglev-2000 routes can be rapidly constructed. Based on a 2 hour time period to place a guideway beam on a pier, and 4 construction teams at the construction site, with each team having a crane, a 2 shift per day schedule could construct 2 miles per week of 2-way Maglev-2000 guideway. This corresponds to 100 miles per year. The first Maglev wave of 6800 miles over a 5 year construction period would have an average construction rate of 1240 miles per year, 12 construction crews could do the whole job. In practice, because of the desire to engage local construction companies, there probably would be more construction crews operating at 8 hours per day and 2 cranes per site. In any case, the field construction requirements will be relatively modest, both in terms of cost, and in personnel.

At 25 million dollars per 2-way mile, the projected cost for the Maglev-2000 monorail guideway, the construction cost of the first Maglev Wave would be $150 billion dollars, about 30 billion $ per year. To put this in perspective, the US consumes approximately 180 billion gallons of gasoline and diesel fuel annually. The 30 billion dollars is equivalent to only 16 cents a gallon – a real bargain, considering it will be much cheaper to travel by Maglev than to drive.

To this construction cost must be added the cost of the intercity Maglev-2000 stations. The amortization cost of the Maglev-2000 vehicles is best included in the operating costs for transport on the Network, since the number of vehicles required will depend on the volume of traffic.

When the 3rd Maglev-2000 Wave is complete, the total guideway construction cost of the 28,800 mile National Maglev Network will be approximately 700 Billion dollars at an average construction cost of $25 million dollars per 2-way mile. All of the 174 metropolitan areas in the 48 continental US states will be served. Conservatively assuming 2 Maglev stations per metropolitan area – many areas will only need 1 station – and 20 million dollars per average station cost, again very conservative, the station cost would be about 60 billion dollars, bringing total system cost to about 760 billion dollars, including the various necessary odds and ends.

This 760 billion dollars would be provided by private investment, probably by government guaranteed bonds, at an average rate of about 76 billion dollars annually. Taxpayers would not provide any of the invested capital.

What are the revenues and benefits of the Maglev America Project? First, let us consider the revenues. The U.S. currently spends about 1500 billion dollars per year on direct transport cost, or 30 trillion dollars over a 20 year period to 2030 AD – 40 times greater than the construction cost of the National Maglev Network. However, if we continue to rely on our oil fueled autos, trucks, planes, and trains, the actual cost will be much greater. First, the US population will increase from today's (2010 populations of 304 million people to 373 million people by 2030). Second, the cost of fuel will be much greater as world supplies dwindle, and countries like China and India get a bigger share of the shrinking oil pie. Third, the *real* US Gross Domestic Product (GDP) per capita – the measure of our average standard of living – will hopefully grow.

The real US GDP per capita in 1990, 20 years ago, was $32,000 per person, measured in 2005 dollars. Today, again measured in constant 2005 dollars, the real GDP per capita is $43,000 per person, a gain of 1.5% per year over the 20 year period.

This translates into a substantially higher average standard of living from that of 20 years ago. Remember, that is the average – some people are much better off, while lots of others are worse off. Americans expect their standard of living to grow with time. If it doesn't, they get angry. Assuming that the real standard of living grows by 1.5% over the next 20 years to 2030 AD, the real GDP per capita then will increase to $58,000, again measured in constant 2005 dollars.

Sounds great, *if* it happens. Now what does that increasing population and increasing GDP per capita mean for transportation outlays? In the last year of which outlay data is available from the US Statistical Abstracts, 2001, the US spent 309 billion dollars on intercity truck transport. As the populations grows from 285 million people in 2001 to 373 million in 2030, and as their real GDP per capita grows from $39,800 in 2001 to $58,000 in 2030, the intercity truck outlay will grow from $309 billion in 2001 to $500 billion. This assumes the same oil fueled truck technology in 2030 as we have today. In practice, the intercity truck outlay will be considerably greater than $500 billion, because of the rapidly escalating cost of diesel fuel and gasoline.

So, assume that in 2030 the 28,800 mile National Maglev Network carried only intercity highway trucks with their loads – no passengers, autos, or freight containers normally carried by railroad. What would be the annual transport savings for the US, as measured in constant 2005 dollars?

For diesel fueled intercity trucks on the highway the operating costs, including truck maintenance, amortization, energy, personnel, traffic scheduling, etc., are about 30 cents per ton mile transported. For trucks carried on the National Maglev Network, the operating costs would be about 10 cents per ton mile.

Accordingly, the annual savings in intercity truck transport outlays would be 20 cents per ton mile carried, or two thirds of the $590 billion it would cost if they all drove by highway instead of taking Maglev. That's an annual savings of 390 billion dollars! From that, must be deducted the return on investment (ROI to the private investors that put up the $760 billion dollars to build the National Maglev Network. At 10% ROI, the net savings in truck transport would be 314 billion dollars annually. At 15% ROI – remember, these are government guaranteed bonds, for which 15% seems high – the net savings would still be very large, 238 billion dollars annually.

However, there are additional sources of revenue for the National Maglev Network. These include passengers that would otherwise be flying or driving, passengers traveling with their autos, and freight containers. These sources can provide over 200 billion of additional revenue per year, making the total transport net savings enabled by the National Maglev Network more that 238 + 200 or 438 billion dollars annually, assuming a 15% ROI on the construction cost of the Network.

The above projections assume that 100% of the long distance transport of trucks, passengers, autos, and freight containers in 2030 AD is carried by the National Maglev Network. Obviously, this will not be the case. However, because of the lower cost, faster travel times, greater convenience, and environmental benefits, it appears very likely that the percentage of US long distance travel that takes place in the Maglev Network will be very high, say in the range of 70 to 80 percent at least.

At a 75% utilization factor, the net transport savings received by the National Maglev Network would be well over 300 billion dollars annually, or about $1000 per person per year. Faster, better, cheaper travel – what could be more desirable?

What are the societal and environmental benefits of the National Maglev Network, which are even more important than the economic benefits?

First, the area of safety and health. Traveling by Maglev will be much safer than by highway. Today, over 5000 deaths per year and 100,000 serious injuries are due to trucks. Highway deaths and injuries will soar in the years ahead as the roads become much more congested. Taking trucks and autos off the roads and carrying them by Maglev will save many thousands of lives and serious injuries per year. Moreover, the damage done to peoples' health by pollutants and micro particulates in heavily traveled areas will be greatly reduced. As an auxiliary benefit, many Billions of dollars now spent because of these deaths, injuries, and damaged health will be avoided.

Second, the linked areas of national security and economic productivity. As a nation, we cannot be secure if our economic productivity is weak, while the US cannot be secure if it depends on unstable foreign sources for critical materials, such as oil. The National Maglev Network will substantially reduce oil use – 70% of US oil consumption is currently used for transport. Building the National Network will provide millions of new US jobs, for both domestic and export application of Maglev. Moreover, reducing the cost of domestic transport and enabling more efficient, faster deliver of people and goods inside the US will increase economic productivity and make our exports more competitive.

Third are the environmental benefits. Maglev emits no pollutants and greenhouse gases, is much more energy efficient than current modes of transport, and is very quiet with no rail, braking or engine noise.

In summary, the Maglev America Project is practical, uses existing technology, and will provide America with tremendous social and economic benefits. The 28,800 National Maglev Network can be completed in 20 years from Start. Built by private investment, it will not require government subsidization for construction and operation.

All that is needed for the US government to bring the National Maglev Network into being is to fund a facility to test and certify the 2nd generation Maglev system described in this proposal. The funding required is extremely modest, about 600 million dollars over a 5 year period. The amounts to a per capita funding of only $2 per American – about the cost of one hot dog. For this investment, the transport savings for the average American will amount to about $30,000 over a 30 year period.

References

(1) Highway Research Board, NAS, 1962)

(2) "Comparison of Cost for Maintaining Highway and Waterway Freight Transport Systems" US DOT, April 9, 2001

(3) Table 1-32 "US Vehicles miles, Research and Innovative Technology Administration, Bureau of Transportation Statistics

(4) Table 1046, "2006 Statistical Abstracts of the United States," US Census Bureau

(5) Table 3, "Resident Population Projections, 2006 US Statistical Abstracts", US Census Bureau

(6) "Measuring Worth", www.measuringworth.org/usgdp/

(7) National Highway Traffic Safety Administration (2005)

Table 20. **Large Metropolitan Statistical Areas—Population: 1990 to 2008**

[**1990 and 2000, as of April 1; beginning 2005 as of July 1 (658 represents 658,000).** Covers metropolitan statistical areas with 250,000 and over population in 2008, as defined by the U.S. Office of Management and Budget as of November 2007. All geographic boundaries for 2000 to 2008 population estimates are defined as of January 1, 2008. For definitions and components of all metropolitan and micropolitan areas, see Appendix II. Minus sign (–) indicates decrease]

Metropolitan statistical area	Number (1,000)					Percent change		
	1990	**2000, estimates base** [1]	**2005**	**2007**	**2008**	**1990 to 2000** [2]	**2000 to 2008** [1]	**Rank, 2008**
Akron, OH	658	695	700	699	699	5.7	0.5	72
Albany-Schenectady-Troy, NY	810	826	846	852	854	2.0	3.4	57
Albuquerque, NM	599	730	797	833	846	21.7	15.9	59
Allentown-Bethlehem-Easton, PA-NJ	687	740	785	802	808	7.8	9.2	62
Anchorage, AK	266	320	351	360	365	20.1	14.1	137
Ann Arbor, MI	283	323	344	348	347	14.1	7.6	143
Asheville, NC	308	369	391	404	408	19.9	10.6	118
Atlanta-Sandy Springs-Marietta, GA	3,069	4,248	4,946	5,261	5,376	38.4	26.6	8
Atlantic City-Hammonton, NJ	224	253	268	270	271	12.6	7.2	165
Augusta-Richmond County, GA-SC	436	500	517	528	534	14.7	6.9	95
Austin-Round Rock, TX	846	1,250	1,465	1,593	1,653	47.7	32.2	36
Bakersfield, CA	545	662	749	787	800	21.4	21.0	63
Baltimore-Towson, MD	2,382	2,553	2,647	2,664	2,667	7.2	4.5	20
Baton Rouge, LA	624	706	729	769	774	13.2	9.7	67
Beaumont-Port Arthur, TX	361	385	380	376	378	6.6	–1.8	132
Birmingham-Hoover, AL	957	1,051	1,088	1,109	1,118	10.0	6.3	48
Boise City-Nampa, ID	320	465	544	587	600	45.4	29.0	85
Boston-Cambridge-Quincy, MA-NH	4,134	4,392	4,455	4,492	4,523	6.2	3.0	10
Boulder, CO [3]	209	270	282	289	293	29.1	8.7	157
Bradenton-Sarasota-Venice, FL	489	590	668	685	688	20.5	16.6	74
Bridgeport-Stamford-Norwalk, CT	828	883	892	891	895	6.6	1.4	56
Brownsville-Harlingen, TX	260	335	371	385	393	28.9	17.2	128
Buffalo-Niagara Falls, NY	1,189	1,170	1,140	1,127	1,124	–1.6	–3.9	47
Canton-Massillon, OH	394	407	408	408	408	3.3	0.2	120
Cape Coral-Fort Myers, FL	335	441	541	588	593	31.6	34.5	86
Cedar Rapids, IA	211	237	247	252	255	12.6	7.7	175
Charleston, WV	308	310	304	304	304	0.6	–1.8	152
Charleston-North Charleston-Summerville, SC	507	549	601	630	645	8.3	17.4	80
Charlotte-Gastonia-Concord, NC-SC	1,025	1,331	1,518	1,646	1,702	29.8	27.9	34
Chattanooga, TN-GA	433	477	502	514	518	10.0	8.8	98
Chicago-Naperville-Joliet, IL-IN-WI	8,182	9,099	9,391	9,497	9,570	11.2	5.2	3
Cincinnati-Middletown, OH-KY-IN	1,845	2,010	2,101	2,144	2,155	8.9	7.2	24
Clarksville, TN-KY	189	232	252	262	261	22.6	12.6	170
Cleveland-Elyria-Mentor, OH	2,102	2,148	2,116	2,095	2,088	2.2	–2.8	26
Colorado Springs, CO	409	537	589	608	618	31.3	14.9	83
Columbia, SC	549	647	691	716	728	17.9	12.5	69
Columbus, GA-AL	266	282	288	287	288	5.7	2.1	160
Columbus, OH	1,405	1,613	1,712	1,753	1,773	14.8	9.9	32
Corpus Christi, TX	368	403	411	413	415	9.7	3.0	115
Dallas-Fort Worth-Arlington, TX	3,989	5,162	5,818	6,153	6,300	29.4	22.1	4
Davenport-Moline-Rock Island, IA-IL	368	376	373	376	378	2.1	0.4	133
Dayton, OH	844	848	843	839	837	0.5	–1.4	61
Deltona-Daytona Beach-Ormond Beach, FL	371	443	486	500	498	19.6	12.3	102
Denver-Aurora, CO [3]	1,667	2,179	2,358	2,453	2,507	30.7	15.0	21
Des Moines-West Des Moines, IA	416	481	524	546	556	15.6	15.5	90
Detroit-Warren-Livonia, MI	4,249	4,453	4,496	4,458	4,425	4.8	–0.6	11
Duluth, MN-WI	269	275	274	274	275	2.3	–0.3	164
Durham, NC	345	424	458	478	490	23.7	15.6	103
El Paso, TX	592	680	710	730	742	14.9	9.2	68
Erie, PA	276	281	279	279	279	1.9	–0.6	163
Eugene-Springfield, OR	283	323	335	343	347	14.2	7.3	145
Evansville, IN-KY	325	343	348	350	350	5.5	2.2	142
Fayetteville, NC	298	337	345	351	356	13.1	5.8	140
Fayetteville-Springdale-Rogers, AR-MO	239	347	408	435	444	44.9	27.9	110
Flint, MI	430	436	439	434	429	1.3	–1.7	111
Fort Collins-Loveland, CO	186	251	276	287	293	35.1	16.4	158
Fort Smith, AR-OK	234	273	282	289	291	16.7	6.5	159
Fort Wayne, IN	354	390	402	409	411	10.1	5.4	117
Fresno, CA	667	799	871	895	909	19.8	13.7	54

See footnotes at end of table.

Table 20. **Large Metropolitan Statistical Areas—Population: 1990 to 2008**—Con.

[1990 and 2000, as of April 1; beginning 2005 as of July 1 (658 represents 658,000). Covers metropolitan statistical areas with 250,000 and over population in 2008, as defined by the U.S. Office of Management and Budget as of November 2007. All geographic boundaries for 2000 to 2008 population estimates are defined as of January 1, 2008. For definitions and components of all metropolitan and micropolitan areas, see Appendix II. Minus sign (–) indicates decrease]

Metropolitan statistical area	Number (1,000)					Percent change		
	1990	2000, estimates base [1]	2005	2007	2008	1990 to 2000 [2]	2000 to 2008 [1]	Rank, 2008
Gainesville, FL	191	232	248	256	259	21.5	11.3	173
Grand Rapids-Wyoming, MI	646	740	768	775	777	14.6	4.9	66
Green Bay, WI	244	282	296	301	303	16.0	7.2	153
Greensboro-High Point, NC	540	643	673	696	706	19.1	9.7	71
Greenville-Mauldin-Easley, SC	472	560	589	613	625	18.6	11.6	82
Hagerstown-Martinsburg, MD-WV	193	223	250	261	264	15.6	18.4	169
Harrisburg-Carlisle, PA	474	509	520	528	531	7.3	4.3	97
Hartford-West Hartford-East Hartford, CT	1,124	1,149	1,179	1,186	1,191	2.2	3.6	45
Hickory-Lenoir-Morganton, NC	292	342	354	360	363	16.9	6.2	138
Holland-Grand Haven, MI	188	238	254	258	260	26.9	9.3	171
Honolulu, HI	836	876	900	901	905	4.8	3.3	55
Houston-Sugar Land-Baytown, TX	3,767	4,715	5,303	5,598	5,728	25.2	21.5	6
Huntington-Ashland, WV-KY-OH	288	289	284	284	284	0.2	–1.5	161
Huntsville, AL	293	343	369	386	396	16.8	15.5	127
Indianapolis-Carmel, IN	1,294	1,525	1,643	1,693	1,715	17.8	12.5	33
Jackson, MS	447	497	521	534	537	11.2	8.1	93
Jacksonville, FL	925	1,123	1,248	1,298	1,313	21.4	17.0	40
Kalamazoo-Portage, MI	293	315	320	322	324	7.3	2.8	148
Kansas City, MO-KS	1,637	1,836	1,937	1,981	2,002	12.2	9.0	29
Killeen-Temple-Fort Hood, TX	269	331	354	371	379	23.0	14.6	131
Kingsport-Bristol-Bristol, TN-VA	276	298	300	303	305	8.3	2.1	151
Knoxville, TN	535	616	658	681	691	15.2	12.2	73
Lafayette, LA	209	239	247	256	259	14.5	8.4	172
Lakeland-Winter Haven, FL	405	484	538	573	581	19.4	20.0	87
Lancaster, PA	423	471	489	498	502	11.3	6.7	101
Lansing-East Lansing, MI	433	448	456	455	454	3.5	1.4	107
Las Vegas-Paradise, NV	741	1,376	1,703	1,828	1,866	85.6	35.6	30
Lexington-Fayette, KY	348	408	432	446	453	17.2	11.0	108
Lincoln, NE	229	267	285	291	295	16.5	10.8	155
Little Rock-North Little Rock-Conway, AR	535	611	645	666	675	14.1	10.6	76
Los Angeles-Long Beach-Santa Ana, CA	11,274	12,366	12,815	12,785	12,873	9.7	4.1	2
Louisville/Jefferson County, KY-IN	1,056	1,162	1,207	1,232	1,245	10.0	7.1	42
Lubbock, TX	230	250	263	268	271	8.6	8.4	166
Madison, WI	432	502	540	554	562	16.1	11.9	89
Manchester-Nashua, NH	336	381	398	401	402	13.4	5.6	126
McAllen-Edinburg-Mission, TX	384	569	667	705	727	48.5	27.6	70
Memphis, TN-MS-AR	1,067	1,205	1,253	1,279	1,286	12.9	6.7	41
Miami-Fort Lauderdale-Pompano Beach, FL	4,056	5,008	5,375	5,392	5,415	23.5	8.1	7
Milwaukee-Waukesha-West Allis, WI	1,432	1,501	1,534	1,543	1,549	4.8	3.2	39
Minneapolis-St. Paul-Bloomington, MN-WI	2,539	2,969	3,132	3,198	3,230	16.9	8.8	16
Mobile, AL	379	400	398	404	406	5.6	1.6	122
Modesto, CA	371	447	500	509	511	20.6	14.2	100
Montgomery, AL	305	347	356	366	366	13.6	5.6	135
Myrtle Beach-North Myrtle Beach-Conway, SC	144	197	228	250	257	36.5	30.9	174
Naples-Marco Island, FL	152	251	305	314	315	65.3	25.4	150
Nashville-Davidson—Murfreesboro—Franklin, TN	1,048	1,312	1,449	1,520	1,551	25.1	18.2	38
New Haven-Milford, CT	804	824	840	844	846	2.5	2.7	58
New Orleans-Metairie-Kenner, LA	1,264	1,317	1,312	1,109	1,134	4.1	–13.9	46
New York-Northern New Jersey-Long Island, NY-NJ-PA	16,846	18,323	18,812	18,923	19,007	8.8	3.7	1
Norwich-New London, CT	255	259	265	264	265	1.6	2.1	168
Ocala, FL	195	259	301	324	330	32.9	27.3	147
Ogden-Clearfield, UT	352	443	491	518	531	25.8	20.1	96
Oklahoma City, OK	971	1,095	1,154	1,189	1,206	12.8	10.1	44
Omaha-Council Bluffs, NE-IA	686	767	810	828	838	11.8	9.2	60
Orlando-Kissimmee, FL	1,225	1,645	1,936	2,029	2,055	34.3	24.9	27
Oxnard-Thousand Oaks-Ventura, CA	669	753	789	792	798	12.6	5.9	64
Palm Bay-Melbourne-Titusville, FL	399	476	526	535	537	19.4	12.7	94
Pensacola-Ferry Pass-Brent, FL	344	412	445	451	453	19.7	9.9	109
Peoria, IL	359	367	367	371	372	2.3	1.5	134
Philadelphia-Camden-Wilmington, PA-NJ-DE-MD	5,436	5,687	5,787	5,823	5,838	4.6	2.7	5
Phoenix-Mesa-Scottsdale, AZ	2,238	3,252	3,873	4,166	4,282	45.3	31.7	12
Pittsburgh, PA	2,468	2,431	2,372	2,354	2,351	–1.5	–3.3	22

See footnotes at end of table.

Table 20. **Large Metropolitan Statistical Areas—Population: 1990 to 2008**—Con.

[**1990 and 2000, as of April 1; beginning 2005 as of July 1 (658 represents 658,000).** Covers metropolitan statistical areas with 250,000 and over population in 2008, as defined by the U.S. Office of Management and Budget as of November 2007. All geographic boundaries for 2000 to 2008 population estimates are defined as of January 1, 2008. For definitions and components of all metropolitan and micropolitan areas, see Appendix II. Minus sign (–) indicates decrease]

Metropolitan statistical area	Number (1,000)					Percent change		
	1990	2000, estimates base [1]	2005	2007	2008	1990 to 2000 [2]	2000 to 2008 [1]	Rank, 2008
Portland-South Portland-Biddeford, ME	441	488	511	512	514	10.5	5.4	99
Portland-Vancouver-Beaverton, OR-WA	1,524	1,928	2,087	2,166	2,207	26.5	14.5	23
Port St. Lucie, FL	251	319	376	399	404	27.2	26.4	124
Poughkeepsie-Newburgh-Middletown, NY	567	622	662	669	673	9.6	8.2	77
Providence-New Bedford-Fall River, RI-MA	1,510	1,583	1,610	1,598	1,597	4.8	0.9	37
Provo-Orem, UT	269	377	464	523	541	39.9	43.5	92
Raleigh-Cary, NC	544	797	953	1,044	1,089	46.5	36.6	50
Reading, PA	337	374	393	401	404	11.0	8.0	125
Reno-Sparks, NV	257	343	394	409	415	33.3	21.0	116
Richmond, VA	949	1,097	1,173	1,211	1,226	15.6	11.7	43
Riverside-San Bernardino-Ontario, CA	2,589	3,255	3,872	4,067	4,116	25.7	26.5	14
Roanoke, VA	269	288	292	296	298	7.4	3.4	154
Rochester, NY	1,002	1,038	1,035	1,032	1,034	3.5	–0.4	51
Rockford, IL	284	320	339	351	354	12.9	10.7	141
Sacramento—Arden-Arcade—Roseville, CA	1,481	1,797	2,032	2,082	2,110	21.3	17.4	25
St. Louis, MO-IL [4]	2,581	2,699	2,773	2,805	2,817	4.6	4.4	18
Salem, OR	278	347	372	385	392	24.9	12.8	129
Salinas, CA	356	402	407	405	408	13.0	1.6	119
Salt Lake City, UT	768	969	1,046	1,095	1,116	26.1	15.2	49
San Antonio, TX	1,408	1,712	1,879	1,985	2,031	21.6	18.7	28
San Diego-Carlsbad-San Marcos, CA	2,498	2,814	2,932	2,960	3,001	12.6	6.7	17
San Francisco-Oakland-Fremont, CA	3,684	4,124	4,158	4,216	4,275	11.9	3.7	13
San Jose-Sunnyvale-Santa Clara, CA	1,534	1,736	1,743	1,786	1,819	13.1	4.8	31
San Luis Obispo-Paso Robles, CA	217	247	258	262	265	13.6	7.5	167
Santa Barbara-Santa Maria-Goleta, CA	370	399	402	402	405	8.0	1.5	123
Santa Cruz-Watsonville, CA	230	256	250	251	253	11.3	–1.0	176
Santa Rosa-Petaluma, CA	388	459	462	462	467	18.1	1.8	105
Savannah, GA	258	293	314	329	334	13.6	14.0	146
Scranton—Wilkes-Barre, PA	575	561	548	549	549	–2.6	–2.0	91
Seattle-Tacoma-Bellevue, WA	2,559	3,044	3,197	3,298	3,345	18.9	9.9	15
Shreveport-Bossier City, LA	360	376	381	388	390	4.5	3.6	130
South Bend-Mishawaka, IN-MI	297	317	315	316	317	6.8	0.1	149
Spartanburg, SC	227	254	265	275	281	11.9	10.6	162
Spokane, WA	361	418	440	456	463	15.7	10.7	106
Springfield, MA	673	680	686	687	688	1.0	1.1	75
Springfield, MO	299	368	400	420	426	23.3	15.7	113
Stockton, CA	481	564	656	668	672	17.3	19.3	78
Syracuse, NY	660	650	646	644	644	–1.5	–1.0	81
Tallahassee, FL	259	320	342	353	357	23.6	11.5	139
Tampa-St. Petersburg-Clearwater, FL	2,068	2,396	2,637	2,715	2,734	15.9	14.1	19
Toledo, OH	654	659	654	651	649	0.8	–1.5	79
Trenton-Ewing, NJ	326	351	362	364	365	7.7	4.0	136
Tucson, AZ	667	844	948	997	1,012	26.5	19.9	52
Tulsa, OK	761	860	881	904	916	12.9	6.6	53
Utica-Rome, NY	317	300	295	294	294	–5.3	–2.0	156
Vallejo-Fairfield, CA	339	395	407	407	408	16.2	3.3	121
Virginia Beach-Norfolk-Newport News, VA-NC	1,451	1,577	1,649	1,660	1,658	8.7	5.2	35
Visalia-Porterville, CA	312	368	405	419	426	18.0	15.8	112
Washington-Arlington-Alexandria, DC-VA-MD-WV	4,122	4,796	5,222	5,302	5,358	16.3	11.7	9
Wichita, KS	511	571	584	595	604	11.7	5.7	84
Wilmington, NC	200	275	316	339	347	37.2	26.4	144
Winston-Salem, NC	361	422	446	462	468	16.7	10.9	104
Worcester, MA	710	750	778	782	784	5.8	4.5	65
York-Hanover, PA	340	382	406	420	425	12.4	11.2	114
Youngstown-Warren-Boardman, OH-PA	614	603	581	571	566	–1.7	–6.1	88

[1] The April 1, 2000, estimates base reflects changes to the Census 2000 population resulting from legal boundary updates as of January 1 of the estimates year, other geographic program changes, and Count Question Resolution actions. [2] Based on 2000 Census numbers as tabulated. [3] Broomfield County, CO, was formed from parts of Adams, Boulder, Jefferson, and Weld Counties, CO, on November 15, 2001, and is coextensive with Broomfield city. For purposes of defining and presenting data for metropolitan statistical areas, Broomfield city is treated as if it were a county at the time of the 1990 and 2000 censuses. [4] The portion of Sullivan city in Crawford County, Missouri, is legally part of the St. Louis, MO-IL MSA. Data shown here do not include this area.

Source: U.S. Census Bureau, "Table 1—Annual Estimates of the Population of Metropolitan and Micropolitan Statistical Areas: April 1, 2000 to July 1, 2008 (CBSA-EST2008-01)" (published 19 March 2009); <http://www.census.gov/popest/metro/CBSA-est2008-annual.html>.