Road and Highway Infrastructure

Section 13

Falling gasoline prices and a weak economy have not altered a long-standing trend in American life: Roads are still crowded, and commuting times for most Americans are longer than ever.

The cause is supply and demand. Demand, as measured by vehicle travel on all public roads in the U.S., increased five-fold, from approximately 600 billion vehicle miles in the mid-1950s to about 3 trillion vehicle miles today, according to a report commissioned by the National Research Council.[1]

Stranded motorists on an expressway park their vehicles and wait out the traffic jam.

But the supply of road infrastructure has not kept pace: after expanding rapidly in the 1950s and 1960s, highway construction hit a wall in the mid-1970s. Few new roads are being built today. More important, the nation is having trouble maintaining existing road and bridge infrastructure.

The congestion "invoice" for the cost of the time and fuel wasted while stuck in traffic was $78 billion in 2005. This is five times the congestion cost of 1982 (in constant 2005 dollars.)[2]

At its most basic level, congestion is the result of population growth outpacing road capacity. America has about 70 million more people than it did a quarter century ago, but highway miles have increased by a little more than 5 percent over that period. And the gap between population growth and road capacity growth will only get worse: the U.S. Department of Transportation (DOT) estimates that the demand for ground transportation—either by road or rail—will be 2.5 times as great by 2050, while highway capacity is projected to rise by only 10 percent during that time.[3]

Immigration is the most important factor driving population growth—and commuter traffic—in urban areas. Immigrants are more likely than natives to live in metropolitan areas (90 percent do), and within metropolitan areas, immigrants are more likely to live in central cities over suburbs (55 percent versus 45 percent).[4]

Recent immigrants are less likely to own automobiles and more likely to commute to work via mass transit. Carpooling, like transit, is also much more common among immigrants, nearly 22 percent for those here less than 5 years versus less than 11 percent of U.S.-born. Over time, however, the travel patterns of immigrants resemble those of the U.S.-born. For those here over 20 years, there is practically no difference.[5]

Even in the "short-run," immigrants add to traffic congestion woes. Cities with large immigrant populations experience larger increases in suburb-to-core commuter traffic—with many of the new suburban commuters having lived in urban cores until displaced by immigrants.

More important, immigrants increase population density in metropolitan areas:

> … For economic reasons, immigrants often live with more people per dwelling unit than do native-born residents; when Fulton et al. (2001) conducted a study on sprawl for the Brookings Institution, they found that the single most important variable in explaining changes of density between 1982 and 1997 was the share of 1990 residents who were foreign born. Los Angeles, as a major immigrant port of entry, ranks near the top of their list of the United States' densest urban areas, and the top 20 are dominated by western urban areas like Phoenix, Modesto, Calif., and Fresno, Calif. Fulton et al. (2001) point as a counterexample to low-density Atlanta, where only 4.1 percent of the residents were foreign born in 1990."[7]

As density increases so does congestion, in part because it is hard to add more street space in areas that are already heavily developed. Most new lane mileage is built on the urban fringe. Finding a parking space is also more time consuming—not to mention expensive—in dense urban cores.

Transportation, Immigration, and Urban Sprawl

In the transportation sector, per-capita energy consumption rose 9.1 percent between 1973 and 2000, a fact that many environmentalists blame on the popularity of sport utility vehicles (SUVs). This popular theory, perhaps, is probably not true, as the following analysis explains:

> Per capita motor gasoline consumption in the U.S. was virtually unchanged between 1974 and 2000 despite major improvements in the fuel efficiency of new vehicles. Per-capita motor gasoline consumption was 471 gallons in 1974 and 463 gallons in 2000. Over this same time period the fuel efficiency of the U.S. passenger car fleet increased from 13.6 miles per gallon (mpg) to 21.4 mpg and the fuel efficiency of the light truck fleet (including vans and SUVs) increased from 11.0 to 17.1 mpg.
>
> The driving factor behind gasoline consumption is vehicle miles, which in turn is driven by population growth. Total vehicle-miles for passenger cars, motorcycles, light trucks, and SUVs rose approximately 113 percent between 1974 and 2000. The fact that vehicle-miles increased more than three times as fast as the population should not be surprising. In the first place, as the population of an urban region grows, the urbanized area increases in size, and the residential areas are almost always on

Roads and Highways by the Numbers

2.6 million miles of paved roads and streets in the U.S.
30 percent of fatal accidents in which road conditions play a role (2005)
38 hours for the average urban commuters spend stuck in traffic annually (2005)
26 gallons of gas wasted by the average urban commuter while delayed (2005)
$383 extra vehicle repair costs urban drivers incur due to poor roads (2005)

Road and Highway Infrastructure Spending (a)
$130.6 billion (2005) ($442 per capita)

2050 Projections (b):
$193.6 billion: at current population trends
$167.7 billion: at 50-percent reduction in immigration
$130.6 billion: at zero population growth

Notes:
a. Capital, operations, and maintenance spending by federal, state, and local governments in 2006 dollars.
b. Infrastructure spending projections assume per-capita spending stays at 2005 levels and U.S. population grows as per the Pew Research Center's February 2008 forecast.[6]

Sources:
American Society of Civil Engineers, Congressional Budget Office, Pew Research Center, U. S. Department of Transportation, Texas Transportation Institute.

the periphery of the urban region.

Therefore, commute distances are increased. Secondly, population growth has caused property values near some urban centers to rise dramatically. People with modest incomes who have been priced out of the housing market in these urban centers have been buying more affordable homes in small towns that, in some cases, are located considerable distances from their places of employment.[8]

We drive more today because the areas in which we live, work, and shop are larger and more spread out. Sprawl occurs when rural land that had been undeveloped or used for agriculture is developed for residential or commercial use. At the most basic level, such sprawl has only three reasons: a rise in per-capita land consumption, a rise in population, or a rise in both.

The relative importance of these factors is quantified in a 2003 study by Roy Beck, Leon Kolankiewicz, and Steven Camarota.[9]

This is what they found:

- Nationally, population growth accounted for 52 percent of urban sprawl between 1982 and 1997, while increases in per-capita land consumption accounted for 48 percent.
- The more rapid a state's population growth, the more a state sprawled. For example, states that grew in population by more than 30 percent between 1982 and 1997 experienced a 46-percent rise in urban sprawl. In contrast, states that grew in population by less than 10 percent experienced an average rate of sprawl of only 26 percent.
- On average, each 10,000-person increase in state population resulted in the development of 1,600 acres of undeveloped rural land, even controlling for other factors such as changes in population density.

For decades, immigrants and their U.S.-born children have been responsible for more than half of U.S. population growth. Less widely appreciated is the impact they have had on urban sprawl. The conventional wisdom is that immigrants live in urban centers, often in crowded conditions. Contrary to the common perception, about half the country's immigrants now live in the nation's suburbs.

The pull of the suburbs is even greater in the second generation. Of the children of immigrants who have settled down and purchased a home, only 24 percent have done so in the nation's central cities.[10]

The suburbanization of immigrants and their children is a welcomed sign of integration. But it also means that they contribute to sprawl just like other Americans.

Indeed, controlling urban sprawl will be difficult—or even impossible—unless immigration is also controlled.

The Los Angeles Effect

As people get richer, they naturally want to live in larger houses with more land, further removed from crowded city centers. Over time, this trend increases per-capita land consumption, thereby contributing to urban sprawl. One would think that metropolitan areas that manage to reduce per-capita land consumption would be winning the anti-sprawl battle, with salutary impact on commuter times.

Think again!

Los Angeles should be a poster child for anti-sprawl efforts. Unlike most U.S. metropolitan areas, Los Angeles stopped per-capita sprawl dead in its tracks. In 1970, the average Los Angelino took up 0.12 acre of land—one of the densest living conditions in America.

Most cities with Los Angeles' low per-resident land use experienced significant growth in per-capita consumption by 1990. But in Los Angeles, per-capita land use actually declined. By 1990, the city had achieved the Smart Growth goal of becoming the most densely populated urbanized area in America. In no other city did residents live in closer proximity to one another.[11]

Yet commute times increased at well above the national average. The culprit was population growth: the population grew 36.5 percent, swamping the 8.4 percent decline in per-capita land consumption. As a result, the city continued to sprawl: 394 square miles of former orchards, farmland, natural habitat and other open spaces fell to residential or commercial development between 1970 and 1990.

Los Angeles was not the only city in which population growth overwhelmed the decline in per-capita land consumption. Among others were Las Vegas, Miami, Phoenix, and San Jose. Like Los Angeles, these cities have large and rapidly growing immigrant populations. Like Los Angeles, they are among the worst offenders in terms of urban sprawl and traffic congestion.

Highway Productivity: Doing More With Less

Notwithstanding the recent spike in gas prices, the nation's transportation bill has declined as a percent of gross domestic product (GDP). Freight costs have shown the most dramatic change, falling from 9 percent of GDP in 1960 to about 6 percent today. There are many reasons for this: Trucks are larger and more fuel efficient; connectivity among rail, truck, and waterborne modes has increased; and the shift from manufacturing to a service-based economy has reduced the fraction of GDP dependent on highways.

The wartime experiences of President Eisenhower provided the impetus for a national highway system.... Under his leadership, the Federal Aid Highway Act of 1956 was passed.

The information highway has alleviated congestion on the asphalt highway.

Two public policy decisions play a large role in the long-term rise in transportation productivity. First was the decision to build a national interstate highway system. In the 20 years following passage of the 1956 Highway Act, interstate route mileage exceeded the growth of both trucks and passenger vehicles. When highway growth slowed in the 1970s, a second policy decision—economic deregulation of trucking, airlines, and railroads—enhanced the ability of private transportation companies to utilize existing infrastructure.

Unfortunately, both of these policies—infrastructure expansion and deregulation—are in decline.

Planning for a system of national highways began in the late 1930s when the Bureau of Public Roads (BPR)—a predecessor of the Federal Highway Administration—began studying the feasibility of a national system of toll roads. Although the BPR concluded that toll revenue would be insufficient to cover highway costs, it recommended a network of toll-free highways that would be even larger.[12] World War II put such plans on hold.

Ironically, the wartime experiences of President Eisenhower provided the impetus for a national highway system. As commander of Allied forces in Europe, he saw first hand the effectiveness of the state-of-the-art German highways, or autobahns. Eisenhower returned from Europe determined to improve American highways, primarily for national defense purposes. Under his leadership, the Federal Aid Highway Act of 1956 was passed. It created for the first time a dedicated system of revenue—mainly federal gas taxes—and specified that the federal government would pay 90 percent of highway infrastructure costs.

Since 1956, the interstate system has been expanded to include 46,000 miles of highways. But the "highway model" provided by Eisenhower-era interstate legislation is approaching the end of easy additional capacity. Interstate highway mileage (measured in lane miles) increased only 16 percent since 1980, while vehicle miles traveled on those roads increased 123 percent.

The interstate highway network was designed with passenger cars in mind. Planners did not an-

ticipate the tsunami of trucks that are responsible for a disproportionate share of roadway wear and tear and that now outnumber cars over many parts of the system.

Nor did highway planners anticipate the rapid—and, in many cases, immigration-driven—population growth of what were much smaller cities in the 1950s. Thus, there were no plans to build an interstate directly between Las Vegas and Phoenix. Today, these cities are among the largest and fastest growing of all U.S. metropolitan areas—yet still without an interstate link. There are about 70 urbanized areas with populations of 50,000 or more that are still not connected to the interstate system. Which of these will be the next Phoenix or Las Vegas?

The Bureau of Public Roads developed an exhibit in 1957 — one of many over the years — to let the public know about the "controlled access Interstate System being built under the Federal-Aid Highway Act of 1956." LEFT TO RIGHT, Robert M. Monahan, special assistant for public affairs; Federal Highway Administrator Bertram D. Tallamy; Harold C. Wood, Sr., of the Motion Picture and Exhibits Section; and Assistant Commissioner for Research E. H. "Ted" Holmes.

At least one observer of the nation's surface transportation system—the American Association of State Highway and Transportation Officials (AASHTO)—suggests that the U.S. must essentially double its current highway arterial capacity to accommodate all of the projected growth in traffic.[13] In contrast, the Federal Highway Administration estimates that capital highway spending by all levels of government would have to increase by 58 percent to accommodate future traffic increases.[14]

Such grand hikes in highway spending are unlikely. Highways are increasingly viewed not merely in traditional economic terms but in terms of how they impact environmental and ecological systems as well as the society as a whole. Because of such concerns, it is practically impossible to envisage a program to greatly expand the U.S. highway system today—even if economic and budget conditions were favorable.

Grading the Highway System

Not surprisingly, travel on the nation's public roads is increasingly crowded and rough. Nearly 32 percent of all trips in urbanized areas occurred during times of congestion in 2004, up from slightly more than 27 percent in 1997, according to DOT's 2006 status report. More than 55 percent of all trips in the United States in 2004 involved pavement that did not provide "good" ride quality, and approximately 48 percent of trips on the highways making up the national network involved pavement that did not provide a "good" ride, a report to Congress noted.[15]

Substandard road conditions are dangerous. Outdated and substandard road and bridge design, pavement conditions, and safety features are factors in 30 percent of all fatal highway accidents, according to the Federal Highway Administration (FHWA). On average, more than 43,000 fatalities occur on the nation's roadways every year. Motor vehicle crashes cost U.S. citizens $230 billion per year, or $819 for each resident for medical costs; lost productivity; travel delay; and workplace, insurance and legal costs.[16]

The nation's highways earned a D in the American Society of Civil Engineers' *2005 Report Card for America's Infrastructure.*

High Gasoline Prices: Boon or Bane?

The good news: Record gasoline prices will reduce traffic volume and average vehicle weight, thereby reducing wear and tear on U.S. highway infrastructure.

The bad news: Higher costs for materials used in highways could swamp these benefits.

The link between highway infrastructure and soaring oil prices is rarely discussed. But most of our road transportation system is built with asphalt—a substance obtained by petroleum refining. Asphalt is used primarily due to its remarkable waterproofing and binding properties. The hard surfaces of roads, for example, depend on the ability of asphalt to cement together aggregates of stone and sand.

There is no substitute for asphalt in the paving the nation's roads. This dark material covers more than 94 percent of the paved roads in the U.S.; it is the substance of choice for driveways, parking lots, airport runways, racetracks, tennis courts, and other places where a smooth, durable driving surface is required.

This material—in earlier incarnations referred to as hot mix asphalt, blacktop, tarmac, macadam, plant mix, asphalt concrete, or bituminous concrete—was originally taken from natural sources. Those sources declined, and for about a century asphalt has been produced as a by-product of refined petroleum.

Asphalt technology made a great leap forward during World War II, spurred by the need for rapid construction and stronger runways for military aircraft. The postwar boom in suburban development made road building a major industry. Larger, faster, and more efficient equipment for deploying asphalt on roadways was developed. Asphalt plants, once a dirty, dusty nuisance, are today well scrubbed and practically invisible.

But it is expensive! For example, the city of Green Bay paid $26 per ton of asphalt in 2002 but expects to pay $41 per ton this year. That is a smaller price hike than oil experienced over that period—reflecting the intense competition (and willingness to trim profit margins) among asphalt companies. But the inexorable math of road construction—e.g., about 2,500 tons of asphalt needed per mile of city street—translates to a total cost of $103,000 per mile today versus $71,000 in 2002.[17]

There are options. Concrete has a longer lifespan than asphalt, and its price has not risen as much. But concrete is also more expensive. Taxpayers would pay more initially.

Concrete also comes with a large environmental downside. Heating limestone to produce concrete, for example, requires burning about 400 pounds of coal for each ton of concrete produced. The resulting CO^2 emissions contribute to global warming —thereby increasing the deterioration rate of all road and highway infrastructure.

Bottom-line: A supply-side solution to the road infrastructure crisis is unlikely. Curbing demand via population and/or immigration controls offers far more promise.

Motor Fuel Tax Offers Weak Support

The Highway Trust Fund is the funding source for most federal spending on surface transportation infrastructure. About 90 percent of the fund's revenues are from motor fuel taxes. There are two such taxes. The tax of 18.4 cents per gallon on gasoline and gasoline–ethanol blends currently accounts for about two-thirds of the trust fund's total revenues. The levy of 24.3 cents per gallon on diesel fuel accounts for about one-fourth more.

Both tax rates have been unchanged since 1993. In 2007, receipts to the Highway Trust Fund from those taxes totaled about $38.8 billion. The trust fund's taxes are scheduled to expire in 2011. If they are reauthorized at current levels, the Congressional Budget Office (CBO) projects that, over the coming decade, revenues credited to the trust fund will rise at an average annual rate of about 2 percent—or below the expected inflation rate. Motor fuel tax collections are expected to decline as a share of GDP—from 0.28 percent in 2007 to 0.20 percent in 2018.

The main reason for that relative decline is that fuel tax collections depend on the gallons of gas consumed rather than on the price of gasoline. Over the years, increased fuel economy has also eroded the ability of this tax to keep pace with construction costs.

Although gas tax rates have not changed in 15 years—and have declined in real terms—a rate hike is unthinkable in the current economic environment.

CBO estimates that a current gasoline tax would need to be about 30 cents per gallon—about 63 percent above its current rate—to match 1993 purchasing power.[18] Even before the current taxes expire, the Highway Trust Fund will be depleted because revenues are not keeping pace with the outlays authorized under the latest two federal highway acts.

There is another problem with the Highway Trust Fund: Congress often diverts gas tax collections to non-infrastructure purposes. By law, the collections cannot be released to state departments of transportation until a contract for road or bridge work is signed. Since 2002, Congress has been using these unobligated funds for "recissions"—a budget device used to offset spending and make the deficit look smaller. Highway-related rescissions have grown from $374 million in fiscal 2002 to $4.3 billion in FY2007.[19]

The reality is that much Highway Trust Fund money is never used for its intended purpose. Congress simply cannot be trusted.

Given the dimensions of the problem, it is not surprising that proposals aimed at supplementing or replacing the gas tax have been put forth. Among them: substantial expansion of toll roads of the current design, and direct metering of all roads within a metropolitan area (for example, by using GPS technology), with charges based on distance traveled and possibly varying with the road, time of day, and traffic conditions.

Such arrangements would invariably reduce federal involvement in highway finance. But pressures to underfund highway infrastructure would remain. From the public's point of view, tolls are taxes, so raising tolls is also politically radioactive. As a consequence, more and more governors are privatizing state toll roads.

The latest to employ this "solution" is Pennsylvania's Governor Ed Rendell. He recently leased part of the Pennsylvania Turnpike to the Albertis Group of Spain. The foreign company paid $12.8 billion for the right to collect tolls and undertake needed infrastructure improvements over the period of a 75-year lease. It now costs $22.75 to cross Pennsylvania. At the end of the lease it would cost $176.

To a cash-strapped state, foreign money up front looks too good to be true. It probably is.

Do Immigrants Pay Their Fair Share?

An immigrant arriving in 2008 immediately has access to all 46,000 miles of U.S. interstate. While he may pay the same gas tax as a native, his tax payment does not come close to covering his share of system's construction costs. Those of us who have been paying federal and state gas taxes since the 1950s are not as lucky. We have financed the current infrastructure.

This, in a nutshell, is the problem with "pay-as-you-go" finance. Under pay-as-you-go government procures infrastructure services by paying the full cost of the facility as it is being built. Proponents favor this arrangement because it is the least expensive, but it is patently unfair to have current taxpayers pay for facilities that will benefit future generations.

For many reasons, bond finance offers an attractive alternative. First, it exploits the power of leveraged finance. For example, if the gas tax generates $100 million per year, the government can build only $100 million worth of highways under pay-as-you-go. If the $100 million is used to cover debt service on a 30-year bond at 6 percent, the government can build $1.3 billion worth of highways.

If the term of the bond matches the physical life of the project, and debt service is paid out of tolls and other user fees, then all beneficiaries—immigrant and native alike—pay a fair share. Intergenerational equity is achieved.

Even bond finance is not without dangers. There are hidden debt service costs involved in paying off the principal and interest over long periods of time. In the above leveraged finance example, for example, the $1.3 billion highway project actually costs taxpayers $3 billion—$100 million per year for 30 years. By focusing on the principal rather than on total debt service payments, borrowers lose sight of their true liability. Economists call this "debt illusion" for good reason.

Mass Transit to the Rescue?

Until recently, mass transit was seen as the best way of reducing metropolitan area highway congestion. There are some success stories. For example:

> Less than 18 months after the October 2005 opening of the city's [Los Angeles's] Orange Line — a high-speed bus line using an old railroad right of way to avoid traffic — ridership had reached the city's 2020 projections. And unlike nearly every other city, Los Angeles drivers spend less time in traffic now than they did a decade ago, thanks to both mass transit and aggressive traffic management.[20]

But experts are increasingly skeptical that public transportation offers a real solution. In the

California highways, particularly in Los Angeles, are some of the nations's most congested expressways. Despite the prevalence of traffic congestion, Californians still prefer to drive their cars than commute via mass transit.

2000 census, just 4.7 percent of people said they used public transit to get to work. Transit represents only 2 percent of daily trips in Southern California. In most cities, even if the percentage of trips using transit tripled, which is not likely, the resulting drop in congestion would be overwhelmed by the projected growth in population.

And expanding mass transit capacity is extraordinarily expensive. Los Angeles Mayor Villaraigosa estimates that a public transit system that would seriously reduce congestion, rather than just slow its growth, would require funding "that has heretofore been unprecedented. I'm talking about ... tens of billions of dollars and beyond." That is in Los Angeles alone.[21]

The prohibitive cost of building new mass transportation infrastructure is one factor behind DOT's new congestion initiative, announced last year. In FY 2008 the program will make $175 million available to local governments to demonstrate innovative ideas for curbing congestion.[22]

> **"A select number of large-scale pilot projects would be chosen based on their willingness to implement a comprehensive congestion reduction strategy. That strategy would include a broad demonstration of some form of congestion pricing, commuter transit services, commitments from employers to expand work schedule flexibility, and faster deployment of real-time traffic information."**[23]

Clearly, DOT's anti-congestion strategy emphasizes efficiency—making better use of existing infrastructure—rather than building new roads and mass transit facilities. Urban choke points are its major focus. Only $25 million is earmarked for expanding capacity along interstate highways and trade corridors.[24]

"Cordon tolls," which charge drivers upon entering crowded urban centers, are already in place in London and Singapore; Mayor Bloomberg's proposed $8 charge for entering Manhattan, assessed using EZ-pass technology and cameras, would be the first in the U.S. Tolls that vary with the time of day and congestion can increase the number of cars able to travel on existing roads by 40 percent, according to the DOT.

But politics takes a heavy toll on congestion toll plans. Bloomberg's proposal faces an uphill battle in the state legislature. Trucking unions oppose the plan. Suburban politicians are generally unwilling to support a plan that would place a daily charge on many of their constituents. The mayor's pledge to increase mass transit to compensate for the toll has not changed many minds.

Another option—High Occupancy Transit (HOT) lanes—in which drivers who carpool or use buses are charged lower tolls—has proved effective in several states. But here, too, politics often intervenes. HOT lanes are derided as "Lexus lanes" for the wealthy. More importantly, HOT lanes lack the major advantages of universal tolls, since drivers can still use the un-tolled lanes and they do not discourage drivers from traveling in peak travel periods.

Implication: While increasing roadways, congestion tolls, and enhanced driver information can help decrease traffic congestion, the problem will continue to grow unless population growth is slowed.

The bottom line: Enforcing immigration laws may be the most cost-effective technique for controlling traffic congestion in urban areas. ■

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