Madison McVeigh/CityLab

CityLab University: Induced Demand

BENJAMIN SCHNEIDER 12:30 PM ET

When traffic-clogged highways are expanded, new drivers quickly materialize to fill them. What gives? Here's how "induced demand" works.

It's time again for "CityLab University," a resource for understanding some of the most important concepts related to cities and urban policy. If you like this feature, have constructive feedback, or would like to see a similar explainer on other topics, drop us a line at editors@citylab.com.

With 26 lanes at its widest point, the Katy Freeway in the Houston metro is the Mississippi River of car infrastructure. Its current girth, which by some measures makes it the widest freeway in North America, was the result of an expansion project that took place between 2008 and 2011 at a cost of $2.8 billion. The primary reason for this mega-project was to alleviate severe traffic congestion.

And yet, after the freeway was widened, congestion got worse. An analysis by Joe Cortright of *City Observatory* used data from Houston's official traffic monitoring agency to find that travel times increased by 30 percent during the morning commute and 55 percent during the evening commute between 2011 and 2014. A local TV station found similar increases.

The Sisyphean saga of the Katy Freeway is a textbook example of a counterintuitive urban transportation phenomenon that has vexed drivers, planners, and politicians since the dawn of the automobile age: *induced demand.*

KEY POINTS

- In urbanism, "induced demand" refers to the idea that increasing roadway capacity encourages more people to drive, thus failing to improve congestion.
- Since the concept was introduced in the 1960s, numerous academic studies have demonstrated the existence of ID.
- But some economists argue that the effects of ID are overstated, or outweighed by the benefits of greater automobility.
- Few federal, state, and local departments of transportation are thought to adequately account for ID in their long-term planning.

SUMMARY

Nearly all freeway expansions and new highways are sold to the public as a means of reducing traffic congestion. It's a logical enough proposition, one that certainly makes plenty of sense to anyone who's stuck in traffic: Small communities served by small roads grow bigger, and their highways need to grow with them. More lanes creates more capacity, meaning cars should be able to pass through faster. But that's not what always happens once these projects are completed.

Just as with the Katy Freeway expansion, adding new roadway capacity also creates new demand for those lanes or roads, maintaining a similar rate of congestion, if not worsening it. Economists call this phenomenon **induced demand**: When you provide more of something, or provide it for a cheaper price, people are more likely to use it. Rather than thinking of traffic as a liquid, which requires a certain volume of space to pass through at a given rate, induced demand demonstrates that traffic is more like a gas, expanding to fill up all the space it is allowed.

Transportation researchers have been observing induced demand since at least the 1960s, when the economist Anthony Downs coined his Law of Peak Hour Traffic Congestion, which states that "on urban commuter expressways, peak-hour traffic congestion rises to meet maximum capacity."

Maybe make this wider? Downtown traffic in Shanghai, China. (Joe White/Reuters)

Many academic studies have since demonstrated a similar effect, although different methods have found widely varying degrees of it. The complex sets of inputs required for quantifying induced demand —including local economic and demographic conditions, the quality and availability of alternative transportation options, and the decision-making processes of thousands of individual actors—leave plenty of room for interpretation. Some advocates for highway projects insist that induced demand is not as significant as many economists say, or else that its existence is no reason not to increase road capacity.

This has also been the de-facto stance of most public officials and departments of transportation in the United States and much of the world, which have largely avoided reckoning with induced demand in their long-term planning. But the public and their elected representatives could be starting to see the writing on the sound barriers. Many departments of transportation are instead touting the benefits of **toll lanes,** a more *au courant* form of roadway capacity expansion.

Such pricing tools can help mitigate induced demand, but these, too, come with their own negative externalities. Tolls, and ever-elusive **congestion pricing** schemes have been criticized for being a regressive form of taxation that is spread among high- and low-income drivers alike. The real solution to induced demand could be freeway removal—call it **reduced demand**—which has been shown to reduce auto traffic while also stimulating new development.

HOW IT WORKS

Induced demand is often used as a catch-all term for a variety of interconnected effects that cause new roads to quickly fill up to capacity. In rapidly growing areas where roads were not designed for the current population, there may be a great deal of **latent demand** for new road capacity, which causes a flood of new drivers to immediately take to the freeway once the new lanes are open, quickly clogging them up again.

But these individuals were presumably already living nearby; how did they get around before the expansion? They may have taken alternative modes of transport, traveled at off hours, or not made those trips at all. That's why latent demand can be difficult to disentangle from **generated demand**—the new traffic that is a direct result of the new capacity. (Some researchers try to isolate generated demand as the sole effect of induced demand).

Initially, faster travel times (or the perception of faster travel times) encourage behavioral changes among drivers. An individual may choose to take the new highway to a more distant grocery store that has cheaper prices. Trips that may have been accomplished by bike or public transportation might now be more attractive by car. More distant leisure and business opportunities might suddenly seem worth the trip. In aggregate, these choices put more cars than ever before on the newly expanded road, increasing net **vehicle miles traveled (VMT) (**and greenhouse gas emissions**).**

In the longer term, roadway expansions make an impact on the human and economic geography of an urbanized area. Businesses that rely on trucking are more likely to locate near these new roads. With those new jobs, and access to countless more via the higher capacity road, housing developments and shopping centers spring up nearby. Urban form responds to existing infrastructure: Roadway capacity expansions spawn autocentric development patterns that utilize the new roads.

These short- and long-term effects eventually bring the expanded road back to its **self-limiting equilibrium**—in other words, back to capacity, fulfilling Downs' Law of Peak Hour Traffic Congestion.

How quickly does new road capacity get filled up?

Once again, it's important to note that measuring induced demand is a somewhat inexact science. Most studies provide ranges that estimate the amount of road capacity that is filled by induced demand over a given period of time. One literature review, conducted by Susan Handy of UC Davis for Caltrans, California's Department of Transportation, found that a 10 percent increase in road capacity yields a 3 to 6 percent increase in vehicle miles travelled in the short term and 6 to 10 percent in the long term. In this paper from the Victoria Transport Policy Institute, author Todd Litman also looks at multiple studies showing a range of induced demand effects. Over the long term (three years or more), induced traffic fills all or nearly all of the new capacity.

What do public officials say?

Freeway projects undertaken in the name of "traffic relief" have historically been political winners, especially for local leaders with suburban constituents. But some leaders are beginning to shift the discourse. In 2016, Houston Mayor Sylvester Turner said the Katy Freeway expansion "clearly demonstrated that the traditional strategy of adding capacity ... exacerbates urban congestion problems. These types of projects are not creating the kind of vibrant, economically strong cities that we all desire."

In Los Angeles, where memories of the 405 widening and subsequent re-clogging are still fresh, the city's transportation agency, L.A. Metro, recently voted against another major freeway expansion. "Widening freeways, we should be past that time unless we are putting vehicles that don't emit into those lanes," Mayor Eric Garcetti said of that decision.

"You can't build your way out of congestion." Tom Maziarz, chief of planning at the Connecticut DOT, told reporters in 2015. These statements are corroborated by econometric studies showing that freeway widenings often do not pencil out from a financial perspective.

So why are highways still being expanded today?

Some states and cities are charging ahead with roadway expansions, induced demand be damned. Despite the advice above, Connecticut is proceeding with an expansion of the I-84 freeway in Danbury, where rates of traffic have remained steady for the past 15 years. Other local leaders fundamentally resist the ID principle. During a public meeting this year about a new tolled interstate expansion in Florida that's encroaching on the Everglades, Miami-Dade Mayor Carlos Gimenez was asked about concerns that the new route would increase congestion. "That's one of the dumbest things I've ever heard," the mayor replied.

Rudeness aside, the fact that Florida's Dolphin Expressway expansion is a toll road does complicate the induced demand equation. Due to budgetary concerns, a large number of planned roadway expansions in the U.S. are slated to be toll roads. Because they offer increased

mobility for a greater price, toll roads should mitigate the effects of induced demand. But it's a tricky business: Price the road too low and risk generating new traffic, or price it too high and create "Lexus Lanes" that only the wealthy can afford.

Some researchers have expressed concern that the public-private partnerships that build many of today's toll roads will end being a bad deal for local governments. If revenues are lower than expected for the private toll road operator, the government is often expected to pay the difference.

But I'm stuck in traffic *now*. Who's got a better idea?

In cities, many experts tout the benefits of adding congestion charges to existing public rights of way as a means of discouraging non-essential driving. London's well-known congestion charging scheme reduced VMT in the charging zone by 10 percent between 2000 and 2015 (it's since crept up again); Stockholm's newer scheme has reduced traffic in the congestion cordon by 20 percent since it was initiated. But congestion charges are politically challenging to undertake and can only impact limited areas. Critics also say that, without special exemptions, they harm families, low-income people, and those with disabilities.

A sign reminding motorists to pony up for London's congestion charge. (Toby Melville/Reuters)

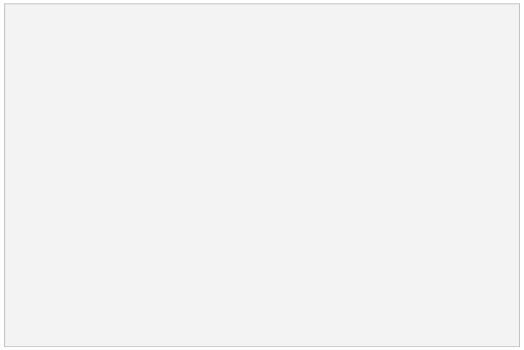
What about charging for parking? That can also help discourage driving: The next big frontier for getting cars off the road and increasing funding for alternative modes of transport could be large-scale parking charges like those being proposed by Donald Shoup.

Perhaps the most effective strategy for solving the conundrum of induced demand: Instead of adding road capacity, remove it. San Francisco's Central Freeway carried around 100,000 passengers per day before it was damaged by the 1989 Loma Prieta Earthquake. The surface-level boulevard that replaced it carries about 45,000 cars. Far from decreasing economic activity, the freeway removal turned the surrounding blocks into one of the city's most desirable (and unaffordable) neighborhoods. Other freeway removals—typically undertaken in dense, central city areas—have been shown to produce similar results. (Bonus: Removing a freeway is often cheaper than repairing it.)

The hard part—and the bigger expense—is coupling highway removals with improved pedestrian and bike infrastructure and robust public transportation that allow commuters and residents to get around without a car.

CASE STUDY: Los Angeles

The 405 is one of the most congested freeways in the country, providing virtually the only north-south link between Los Angeles's west side and the San Fernando Valley. A project to add a northbound carpool lane and a few new on-ramps and off-ramps to the road lasted from 2009 to 2014 and cost $1.6 billion—$600 million over budget—and caused severe disruption to motorists along the route, including two weekend-long total shutdowns, or "carmageddons," in Angeleno parlance.



Demand under control! The empty 405 during 2012's "carmageddon." (Dan Krauss/Reuters)

Once completed, the project's effect on traffic congestion was mixed. A 2015 report from L.A. Metro revealed that travel times during the afternoon rush hour increased slightly in the northbound direction with the new lane, although the duration of peak hour traffic shrunk (it lasts from 3 to 8 p.m., rather than 2 to 9 p.m.), and travel times have become more predictable. "There's a lot of bad taste in my mouth about this," said former L.A. County Supervisor Zev Yaroslovsky of the project's cost overruns, and its net benefits.

Still, it would be unfair to say the project was all for naught: L.A. Metro's report noted 15 percent fewer accidents reported in 2015 than in 2009. When transportation officials need to disrupt traffic flow to make important safety improvements, it can be easier to sell to the public if they throw in a capacity expansion as well.

VIEWPOINTS

Most transportation researchers believe induced demand is a real phenomenon, based upon decades of literature on the subject. But there's plenty of debate about the extent of its effects, and where it is most severe. Highly populous areas, like Houston and Los Angeles, tend to see more severe induced demand than sparsely populated areas.

But many conservative and libertarian-leaning analysts have a different interpretation. Cato Institute Fellow Randal O'Toole argues

that the effects of induced demand are complicated by the fact that historically, in the U.S., vehicle miles traveled has tended to go up regardless of new roadway capacity. In metro Boston, VMT increased by 35 percent between 1983 and 1993, while road capacity increased by only 1 percent; meanwhile in metro Madison, Wisconsin, VMT increased by 20 percent, while road capacity increased by 35 percent over the same span.

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Even while acknowledging some induced demand effect, O'Toole and like-minded observers say that increased automobility leads to greater economic activity. "We know that every car on the road has someone in it who is going somewhere that is important to them," O'Toole writes. "[I]ncreasing highway capacity leads to net economic benefits because it generates travel that wouldn't have taken place otherwise."

Handy's study for Caltrans contradicts this point, however, finding, "most studies of the impact of capacity expansion on development in a metropolitan region find no net increase in employment or other economic activity."

Further Reading

"Highway Boondoggles 3"

"The Fundamental Law of Road Congestion"

"Increasing Highway Capacity Unlikely to Relieve Congestion"

"Closing the Induced Vehicle Travel Gap Between Research and Practice"

"Generated Traffic and Induced Travel: Implications for Transport Planning"

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