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Inconvenient Evidence

One thing I love about transportation is how counterintuitive things can be. If we have too much traffic on a highway, for example, it's perfectly logical to think we need more lanes. But time and time again, the seemingly simple solution fails. Instead of the same people doing the same thing at the same time of day, people adapt to what we've put in front of them.

Let's say I always leave for work at 5 a.m. to beat the traffic. Now that new highway lanes have been added, leaving at 7:30 a.m. with some extra sleep under my belt and time for a cup of coffee sounds pretty, pretty good.

Or maybe I used to take the train every day because of all that traffic on the highway. Now, somebody told me that a ton of money has been spent trying to fix the traffic problem, so I'll try driving again.

Or perhaps I used to take back roads to work. Instead of the highway, the back roads were a little farther distance-wise but got me there quicker. If the traffic problem has been fixed, I might go back to the highway.

Or possibly I used to get a ride from a coworker, but now we drive separately again.

All these scenarios add up to what we call ***induced demand*** and, in turn, a giant fail.

Whenever induced demand comes up, so does Anthony Downs. Downs lays out the above thinking in a 1962 *Traffic Quarterly* paper and takes it a step further: "In pure theory, only a road or system of roads wide enough to carry every commuter simultaneously at an optimal speed would be sufficient to eliminate all peak-hour congestions. It is obvious that no such roads are practical unless we convert our metropolitan areas into giant cement slabs."[1]

For years, I imagined Downs as a lone voice in the wilderness, shouting about induced demand and the law of peak-hour traffic congestion. But this issue was discussed repeatedly well before Downs's 1962 paper.[a] For instance, a 1956 *Traffic Quarterly* paper by the chief engineer for the Arkansas Department of Transportation complains that "one might assume that an expected annual compounded traffic increase of 3 or 4 percent might be applied to the present traffic and thus arrive at a logical and satisfactory answer for twenty years from now. To follow such a procedure is the height of folly. Much has been learned of induced traffic on modern thoroughfares and much remains to be learned."[2]

Other papers from the 1950s were even quantifying induced demand, something we rarely do even today. The "after" traffic on the Eden Expressway in Illinois, for example, was shown to be between 32.2 and 62.2 percent higher than anyone would have expected.[3]

Even *Peppa Pig* gets it. In one episode, Mr. Bull wants to remove the old "*wibbly-wobbly*" road and replace it with new one that is wide and straight. At first, Mr. Bull plans to tear down the veterinarian's office, but Dr. Hamster asks if the road can go around the building instead. That confuses Mr. Bull. "Around the building? Around? But then the road wouldn't be straight. Busy people can't waste time driving around things."

After deciding that the place for sick pets is worth keeping, the work crew tunnels under. But once the new road is done, Peppa asks why the cars still aren't going that quickly. Mr. Rabbit, the traffic engineer, wonders aloud, saying, "Hmmm. There are more cars using this road than we had planned for." And the narrator explains that "the new road is so nice and straight that lots of cars have come to use it." The solution? "We'll need a bigger road!"

And everyone falls onto their backs and laughs uncontrollably, which, if you've seen *Peppa Pig*, makes a lot more sense.

Others kept trying to downplay induced demand. Russell Singer, in a 1964 *Traffic Quarterly* paper, tells us it's a myth: "Myth No. 2: Building freeways and providing parking space is self-defeating because such facilities merely attract more traffic, causing greater congestion and leaving the city worse off."[4]

One 1971 *Traffic Quarterly* paper confronts the "conventional wisdom" of induced demand and this "spiral theory of more highways leading to more cars" by saying that induced demand won't matter once we've acquired enough land for highways (and parking).[5]

Despite the empirical evidence,[b] most traffic engineers drank the Kool-Aid. What was once conventional wisdom became whatever the opposite of conventional wisdom is. It got to the point where traffic engineers could no longer figure out why our "investments" weren't working out.[c] As a 1986 *Transportation Quarterly* paper says, "In spite of these 'investments,' traffic congestion and the physical condition of the commuter transportation system continue to deteriorate."[6]

Why am I talking so much about induced demand in a book about safety? One reason has to do with seemingly logical underlying assumptions. When empirical outcomes don't jive with what we assumed, we treat them as an inconvenience that can be explained away. And since transportation outcomes tend to be counterintuitive, that happens way too often.

Remember the edge-lining experiments from the 1950s? The results suggested that edge lining didn't help safety: "Total accidents, including those at access points, increased by 1% and the number of persons killed and injured increased by 16%."[7]

Yet states kept right on edge lining, because it makes logical sense that edge lining should help safety. A few years later, the American Association of State Highway Officials recommended edge lining nationwide.[8]

The 1963 design manual by the Automotive Safety Foundation couldn't "explain some of the apparent contradictions in certain data."[9] For instance in terms of sight distance, "when substandard features are a common occurrence, drivers apparently compensate for them and the accident rate for that stretch of road may be less than average."[10]

Yet one of our basic design criteria remains sight distance because, for example in the case of uncontrolled railroad crossings, we want to make sure the driver can see if a train is coming and stop in time. Accordingly, the AASHTO Green Book states that "sight distance is a primary consideration at crossings without train-activated warning devices."[11]

AASHTO also refers us to the *Highway-Rail Crossing Handbook*, which tells us that "adequacy of sight distance is critical at passive crossings."[12]

Traffic engineers use a combination of math and physics along with some assumed values to calculate sight distance. This calculated sight distance becomes our minimum design value.[d] Anything bigger is better.[13]

Why do we do that? Well, we do it for safety. A 1987 report from the National Cooperative Highway Research Program (NCHRP) says we can "improve safety conditions at the crossing" with "improved sight distances and a wider roadway."[14]

As for how much of a safety benefit will we get, the report doesn't know: "Techniques to accurately estimate the change are not available and so no estimate is presented."[15]

So even if we don't know how big of a safety benefit we get, it's at least a benefit, right?

Right?!?

A 1968 NCHRP report brushed this question off, and instead the authors tried to come up with "a logical explanation for the nonexistence, or existence as a very minor variable, of sight distance in predictive equations."[16] Even though the data says that sight distance—our critical design criteria—doesn't matter much in terms of safety, "this does not seem logical: sight distance should be one of the most important variables." They never found that logical explanation other than to say that "common sense indicates that there is a minimum value which should be provided at all crossings."[17] So that is what we did.

Researchers finally tested different sight distances at the same railroad crossings in 1996. When they increased sight distance, drivers could see farther down the tracks. Drivers felt safer, so drivers drove faster.[e] The researchers concluded that increased sight distance, the very thing we say is so "critical" at such crossings, "resulted in no demonstrable net safety benefit."[18]

I'm not trying to get you fired up about induced demand, railroad crossings, or even sight distances. I'm pointing out that traffic engineering outcomes are often counterintuitive and that traffic engineers have a history of overlooking the disconnect between what we think leads to better safety and what actually does.

When traffic engineers assume that some design criteria will lead to better safety, they develop mathematical equations to calculate how much of that design criteria is needed. Do these calculations give us actual safety benefits? Maybe, but it's tough to tell

because these design criteria are not as based on empirical crash outcomes as any of us might assume.

So when it comes to safety, traffic engineers don't know as much as *you* would think. Hell, traffic engineers don't know as much as *traffic engineers* would think.

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[a] Including as far back as 1928 when a Los Angeles official said that "a newly . . . widened street immediately becomes glutted by the access of cars that hitherto have reposed more in their garages than they have utilized the streets." Brian Ladd, "'You can't build your way out of congestion.'–Or can you? A Century of Highway Plans and Induced Traffic," *disP - The Planning Review* 48, no. 3 (2012).

[b] And despite that Russell Singer worked for AAA.

[c] A higher-up at an unnamed state department of transportation recently told one of my former students that induced demand remains "controversial and unproven." After my student suggested otherwise and asked about DOT leadership often using the phrase "you can't build your way out of congestion" at public meetings, the higher-up responded by claiming that that phrase has nothing to do with induced demand and that we still need to add vehicle capacity. Yup.

[d] Some states consider sight distance at railroad crossings so important that they've set laws establishing minimums far beyond our calculated minimums. Even if our equations tell us that 69 feet is enough, Illinois wants "a distance of not less than 500 feet in either direction from each grade crossing." Illinois Compiled Statutes, "Sec. 18c-7401. Safety Requirements for Track, Facilities, and Equipment."

[e] It is worth noting that this study didn't look at actual crash outcomes either, only at driver behavior.