Chat Questions and Responses

Downs Law Revisited: How and Why Expanding Roadways Reduces Congestion Despite Induced Travel

Prof. Alex Anas, March 3, 2025

During the TBD Webinar, various questions and comments were received, but not all could be addressed due to time constraints. This document has been prepared by Prof. Alex Anas in response to the unaddressed questions and comments.

Q1. This implicitly assumes that (all) person trips are by car. Where non-car modes have a large share, then suppressed demand can increase congestion - Downs/Thompson Paradox.
Response: True. The paper by Downs (1962) had two parts. The first dealt with situations involving car travel only, and the second part got into bimodal situations car and public transit competing.
When public transit is available, then it has been pointed out that if we improve road travel times (say by adding road capacity), this can cause many trips to switch from transit to roads. Because transit systems have economies of scale, then the average (per trip) cost of public transit can increase. This in turn would cause more transit riders to switch to cars and congestion could increase.

This result depends on the implicit assumption that the average cost (per trip) of public transit is charged to the public transit user. But this is not observed often as the fixed costs of public transit networks are funded not by fares but by general taxes. Also, the time-cost of accessing the public transit system should be included and would increase with the number of riders causing diseconomies of scale. In that case, adding to road capacity can decrease the per-trip time cost.

One might also note that improvements in public transit that attracted new riders from roadway travel may free up roadway capacity that might then induce more VMT offsetting some of the saving of the diversion to transit. So, induced driving demand can also occur because public transit has been improved. This is important to point out in our context since we are discussing induced demand.

Q2. In most cases, the very act of adding capacity will reduce capacity (through construction) for a period of time. In the case of a major freeway, that capacity reduction during construction will take several years. I'm curious how you think that shift before the capacity is increased would change (or not change) these models.
Response: This is not always true, since when building a new road, we do not have to shut down existing roads. It can be true in some cases when, say, we add more lanes to an existing road. If that is true, then temporarily congestion would increase.

I am not aware of any analysis of whether the travel behavior changes during construction persist after the construction is completed. For example, major construction could impact trip distribution that may not revert to the prior pattern after a new habit has been formed.

Q3. I joined the discussion late, so I may have missed this. Does 'travel time' refer to the total travel time for the entire system or the average travel time per individual traveler?
Response: I talked about both. There is per-trip travel time and aggregate travel time when we add up the per-trip travel times.

Q4. Hi Alex, What is your view of current NYC Congestion pricing which is one price form 5 am to 9 PM. How peak spreading can happen?
Response: The NYC congestion pricing covers peak and off-peak periods and cannot be easily avoided by peak spreading. This makes the response of the drivers less elastic than in other places (London, Singapore, Stockholm).

It supports the idea that the main purpose is to raise revenue for MTA and less important to spread traffic.

I think, perhaps, many deliveries would happen before 5 am and after 9 pm because there is probably more flexibility in scheduling some deliveries at off peak hours.

Q5. It's interesting to see the change in policy and perception that congestion is no longer the focus (at least in CA), rather VMT is the major metric. Although the congestion will be lesser for build vs no build roads scenario, it's still adding more travel, more emissions. Now, we want to go back to 60s, 70s time where the population density needs to be higher (as showed in Prof. Anas's earlier slide) but ideally cut congestion through the increased demand by diverting the traffic to transit or other non-SOV modes.

Response: I explained that if we focus on VMT as a metric, it not a metric of road congestion but a metric of road utilization. More VMT can be occurring because of less congestion, keeping other factors constant. More VMT can be good because it is reflecting more mobility and access to opportunities. But it can be bad also because it has costs.

Q6. What about opportunity cost of the use of the land now devoted to the expressway. Seems like another factor that must be added into the analysis.

Response: Yes, if traffic on existing expressways falls a lot, their removal and the use of the land in some other use can be beneficial.

Q7. In a nutshell, this is what the battles were about when urban neighborhoods started pushing back against adding urban freeways.

Response: Yes. See these examples Two Buffalo Highways Are the Worst In New York State
Group of residents file lawsuit to stop Kensington project in Buffalo | wgrz.com
Options to restore a Buffalo neighborhood divided by the Kensington Expressway

Q8: I don't think I would disagree with the contention that building roads reduces congestion in a directional sense. However, I think the empirics matter very much. How much congestion benefit do we get on an elasticity basis in a metropolitan area where roads are largely congested? Is this even forecastable?

Response: Please look at the page in my power point where I present sample numerical examples, one for higher and another for a lower price elasticity of demand. Both calculations are for highly congested situations.

Q9. Other modes must include walk (and bike). Places like NYC obviously have huge walk modes due to a variety of factors, where in low-density cities the walk mode is almost negligible.

Response: Good point.

Q10. If a highway in rural area was improved to add capacity for safety, goods movement, or evacuation but the contextual setting does not have latent demand, lacks significant congestion, does not result in significant travel times, and the county is low growth.....would this improvement result in significant induced demand?

Response: There are examples of highways that are used much less than expected.
https://www.youtube.com/watch?v=jRsyGwtDDrg&t=496s

Q11. Is there a congestion equation or model that analyzes the demand vs capacity (similar to the one being showed on the slides) for a good transit city where non-auto trips are attracted towards roads because of the capacity improvement?

Response: The demand for using the road increases as the time-cost of using the road decreases. The increase in demand comes from many sources one of which is switching from public transit.

Q12. Given "same" conditions between the before- and after a capacity increase, are there any situations where the demand curve shifts enough toward the right that E'' is higher on travel time than E? For example, if suppressed (latent) demand is so high that, after expansion, the demand increases very substantially?
Response: I could find no such shift in all the cases I examined theoretically. In the case where the road spurs Marshallian agglomeration externalities, I find that it is theoretically possible but not at all likely empirically because the agglomeration effect is small.

I guess the question I am asking is whether you have been able to prove theoretically that a capacity increase WILL ALWAYS reduce congestion, or is this really an empirical issue based on context?

Response: See above. There can be no general proof at least because of Braess's paradox, or if hypothetically the agglomeration externalities were very strong. The first seems very occasional as you say below and the second is a weak effect as I state in the paper. But since these cases are possible through not likely, they serve as counterexamples and a general proof should not be possible.

And what about those very occasional cases where things like Braess's paradox hold?

Response: Almost everyone I have discussed this with, agrees that it is very occasional. Still, I think we should keep an open mind about it.

Thanks, Alex, insightful thoughts.

Q13. This analysis explores the impact of adding highway capacity, particularly in relation to induced demand and congestion levels. However, what are the broader implications if capacity expansion projects are halted?
Response: It should be more congestion than would be true if they were not halted.

If no additional capacity is added, how can cities accommodate population growth and increasing travel demand? In such cases, would congestion extend beyond peak hours as non-work trips—accounting for 75% of total trips—shift to off-peak periods?
Response: Yes, I think that we should expect that to be more likely if road capacity is not expanded.

Looking at global examples, high-density cities in Asia, such as Karachi and Kolkata, experience severe congestion from 9 AM to 9 PM, resulting in extremely low travel speeds. This persistent congestion imposes significant economic costs, increasing travel time burdens, reducing productivity, and deterring economic growth.
Response: Absolutely.

Q14. The discussion on capacity expansion may also need to consider broader economic impacts. In developed countries, highway expansions often enhance consumer surplus by improving accessibility and reducing travel time costs. In contrast, many developing cities in Asia suffer from a consumer deficit due to chronic congestion, inadequate infrastructure, and limited transportation alternatives.
Response: Exactly. Broader economic impacts are considered in the RELU-TRAN model's various applications.

For the United States, maintaining a certain level of consumer surplus is crucial to promote economic growth, enhance quality of life, and attract global talent.
Response: Yes.

What are your thoughts on this perspective? How do social marginal costs and consumer surplus vary when capacity is added versus when it is not?

Response: If we have too little capacity, then adding more will increase the social benefits which include consumer surplus and broader economic impacts. If there is already too much capacity, then adding more will cause a small increase in social benefits which again include the same things.

Q15. Fewer workers in Manhattan will also reduce peak congestion, so that is part of the reallocation of where firms locate. That should be one of the goals.
Response: In my application of RELU-TRAN to Chicago to study counterfactual cordon tolling, the cordon causes some firms/jobs to move out of the cordoned area, while residences move in. Some people locate inside the cordon residentially, because by doing so they can avoid commuting in and paying the toll.
The economics of cordon tolling: General equilibrium and welfare analysis - ScienceDirect