

# One Simple New Practice to Make Infrastructure Equitable and Less Greenhouse Gas Intensive

## SYSTEMIC BEFORE-AND-AFTER STUDIES

### SUMMARY

The Infrastructure Bill / American Jobs Act sets the goal of massive investment in transportation infrastructure with the explicit objective to foster equity and reduce greenhouse gas and criteria air emissions as a result. One key hurdle stands in the way of achieving these outcomes – we don't have a good handle on **what types of policies and investments actually do foster equity and reduce emissions**. Requiring before-and-after studies for new federally-funded investments that cover greenhouse gases, criteria air emissions, and social equity can foster more accountability and a constant march of improvement in our ability to hit our goals.

**PROBLEM:** We don't really know what works in transportation because we don't do before-and-after studies.



**BARRIER PRE-2010**  
Lack and expense of data



**Solved by availability of Big Data**

So why is the industry *still* not doing these studies?



**NEW BARRIER #1**  
Staff don't have TIME to do it



**Solution:** Projects receiving federal funds should predict impact on congestion, equity, and GHGs and measure 1, 5, 10 years post-project completion



**NEW BARRIER #2**  
Officials have no INCENTIVE to show their promise may not have worked out



**Solution:** Incentives for agencies that adopt a culture of continuous learning and improvement

# PROBLEM

While the availability of data has exploded in the past decade, we haven't taken advantage of it in ways to measure the impact of the investments we make. **Thus, our industry still doesn't have an adequate understanding of exactly what will get us to our transportation goals, especially related to climate and equitable access.**

*Here are some questions that we don't know the full answer to:*

- When we build new highways, sponsors make promises (reduced congestion, access to jobs, etc). In which highways built in the past decade have they come true, and not come true?
- Where does adding a bicycle lane increase bicycling (thus reducing emissions), and where does it simply make existing biking safer? Do you need a network of bike lanes to cause mode shift?
- If people work from home, will their overall VMT go down? The pandemic has clearly challenged this long held assumption.

**The reason we're still in the dark is that we don't have a practice of consistent, widespread before-and-after (also called ex post) studies.** This problem exists for classic transportation metrics, like congestion. When it comes to greenhouse gas emissions and equity, the problem is many-fold more profound. Many have remarked on this gap – for example, a past review of published impact studies says:

Over the last few decades, there has been increasing attention given to the lack of demand forecast accuracy. However, since data availability for comprehensive ex-post appraisals is problematic, such studies are still relatively rare...Mandatory, systematic ex-post evaluation programmes are suggested as a necessary tool to improve decision support, as data availability for ex-post studies is often remarkably poor even for internal audits. (Nicolaisen and Driscoll, 2014).<sup>1</sup>

Big Data has solved this data gap since 2014. This includes the explosion of data from mobile and IoT devices, combined with the scale of cloud compute resources. We can broadly measure changes over time in congestion, greenhouse gas emissions, mode shift, equity, and accessibility. So why aren't more before-and-after studies happening?

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<sup>1</sup> Nicolaisen, Morten Skou, and Patrick Arthur Driscoll. "Ex-Post Evaluations of Demand Forecast Accuracy: A Literature Review." *Transport Reviews* 34, no. 4 (July 4, 2014): 540–57. <https://doi.org/10.1080/01441647.2014.926428>

## PROPOSED SOLUTION

Every state DOT, all major Metropolitan Planning Organizations and most cities have used “Big Data” to create a baseline understanding of their system in the past five years to help with some decision. However, using this data over time to do ex post facto studies has not often occurred. There are two barriers that, based on conversations with advocates and agency staff, hold them back:

1. Agencies staff tends to have near-infinite responsibilities, so new ideas and unrequired investigations don't often get room on the schedule.
2. Agency leaders and elected officials do not have much incentive for before-and-after studies if they risk making past investments look like bad choices.

### *To mitigate Barrier 1:*

We propose that any agency that receives federal dollars tied to new, significantly altered, or expanded infrastructure must first predict that investment's outcome on:

- Regional greenhouse gas emissions,
- Local and regional criteria air emissions,
- Equitable transportation access,
- Any other components they value, such as revenues, congestion, safety, jobs, etc.

The bill should not specify the means by which the prediction is made – different regions use different approaches ranging from highly quantitative models to rules of thumb. The prediction could thus be very specific (“local travel time to work will decrease by 10%”) or broader (“greenhouse gas emissions from transportation per capita will go down”).

Whatever the format of prediction, the agency must then measure what really happened one, three, five, and 10 years after the project's completion. Both the prediction and the measurements must be publicly reported. **I'm certain that initially many predictions will be wrong! But by collecting information and sharing what we learn, the community will get better and better at making decisions based on what achieves our goals – and not based on assumptions, habits, squeaky wheels, or political pressure.**

This measure should be accompanied by centralized best practice research programs by federal research agencies and/or universities and national labs, as well as funding for agencies to train their own staff.

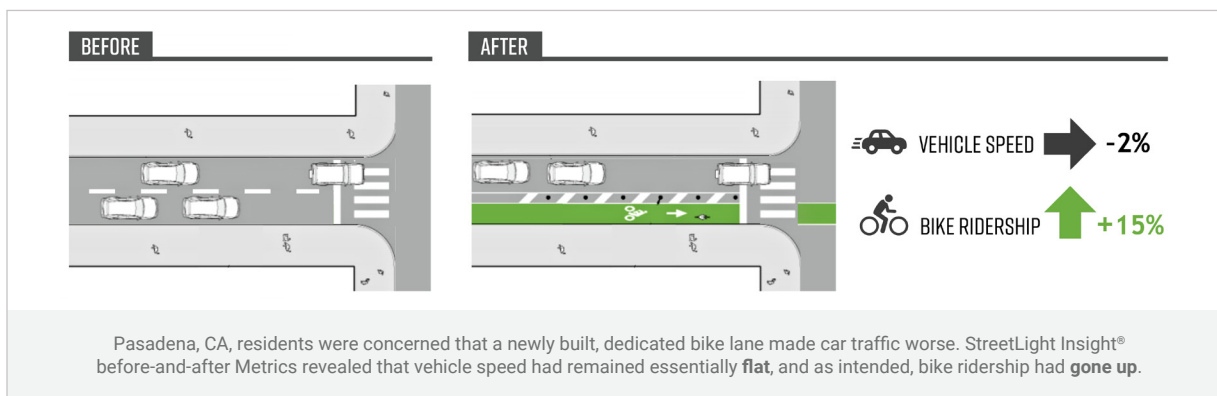
States may demand additional funding be made available for the data. Data collection costs in the era of Big Data are trivial compared to the cost of infrastructure, so it could suffice to classify “data and analytics” as part of modern transportation infrastructure, to be paid for out of the same resources that may pay for concrete, paint, and steel. Additionally, a special pool of money for these studies can mitigate the concern.

## To mitigate Barrier 2:

While we may not have a history of evaluating investment decisions in surface transportation, there is one mode of transportation where it is viewed as a central feature: aviation safety. The primary objective is safety instead of equity or emissions. However, the basic principle of continuous improvement in decision-making based on evaluating operational data is the same. In this culture of continuous operation improvement, after a decision is made it's acceptable and expected to update the decision as more information comes in. This process is defined as "service monitoring and corrective actions that feedback into a product's design and production." An updated or even reversed decision is not a cause for blame – it's part of managing well. This approach is taken even amongst competing airlines because safety is not an area of competition. Likewise, safety, equity, and greenhouse gases are not an area of competition between states. Federal agencies can offer incentives to states that demonstrate adoption of this philosophy.

## Two simple case studies illustrate the power of before-and-after studies:

A two-lane road in Pasadena, California, was turned into one car plus one protected bicycle lane. Pasadena residents were concerned that the new bike lane made travel time for cars worse. Big-data derived analysis showed it did not.



In 2008, the Katy Freeway into Houston was expanded from six to 12 lanes plus two HOT lanes for \$2.8B. The stated goal was to reduce the bottleneck. But despite an initial drop in traffic jams, commute times along the freeway are now up over 50% compared to pre-expansion.

