2-4-2022

Reckoning with Induced Vehicle Travel

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RECKONING WITH INDUCED TRAVEL

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RUN OF SHOW

- Induced Travel Primer
- Evidence from the Research
- Induced Travel Calculators
- Induced Travel in the Environmental Review Process
- Next Steps

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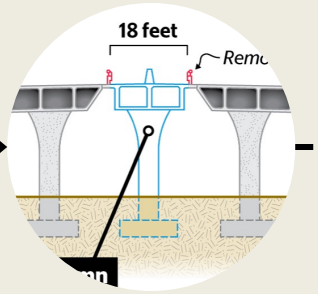
HISTORICAL APPROACH TO CONGESTION MANAGEMENT

Congestion & Air Quality Problems



New Roadway Capacity

Faster Speed, Shorter Times, Less Congestion

New Driving

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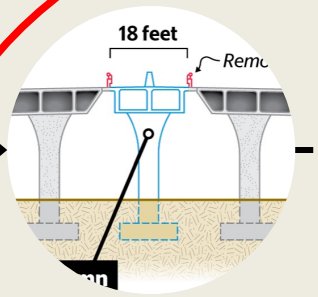
HISTORICAL APPROACH TO CONGESTION MANAGEMENT

Induced Travel

Congestion & Air Quality Problems



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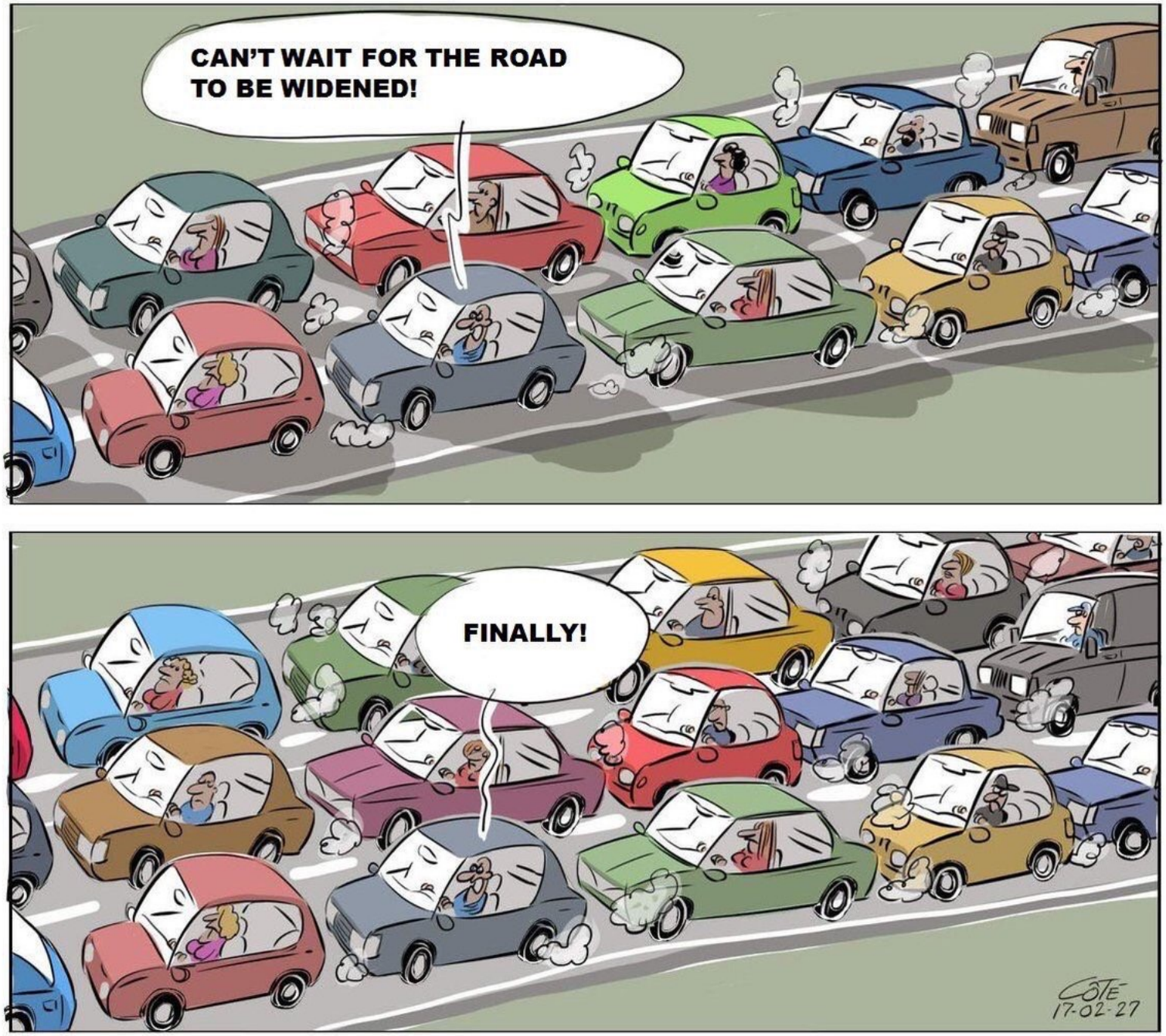
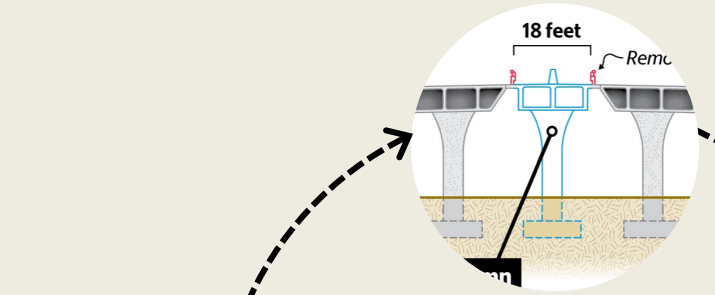

CAN'T WAIT FOR THE ROAD TO BE WIDENED!
FINALLY!
CÔTÉ 17-02-27

HISTORICAL APPROACH TO CONGESTION MANAGEMENT



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INDUCED TRAVEL EFFECT

- Adding roadway capacity in congested areas, areas with minimal accessibility, or areas with unsafe or low-speed roads ***reduces the time cost of driving***
- When the price of driving goes down, ***vehicle miles traveled (VMT) go up***

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INDUCED TRAVEL EFFECT

- Both short- and longer-run behavioral changes
  - Longer trips
  - More frequent trips
  - Mode shifts
  - Route shifts
  - Households and businesses relocate throughout the metro area (sprawl, etc.)
  - Induces migration to the area, which increases demand

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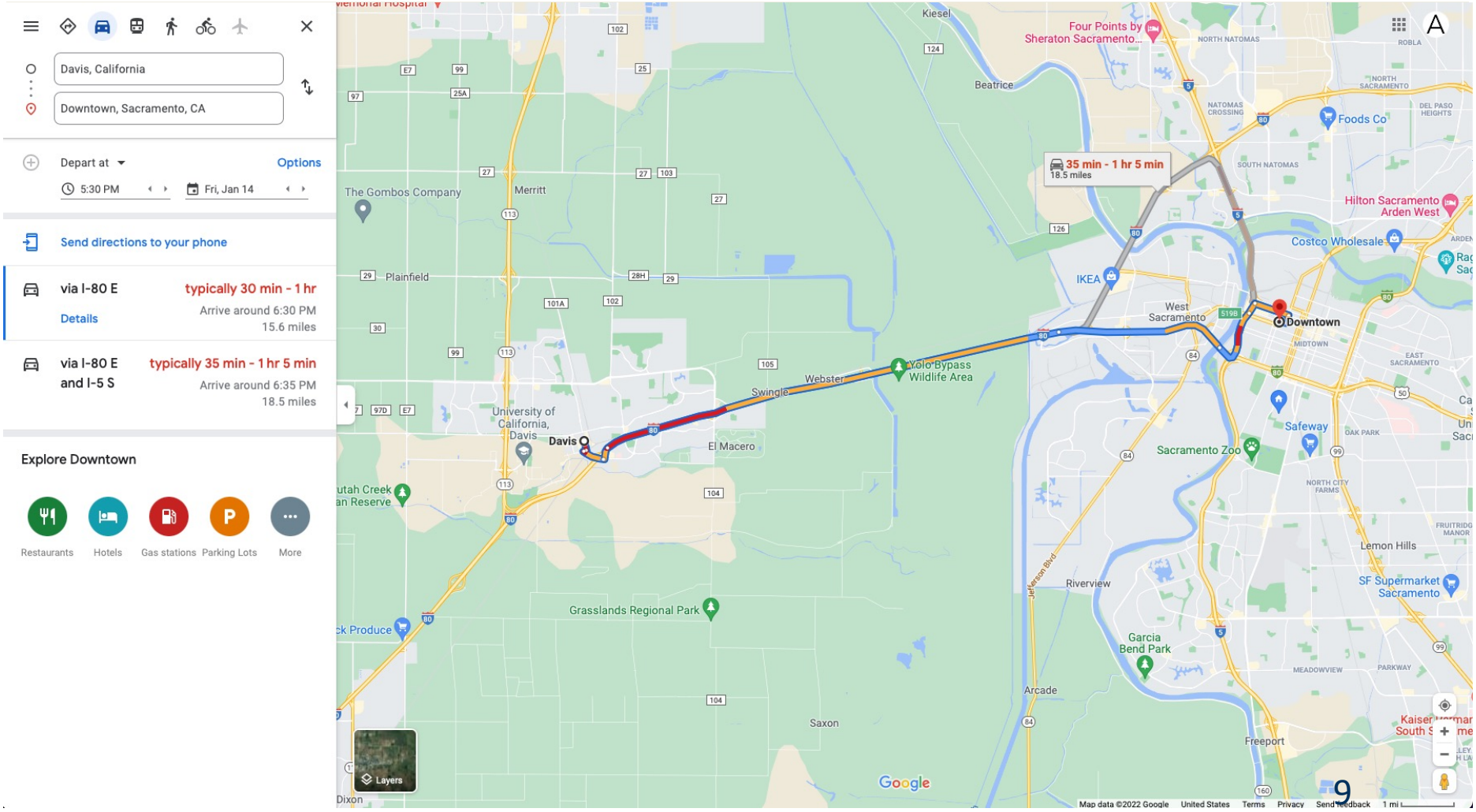
INDUCED TRAVEL HYPOTHETICAL



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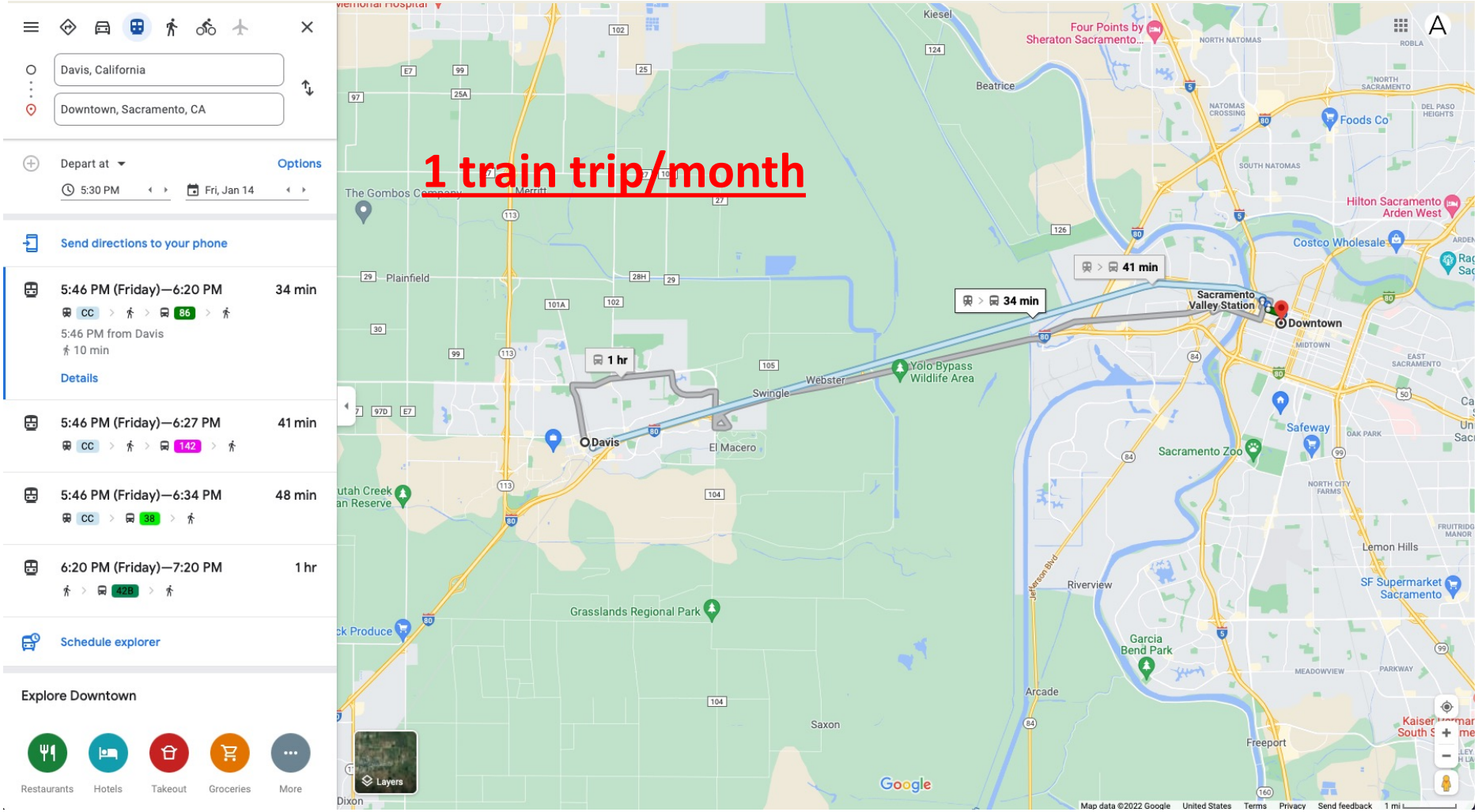

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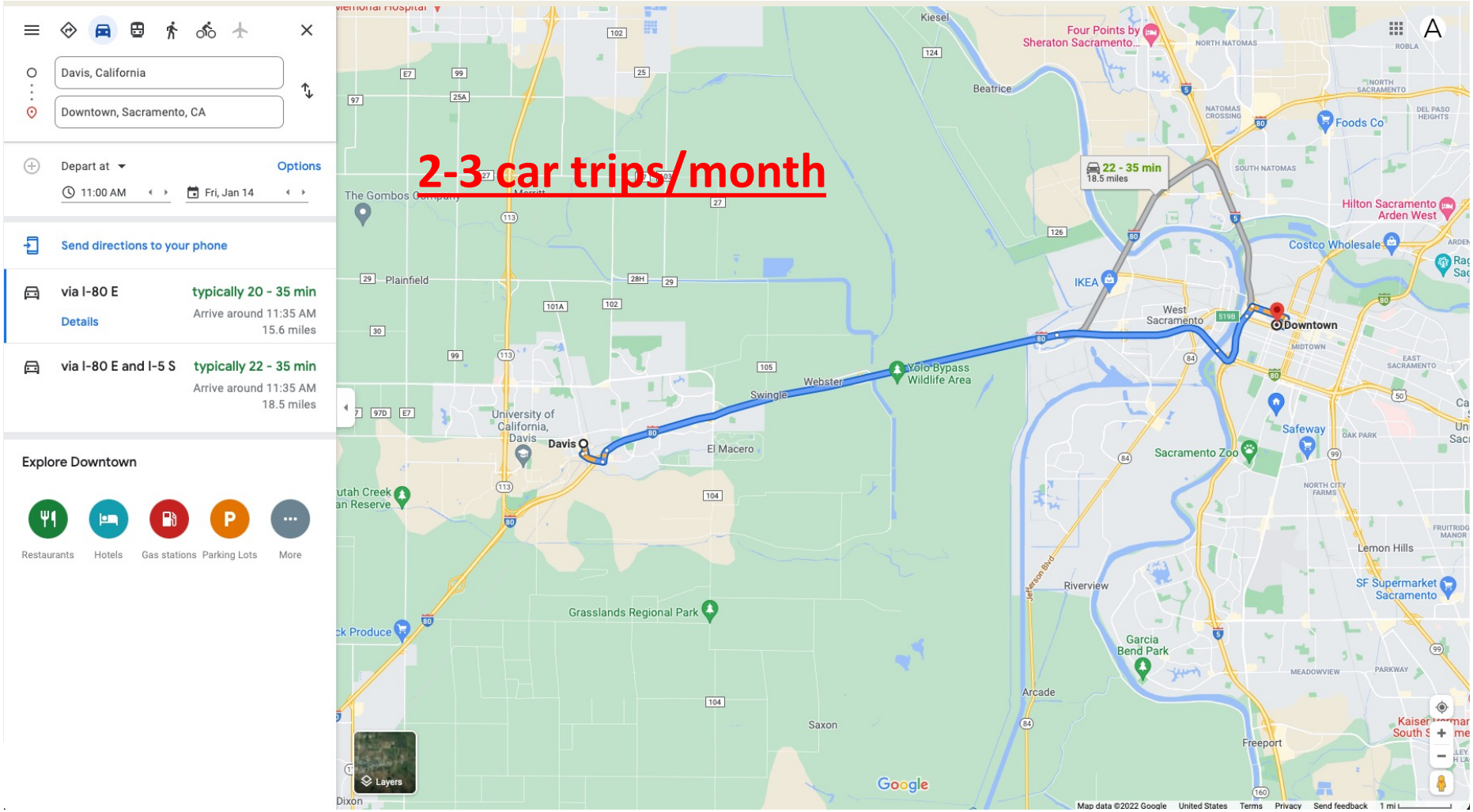

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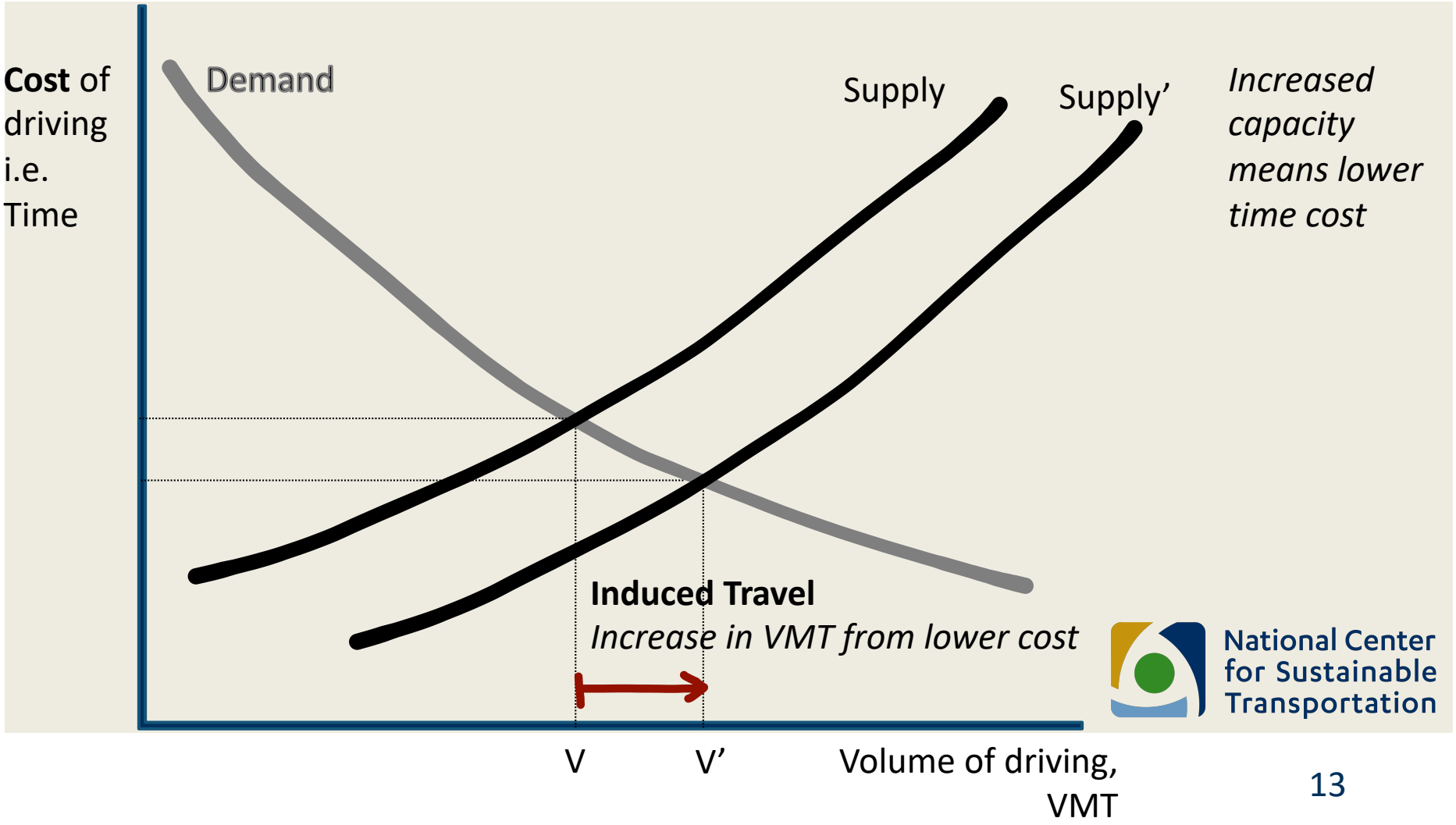
INDUCED TRAVEL EFFECT: SHORT RUN



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INDUCED TRAVEL EFFECT: SHORT RUN

- Short-run behavioral changes
  - Longer trips
  - More frequent trips
  - Mode shifts
  - Route shifts

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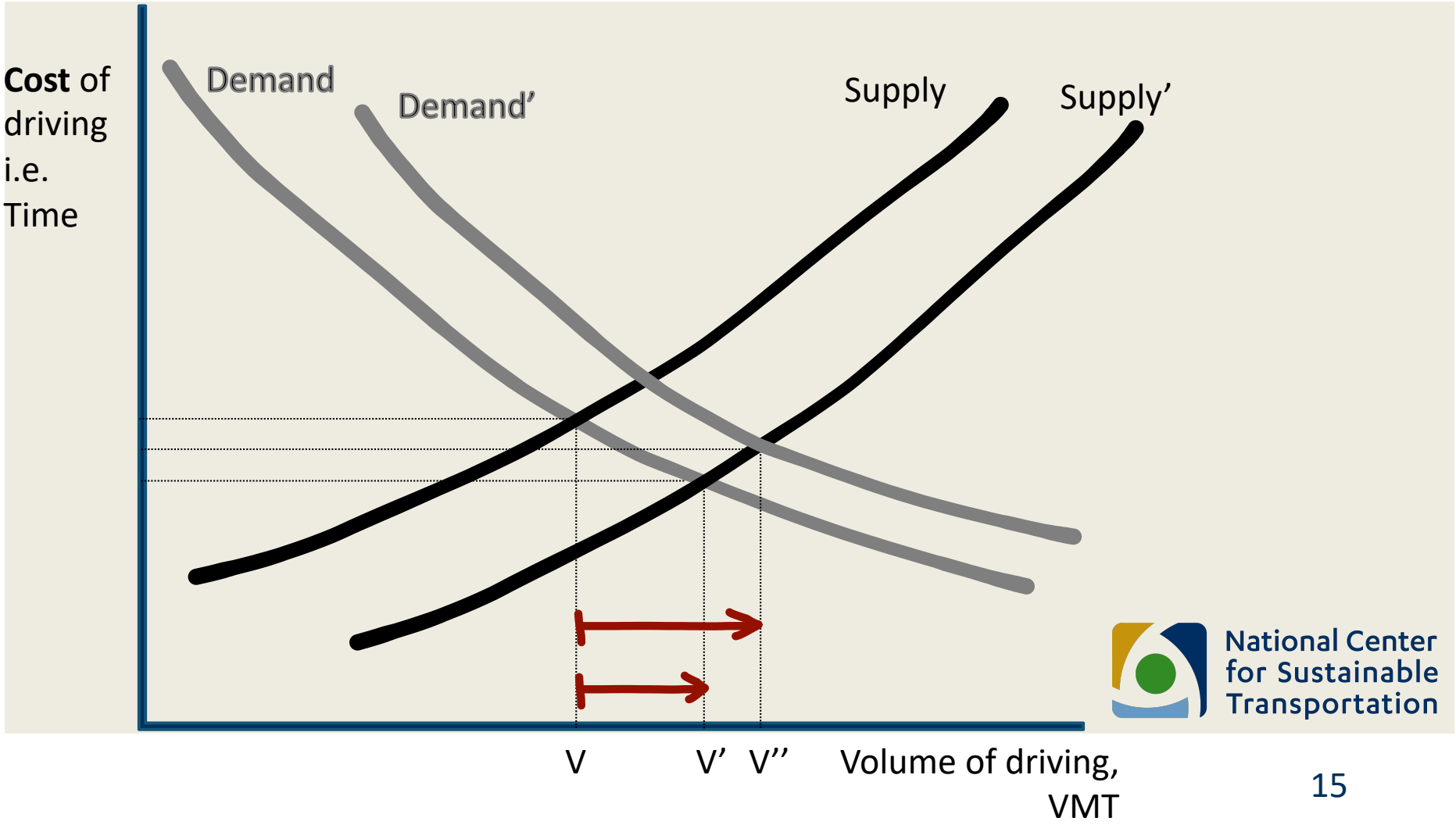
INDUCED TRAVEL EFFECT: LONG RUN



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INDUCED TRAVEL EFFECT: LONG RUN

- Longer-run demand shifts
  - Households and businesses relocate throughout the metro area (sprawl, etc.)
  - Induces migration to the area, which increases demand

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MEASURING INDUCED TRAVEL: ELASTICITIES

$$Elasticity = \frac{\%\ Change\ in\ VMT}{\%\ Change\ in\ Lane\ Miles}$$

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MEASURING INDUCED TRAVEL: EVIDENCE FROM THE RESEARCH

Authors	Elasticity	Roadway Types	Methodology (Estimator)	Study Location	Study Years
Duranton & Turner (2011)	**1.03** (10 year)	Interstates	2-stage least squares regression with instrumental variables	United States (metropolitan statistical areas)	1983–2003
	0.67–0.89 (10 year)	Other highways, arterials, and collectors	Pooled ordinary least squares		
Melo et al. (2012)	**0.98** (~10 year)	Arterials	Generalized method of moments	United States (urbanized areas)	1982–2010
Graham et al. (2014)	**0.77** (~10 year)	Freeways and arterials	Propensity score	United States (urbanized areas)	1985–2010
Hymel (2019)	**0.89–1.06** (5 year)	Freeways and other limited-access roads	2-stage least squares regression with instrumental variables	United States (urban areas)	1981–2015

MEASURING INDUCED TRAVEL: EVIDENCE FROM THE RESEARCH

- Relationship is about 1-to-1
- Congestion and its impacts?
  - Generally, net effect in the long-run is no decrease in congestion
  - Driving increases along with capacity

October 2015

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Increasing Highway Capacity Unlikely to Relieve Traffic Congestion

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POLICY BRIEF

Issue

Reducing traffic congestion is often proposed as a solution for improving fuel efficiency and reducing greenhouse gas (GHG) emissions. Traffic congestion has traditionally been addressed by adding additional roadway capacity via constructing entirely new roadways, adding additional lanes to existing roadways, or upgrading existing highways to controlled-access freeways. Numerous studies have examined the effectiveness of this approach and consistently show that adding capacity to roadways fails to alleviate congestion for long because it actually increases vehicle miles traveled (VMT).

An increase in VMT attributable to increases in roadway capacity where congestion is present is called "induced travel". The basic economic principles of supply and demand explain this phenomenon: adding capacity decreases travel time, in effect lowering the "price" of driving; and when prices go down, the quantity of driving goes up.[1] Induced travel counteracts the effectiveness of capacity expansion as a strategy for alleviating traffic congestion and offsets in part or in whole reductions in GHG emissions that would result from reduced congestion.

Key Research Findings

The quality of the evidence linking highway capacity expansion to increased VMT is high. All studies reviewed used time-series data and sophisticated econometric techniques to estimate the effect of increased capacity on congestion and VMT. All studies also controlled for other factors that might also affect VMT, including population growth, increases in income, other demographic factors, and changes in transit service.[2]

Increased roadway capacity induces additional VMT in the short-run and even more VMT in the long-run. A capacity expansion of 10% is likely to increase VMT by 3% to 6% in the short-run and 6% to 10% in the long-run. Increased capacity can lead to increased VMT in the short-run in several ways: if people shift from other modes to driving, if drivers make longer trips (by choosing longer routes and/or more distant destinations), or if drivers make more frequent trips.[3,4,5] Longer-term effects may also occur if households and businesses move to more distant locations or if development patterns become more dispersed in response to the capacity increase. One study concludes that the full impact of capacity expansion on VMT materializes within five years[6] and another concludes that the full effect takes as long as 10 years.[7]

Capacity expansion leads to a net increase in VMT, not simply a shifting of VMT from one road to another. Some argue that increased capacity does not generate new VMT but rather that drivers simply shift from slower and more congested roads to the new or newly expanded roadway. Evidence does not support this argument. One study found "no conclusive evidence that increases in state highway lane-miles have affected traffic on other roads"[8] while a more recent study concluded that "increasing lane kilometers for one type of road diverts little traffic from other types of roads".[9]

Increases in GHG emissions attributable to capacity expansion are substantial. One study predicted that the growth in VMT attributable to increased lane miles would produce an additional 43 million metric tons of CO_2 emissions in 2012 nationwide.[10]

ITS UCDAVIS INSTITUTE OF TRANSPORTATION STUDIES

https://ncst.ucdavis.edu/research-product/increasing-highway-capacity-unlikely-relieve-traffic-congestion

MEASURING INDUCED TRAVEL: EVIDENCE FROM THE RESEARCH

Authors	Facility	County	Type of Expansion	Year of Expansion
Anderson et al. (2021)	SR-24	Alameda & Contra Costa	Two new general purpose lanes (off-peak direction)	2013
	I-215	San Bernardino	One new general purpose lane and one new HOV lane	2010
	I-580	Alameda	One new HOT lane	2016
	I-405	Orange	One new HOV lane and new connectors	2014

MEASURING INDUCED TRAVEL: EVIDENCE FROM THE RESEARCH

- "Overall, we find that the implied elasticities are similar across different types of lane expansions" – including general purpose, HOV, and HOT lanes – "and in all cases within the range of estimates from previous studies" (Anderson, et al., 2021, p. 65)

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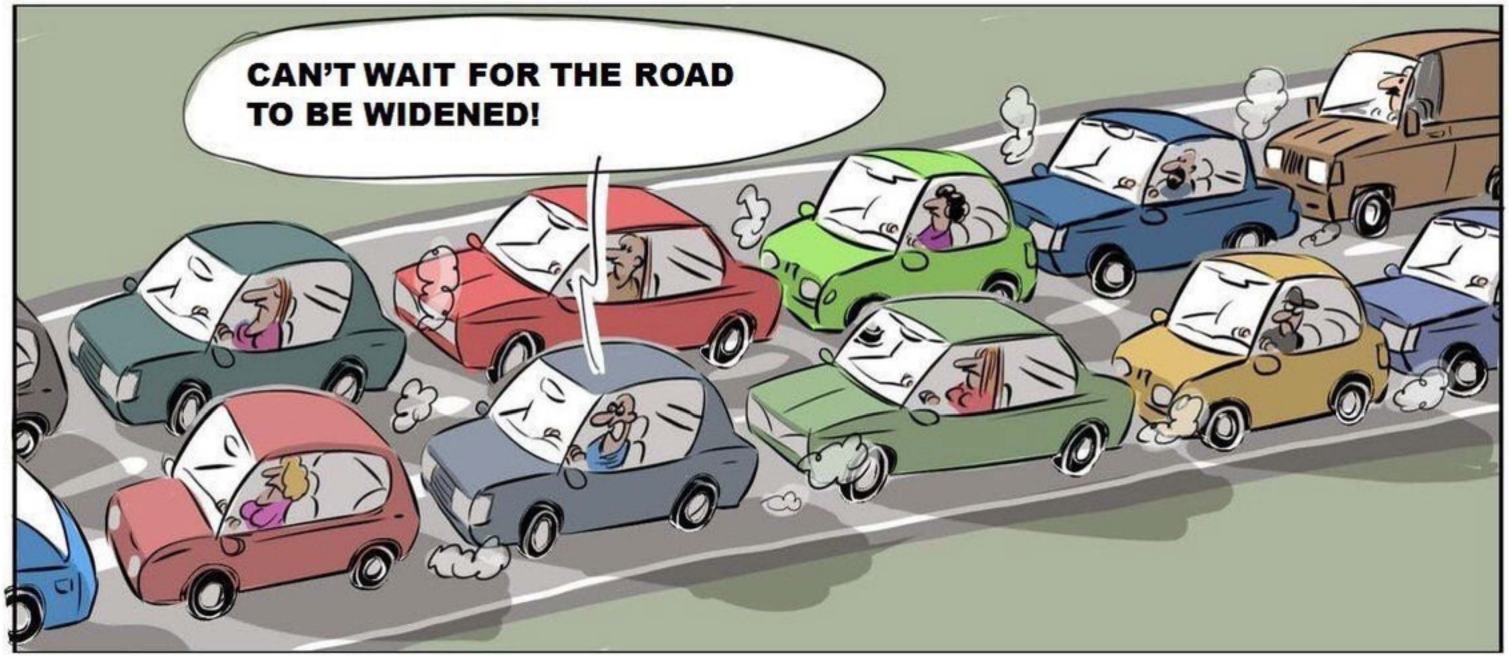
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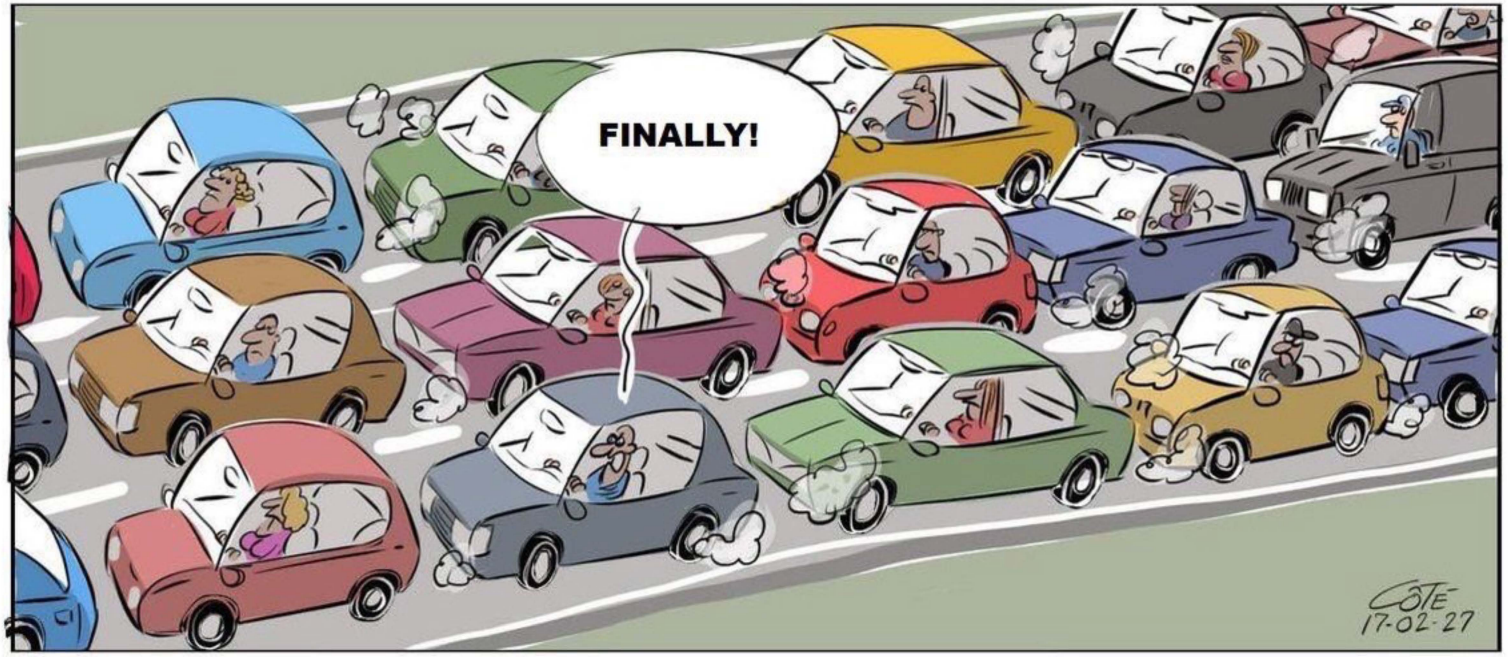
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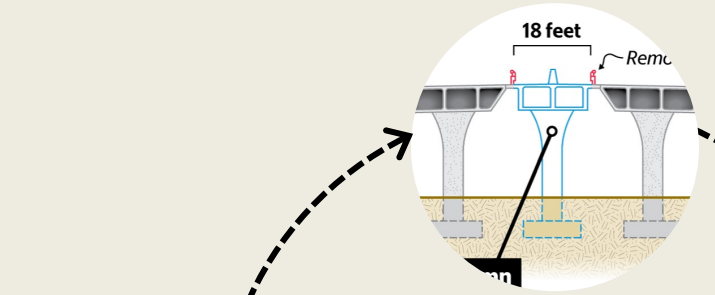
THE ROADBUILDING RUT



New Roadway Capacity

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TRAVEL DEMAND MODEL LIMITATIONS

- Often do not include all the feedback loops necessary to capture the behavioral changes caused by capacity expansion
  - E.g. effect of capacity expansion on trip generation
  - E.g. effect of capacity expansion on trip distribution (farther trips)
  - E.g. effect of capacity expansion on growth and distribution of population and employment
- Results can be noisy for smaller projects
- Can be expensive and time-consuming to run

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NCST's Induced Travel Calculator

NCST's Induced Travel Calculator for California:

https://travelcalculator.ncst.ucdavis.edu

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California Induced Travel Calculator

Calculator FAQ About

Overview

This calculator allows users to estimate the VMT induced annually as a result of adding general-purpose lane miles, high-occupancy vehicle (HOV) lane miles, or high-occupancy toll (HOT) lane miles to publicly owned roadways, like those managed by the California Department of Transportation (Caltrans), in one of California's urbanized counties (counties within a metropolitan statistical area (MSA)). The calculator applies only to facilities with Federal Highway Administration (FHWA) functional classifications of 1, 2 or 3. That corresponds to interstate highways (class 1), other freeways and expressways (class 2), and other principal arterials (class 3).

How to Use

To obtain an induced VMT estimate for a roadway capacity expansion project, enter the project length (in lane miles added), the geography (MSA for additions to interstates; county for additions to other Caltrans-managed class 2 or 3 facilities), and the base year (2016, 2017, 2018, or 2019). The base year indicates which year of VMT and lane mile data will be used to estimate the induced VMT.

More about this calculator

Calculator

1. Select Year

Select Year

NCST's Induced Travel Calculator

- **Projects:** adding general-purpose, high-occupancy-vehicle (HOV), or high-occupancy-toll (HOT) lane miles to major publicly managed roadways in the state (FHWA Class 1, 2, or 3)
- **Geography:** California's urbanized counties - counties within a metropolitan statistical area (MSA)

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SHIFT Calculator

State Highway Induced Frequency of Travel

The SHIFT calculator enables users to estimate long-run (i.e., after 5 to 10 years) induced vehicle miles traveled (VMT) and emissions impacts from capacity expansions of large roadways in Metropolitan Statistical Areas (MSAs) or urbanized counties, based on existing lane mileage and vehicle miles traveled data from the Federal Highway Administration (FHWA).

FAQ

Methodology

Calculator

The calculator applies to roads with Federal Highway Administration functional facility classifications of 1, 2 or 3, corresponding to interstate highways, other freeways and expressways, and other principal arterials, respectively. The calculator generates a reasonable estimate for induced vehicle miles traveled at the appropriate order of magnitude for a given area. It is not intended as a substitute for more granular traffic modeling or simulations—but rather as a tool that can effectively translate well-established induced travel demand elasticities to analysis of roadway capacity expansion impacts.

1. Select a state

Oregon

2. Choose a type of road

- (•) Interstate Highways (Class 1 Facility)
- ( ) Other Freeways & Expressways OR Other Principal Arterials (Class 2 or 3 Facility)

3. Choose an urbanized area or county

If calculating the expansion of an interstate highway, the calculator will provide a list of Metropolitan Statistical Areas (MSAs). If calculating the expansion of a class 2 or 3 facility, the calculator will provide a list of urbanized counties.

Portland-Vancouver-Hillsboro, OR-WA

4. Input total lane miles added

3

16 to 23 million additional VMT/year

(Vehicle Miles Travelled)

Portland-Vancouver-Hillsboro, OR-WA currently has **715 lane miles** of Interstate highway on which **~4.6 billion** vehicle miles are travelled per year.

A project adding **3 lane miles** would induce an additional **16 to 23 million** vehicle miles travelled per year. Under today's conditions, the annual emissions from this are the same as **~2,100** passenger cars and light trucks or **~1 million** gallons of gas.

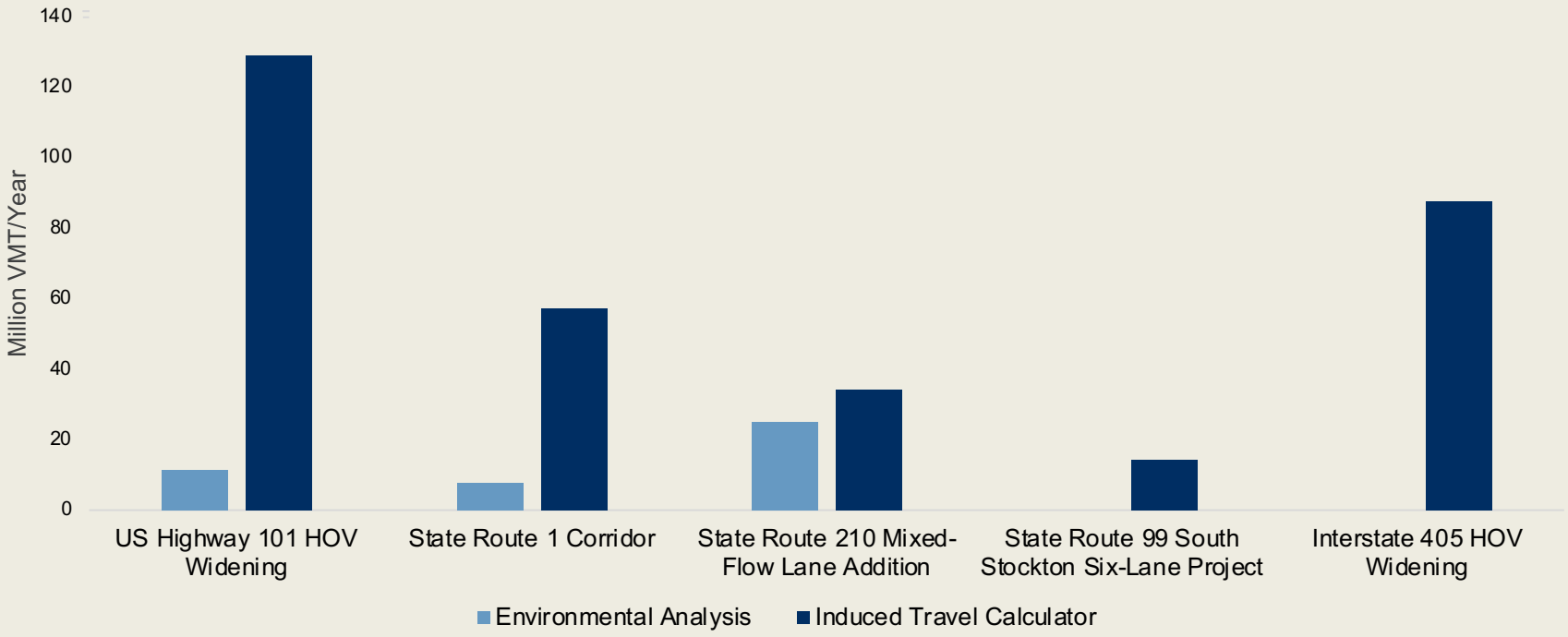
Cumulative emissions projections range from **0.1** MMT CO_2e to **0.2** MMT CO_2e and are shown in the following table:

Cumulative Emissions Added Through 2050

	NDC-Aligned Scenario	BAU Scenario
Direct Emissions	~0.1 MMT CO_2e	~0.2 MMT CO_2e
Lifecycle Emissions	~0.1 MMT CO_2e	~0.2 MMT CO_2e

This calculation is using an elasticity of **1.0** .

INDUCED TRAVEL IN THE ENVIRONMENTAL REVIEW PROCESS



Volker, Lee, & Handy (2020)

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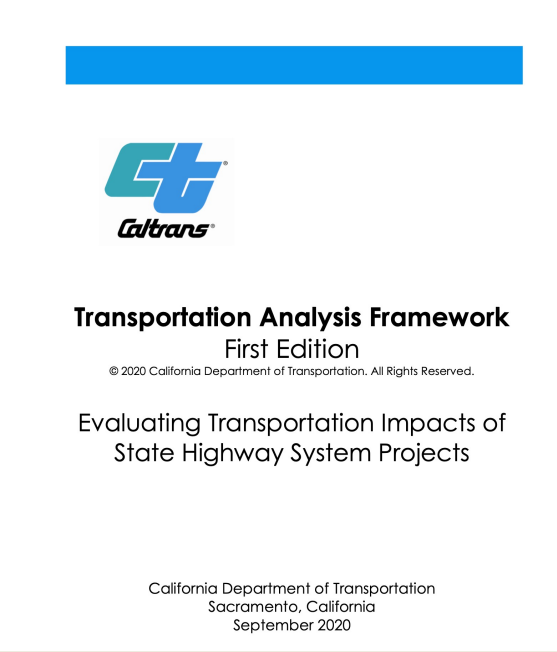
INDUCED TRAVEL IN THE ENVIRONMENTAL REVIEW PROCESS

NCST's Induced Travel Calculator is now recommended by Caltrans:



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NEXT STEPS

- More empirical research on induced travel, especially on managed lanes
- More empirical research on the effects of removing lanes or roads
- More empirical research on the effects of non-physical capacity expansions (e.g. intelligent transportation systems, ITS)
- Better accounting for induced travel in travel demand models
- Better understanding and daylighting the other long-ignored impacts of roadway expansion, like displacement and air quality impacts that have fallen disproportionately on lower-income, Black, and Hispanic neighborhoods
- https://www.destructionfornada.com

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THANK YOU!

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