2025 Modeling Mobility Conference (MoMo)
Zephyr Foundation
Minneapolis, Minnesota, September 2025

Measuring the Contribution of Additional Lane Miles on the Increase in U.S. Vehicle Miles Traveled from 1980 to 2019

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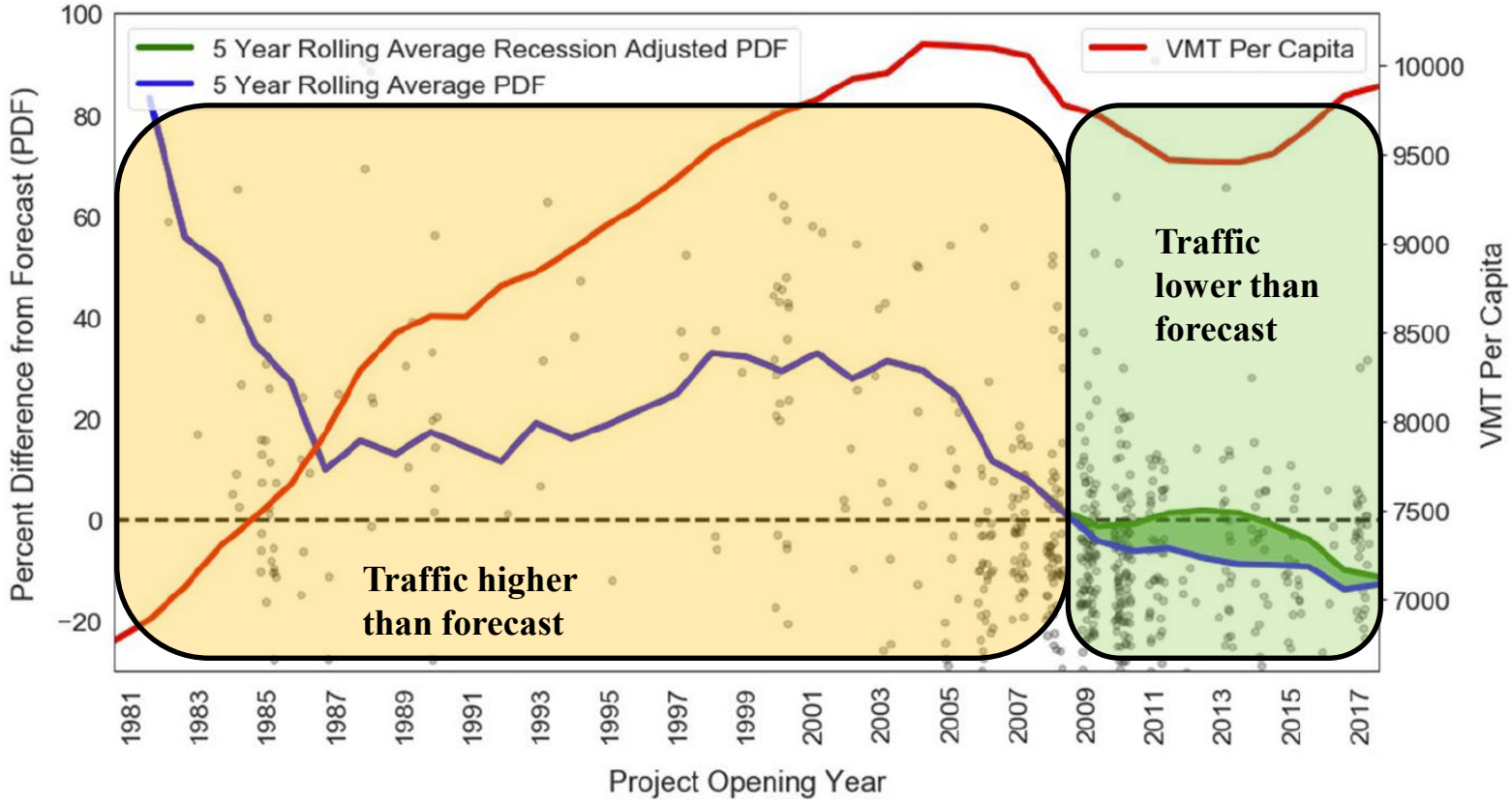
Forecast accuracy changed in the 2000s, at about the same time VMT per capita reached its peak



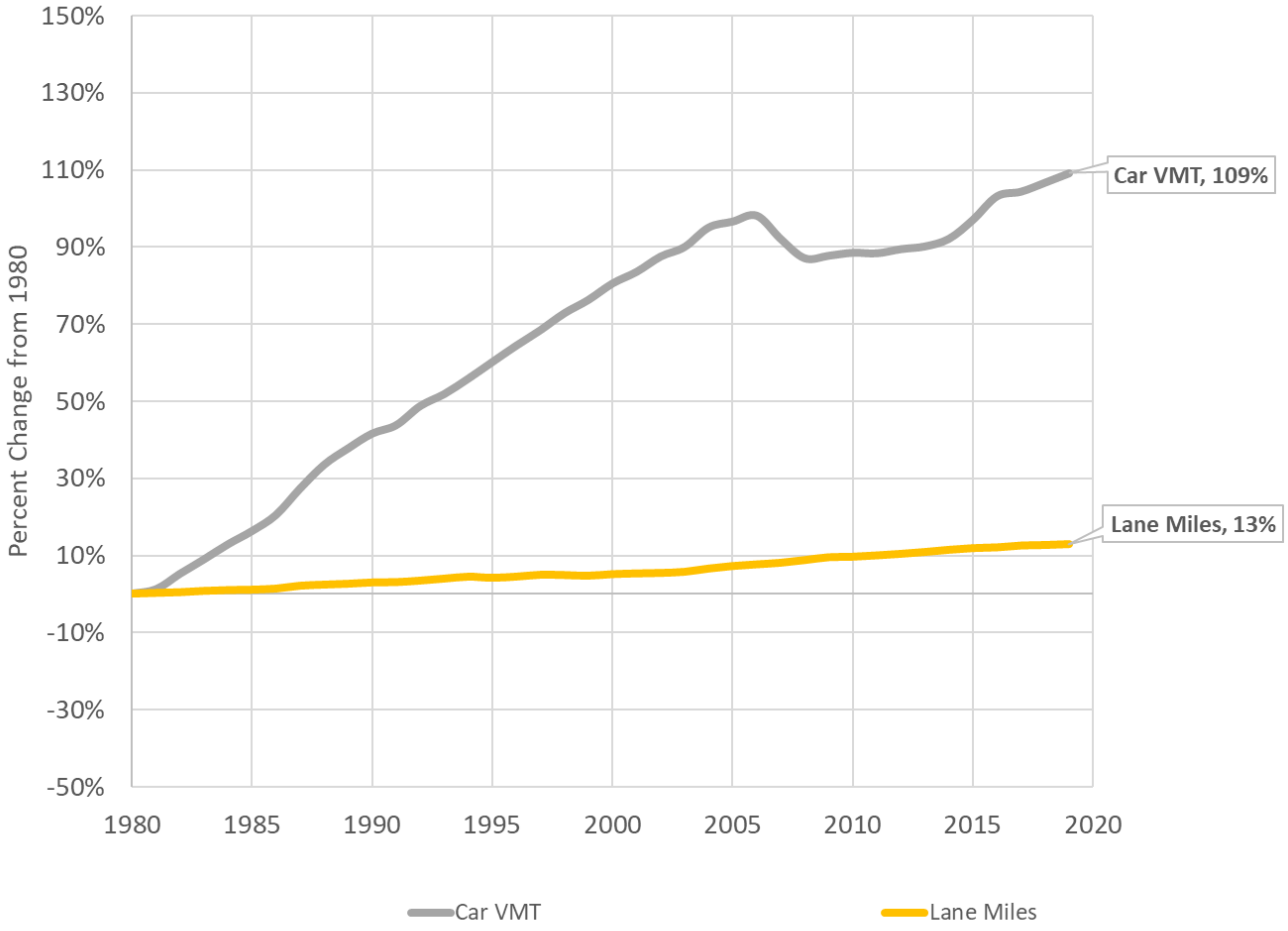
Some questions…

- If we included more recent data than some older induced travel studies, would still find the same effect?
- What explains the VMT per capita trend?
- Do our traffic forecasts accurately capture induced travel?

Our approach

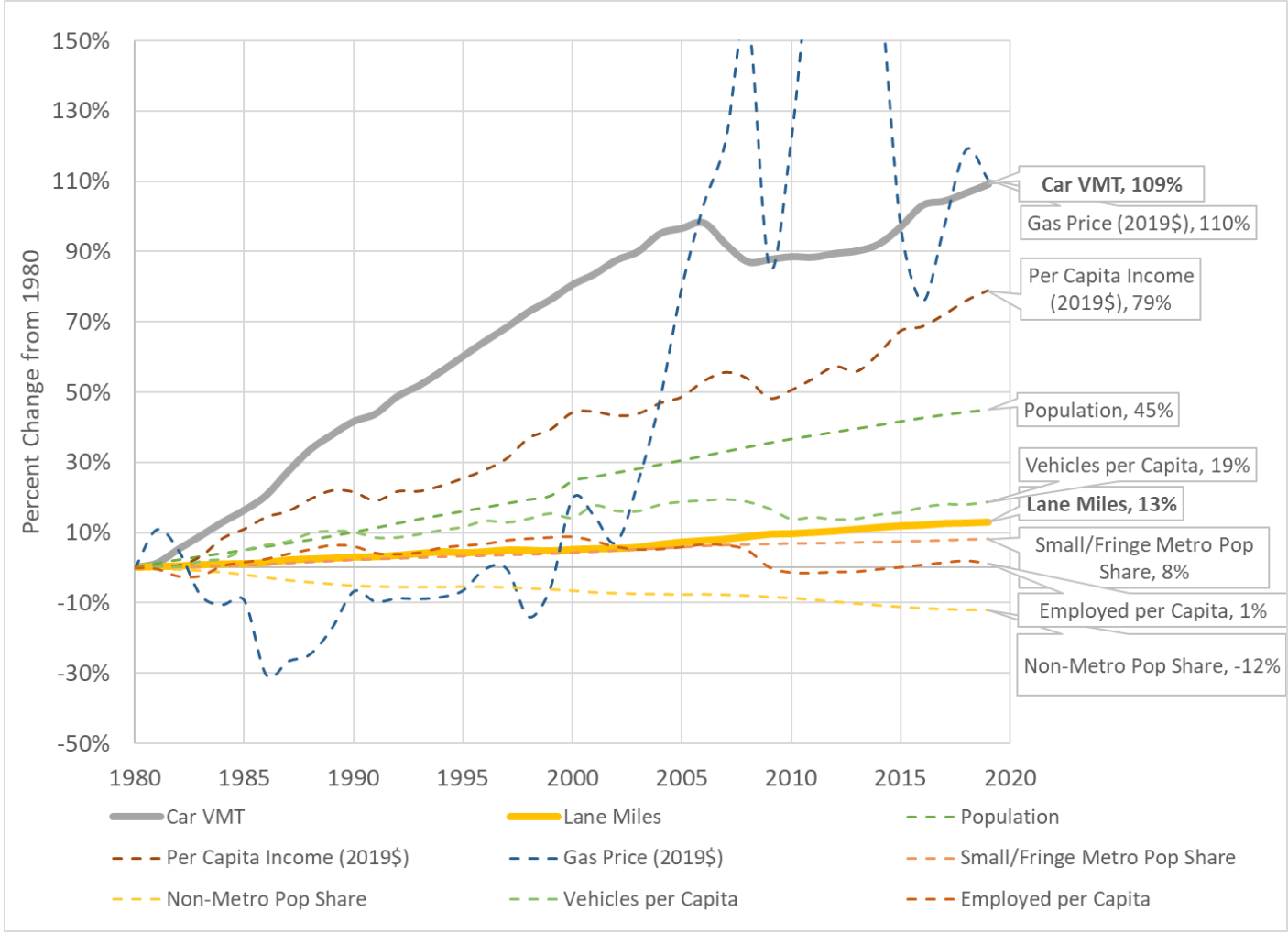
- Data: Highway Performance Monitoring System (HPMS)
  - State reported lane miles + count-derived VMT by functional class
  - Requires data cleaning to ensure year-by-year consistency
  - Excludes local roads
  - Use a state level analysis to avoid reclassification of rural to urban roads
- Method: Fixed-effects regression of the natural log of VMT
- Application: Apply estimated elasticities to observed data year-by-year and state-by-state

Between 1980 and 2019, lane miles increased 13% and passenger car VMT increased 109%.



VMT is also affected by other factors, including:

- gas price
- population
- income
- employment rates
- vehicle ownership
- land-use



With a full set of controls and data through 2019, we find the elasticity of car VMT w.r.t. changes in lane miles is positive and highly significant.

Dependent variable is log of Car VMT	Model Summary	
	Coefficient	T-Stat
LN (lane miles)	**0.483**	**10.073**
LN (population)	0.891	38.085
LN (per capita income)	0.561	23.840
LN (retail gas price)	-0.050	-6.481
Share of population in fringe/small metro	0.856	4.302
Share of population in non-metro	0.441	2.017
Auto and truck registrations per capita	0.072	2.866
Employed per capita	1.956	21.483
Constant	-15.991	-38.757
R^2	0.901	

We tested and found no evidence that this elasticity has changed over time.

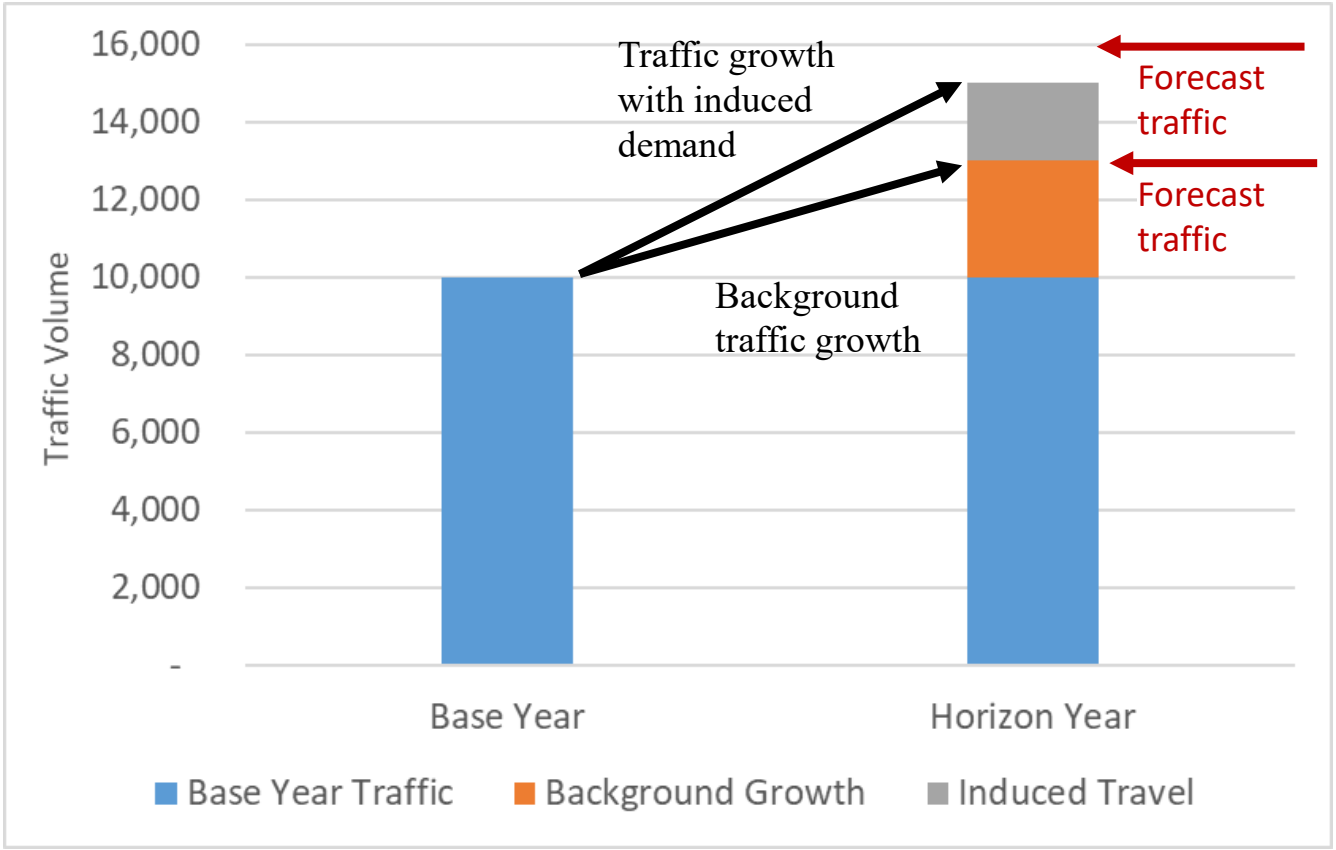
Our estimates are within the range of past studies, which consistently show positive and significant elasticities of VMT w.r.t. lane miles.

Criteria	*Short Run Elasticity Range*	*Long Run Elasticity Range*
Geography		
State Level	0.03-0.29	0.16-0.41
County Level	0.43-0.59	0.59
Urban Areas	0.02-0.76	0.66-1.34
Facilty Type		
All	0.03-0.59	0.16-0.41
Interstates	0.55-0.63	0.92-1.24
Interstates and Arterials	0.02-0.76	0.70-1.06
Arterials	0.27-0.63	0.99
Arterials and Collectors	-	0.66-0.91
Collectors	0.54-0.89	-
National Expressway (Japan)	-	1.02-1.34
Estimation Method		
OLS	0.02-0.76	0.37-1.17
2SLS	0.29-0.76	0.89-1.34
3SLS	0.03-0.04	0.16-0.59
GMM	0.08-0.19	0.71-0.99
Time Period		
Short Run	0.02-0.89	-
Long Run	-	0.16-1.34

Between 1980 and 2019, lane miles in the US increased 13%, leading to an 11% increase in passenger vehicle VMT

	Change in variable	Change in VMT due to variable
Lane miles	**13%**	**11%**
Population	45%	56%
Per capita income	79%	52%
Retail gas price	105%	-7%
Share of population in fringe/small metro	8%	6%
Share of population in non-metro	-12%	-2%
Auto and truck registrations per capita	19%	1%
Employed per capita	1%	-4%
Car Vehicle Miles Traveled	109%	-
Unexplained Change	-	-5%

To assess whether travel models correctly capture induced travel, we must look at more than the asbsolute forecast

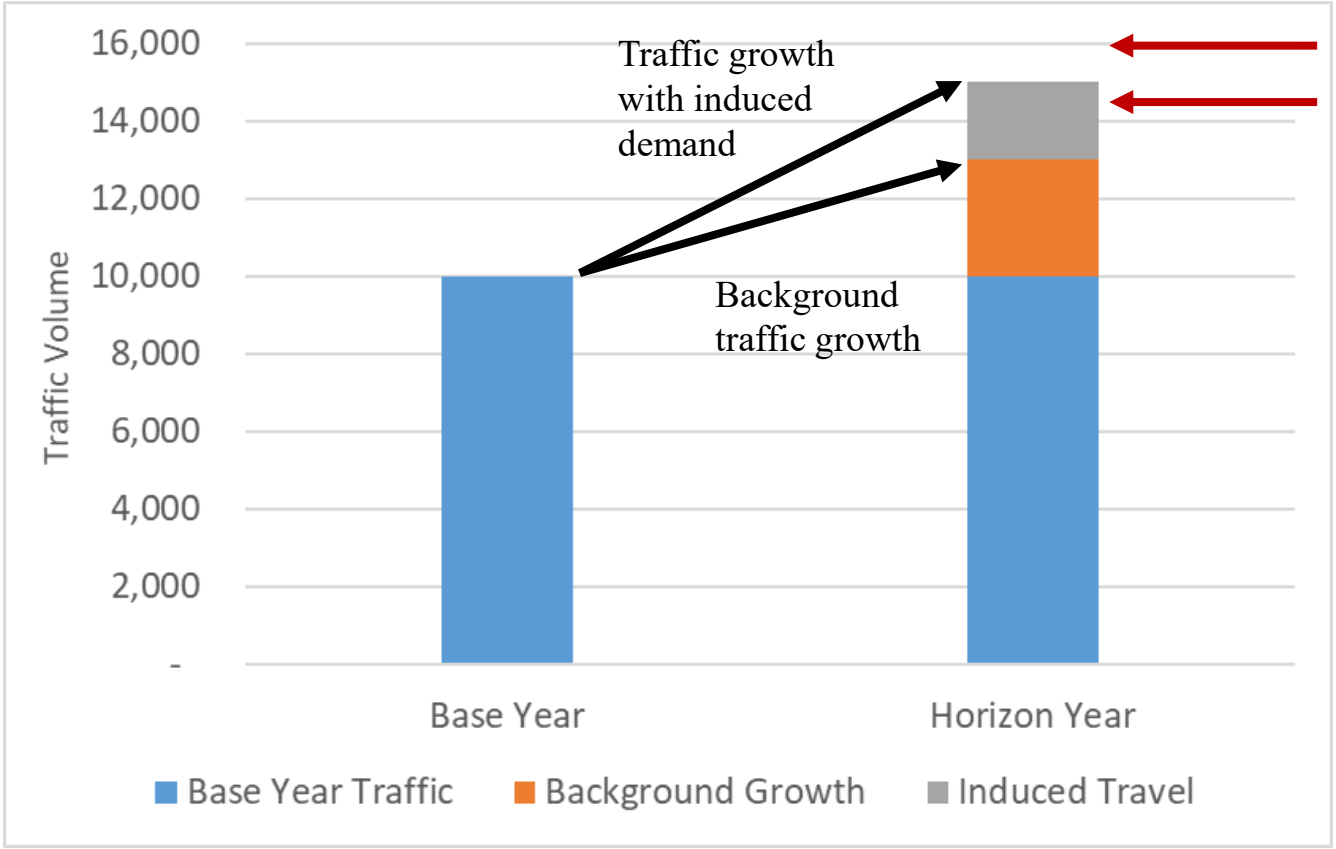


Instead we observe that counted traffic is on average 6% lower than forecast.

If we were under-estimating induced demand, we might expect observed traffic to be higher than forecast.

Either way, measuring the overall accuracy of traffic forecasts does not necessarily say much about whether those forecasts accurately capture induced demand.

To assess whether travel models correctly capture induced travel, we must look at more than the asbsolute forecast



Build forecast

No-Build Forecast

The difference between the build and the no-build forecast is the travel model's estimate of short-term induced demand.

We can compare this difference to empirical estimates.

We are doing this now in Kentucky by examining every major widening project in the past ~15 years

OBJECTI	Identifie	Type Route	Type Project	Route Length (Miles)	Plan Yea	Type of Work	Construction: Fiscal Year	Construction: Stage	Construction: Authorized Date	Highway District	SYP Item Number	Beginning Milepoi	Ending Milepoi	County Number	County Name	Prefix	Route Number	Suffix	Couple ID
788	10-114.00	Existing	DistrictItemNumber	2.47	2006	MAJOR WIDENING(O)		AWARDED	4/1/2015	10	114	0	2.494	97	PERRY	KY	7		
883	10-126.12	Existing	DistrictItemNumber	2.41	2014	MAJOR WIDENING(O)		AWARDED	4/5/2024	10	126.12	71	73.4	77	MAGOFFIN	KY	9009		
892	10-126.40	Existing	DistrictItemNumber	4.6	2018	MAJOR WIDENING(O)	2019	AWARDED	4/5/2024	10	126.4	65	69.6	77	MAGOFFIN	KY	9009		
928	10-126.60	Existing	DistrictItemNumber	3.28	2016	MAJOR WIDENING(O)	2018	AWARDED	4/5/2024	10	126.6	59.3	62.588	88	MORGAN	KY	9009		
938	10-126.70	Existing	DistrictItemNumber	1.58	2016	MAJOR WIDENING(O)	2018	AWARDED	4/5/2024	10	126.7	57.72	59.3	88	MORGAN	KY	9009		
941	10-126.70	Existing	DistrictItemNumber	0.92	2016	MAJOR WIDENING(O)	2018	AWARDED	4/5/2024	10	126.7	56.8	57.72	119	WOLFE	KY	9009		
987	10-140.00	Existing	DistrictItemNumber	1.93	2014	MAJOR WIDENING(O)		AWARDED	5/28/2015	10	140	73.4	75.331	77	MAGOFFIN	KY	9009		
1009	10-142.00	Existing	DistrictItemNumber	0	2010	MINOR WIDENING(O)	2021	AWARDED		10	142	11.7	12.2	65	LEE	KY	52		
1080	10-166.00	Existing	DistrictItemNumber	2.1	2016	MAJOR WIDENING(O)		AWARDED	7/14/2021	10	166	12.486	14.566	77	MAGOFFIN	US	460		
1082	10-166.00	Existing	DistrictItemNumber	0.33	2016	MAJOR WIDENING(O)		AWARDED	7/14/2021	10	166	75.331	75.666	77	MAGOFFIN	KY	9009		
1108	10-168.00	Existing	DistrictItemNumber	11	2022	MAJOR WIDENING(O)	2022	AWARDED	5/25/2022	10	168	45.8	56.8	119	WOLFE	KY	9009		
1609	10-280.00	Existing	DistrictItemNumber	1.34	2002	MAJOR WIDENING(O)		AWARDED	6/9/2006	10	280	11.211	12.546	77	MAGOFFIN	US	460		
1791	10-376.00	Existing	DistrictItemNumber	1.15	2020	MAJOR WIDENING(O)	2024	AWARDED	8/5/2024	10	376	16.75	17.9	13	BREATHITT	KY	15		
4863	11-11.26	Existing	DistrictItemNumber	2.5	2006	MAJOR WIDENING(O)		AWARDED	2/28/2025	11	11.26	48	50.5	63	LAUREL	I	75		
4866	11-11.30	Existing	DistrictItemNumber	0.57	2002	MAJOR WIDENING(O)		AWARDED		11	11.3	50.2	50.767	63	LAUREL	I	75		
4870	11-11.30	Existing	DistrictItemNumber	0.44	2002	MAJOR WIDENING(O)		AWARDED		11	11.3	50.767	51.206	102	ROCKCASTLE	I	75		
4874	11-11.31	Existing	DistrictItemNumber	0.44	2002	MAJOR WIDENING(O)		AWARDED		11	11.31	50.767	51.206	102	ROCKCASTLE	I	75		
4875	11-11.31	Existing	DistrictItemNumber	0.57	2002	MAJOR WIDENING(O)		AWARDED		11	11.31	50.2	50.767	63	LAUREL	I	75		
5188	11-14.82	Existing	DistrictItemNumber	0.37	2020	MAJOR WIDENING(O)	2024	AWARDED	10/21/2024	11	14.82	0	0.374	118	WHITLEY	I	75		3
5314	11-147.10	Existing	DistrictItemNumber	0.45	2018	MAJOR WIDENING(O)	2018	AWARDED	6/13/2025	11	147.1	9.187	9.654	63	LAUREL	KY	363		
5346	1-115.00	Existing	DistrictItemNumber	3.32	2020	MAJOR WIDENING(O)	2024	AWARDED	9/16/2024	1	115	13.62	16.937	4	BALLARD	US	60		
5347	1-115.00	Existing	DistrictItemNumber	0.39	2020	MAJOR WIDENING(O)	2024	AWARDED	9/16/2024	1	115	0	0.385	73	MCCRACKEN	US	60		
5598	11-185.00	Existing	DistrictItemNumber	2.02	2022	MINOR WIDENING	2022	AWARDED	11/9/2023	11	185	0	2.024	63	LAUREL	US	25	E	

Some answers…

Ivanchak, B. Induced Travel Demand: Measuring the Contribution of Additional Lane Miles on the Increase in U.S. Vehicle Miles Traveled from 1980 to 2019. MS Thesis, University of Kentucky 2022.

- If we included more recent data than some older induced travel studies, would still find the same effect?
  - Yes. We find no evidence that the elasticity of VMT w.r.t. lane miles has changed.
- What explains the VMT per capita trend?
  - Mostly population growth (+56%) and income growth (+52%), but also additional lane miles (+11%)
- Do our traffic forecasts accurately capture induced travel?
  - We don’t know, but are looking at this now.

Sensitivity Test: Assume the elasticity of VMT w.r.t. changes in lane miles is 1

	Change in variable	Change in VMT due to variable
Lane miles	**13%**	**24%**
Population	45%	56%
Per capita income	79%	52%
Retail gas price	105%	-7%
Share of population in fringe/small metro	8%	6%
Share of population in non-metro	-12%	-2%
Auto and truck registrations per capita	19%	1%
Employed per capita	1%	-4%
Car Vehicle Miles Traveled	109%	-
Unexplained Change	-	-17%

With this assumption, additional lane miles would be responsible for a 24% increase in passenger vehicle VMT between 1980 and 2019.