



CENTRAL TEXAS REGIONAL
MOBILITY AUTHORITY

October 30, 2019
AGENDA ITEM #16

MoPac Express Lane Performance
Review & Operations Update

Strategic Plan Relevance: Regional Mobility
Department: Operations
Contact: Tracie Brown, Director of Operations
Associated Costs: N/A
Funding Source: N/A
Action Requested: Briefing and Board Discussion Only

Summary:

- A. Operations Update
- B. Emissions and Fuel Consumption Analysis
- C. Metropia Rideshare Analysis
- D. CapMetro ridership

Backup Provided: Performance Overview and Analysis Reports

MOPAC EXPRESS LANE



PERFORMANCE OVERVIEW 2018-2019

Origin → Destination
CVZ = Cesar Chavez St.
Parmer = Parmer Ln.
2222 = FM 2222

	NORTHBOUND TRIPS			SOUTHBOUND TRIPS		
	CVZ → US 183	CVZ → Parmer	US 183 → Parmer	Parmer → 2222	Parmer → CVZ	2222 → CVZ
Average monthly trips	203,130	137,139	63,951	37,532	119,670	257,468
% Increase from 2017-18	▲ 13%	▲ 24%	▲ 4%	▲ 21%	▲ 33%	▲ 9%
Average weekday trips	7,702	5,244	2,670	1,590	4,775	10,042
% Increase from 2017-18	▲ 13%	▲ 27%	▲ 2%	▲ 26%	▲ 44%	▲ 7%
Average weekday tolls	\$0.80	\$1.45	\$0.67	\$0.50	\$2.02	\$1.50
% Increase from 2017-18	▲ 14%	▲ 13%	▲ 16%	▲ 24%	▲ 33%	▲ 37%
Maximum toll rates	\$7.65	\$12.46	\$7.24	\$8.04	\$13.31	\$13.06
Avg. weekday speed (mph) <i>Express Lane / General Purpose</i>	65 / 56	69 / 60	72 / 64	71 / 64	66 / 58	66 / 56

Toll exempt trips ¹	104,810 trips (\$356,500 in tolls waived)
% Increase from 2017-18	▲ 16% increase in trips (33% more in tolls waived ²)

¹Toll rate exempt trips include first responders, private ambulances, qualified veterans as well as CapMetro buses and van pool vehicles. ²The percentages are different due to difference in average toll rate per trip between 2017-18 and 2018-19.

PEAK PERIOD PERFORMANCE HIGHLIGHTS

Average Peak Period Speed (mph) *Express Lane / General Purpose*

AM Peak	71 / 63	73 / 66	75 / 68	60 / 43	59 / 45	59 / 50
PM Peak	44 / 24	50 / 32	58 / 43	72 / 65	50 / 35	41 / 24

Average Peak Period Tolls

AM Peak	\$0.31	\$0.59	\$0.28	\$2.01	\$3.99	\$1.94
% Increase from 2017-18	▲ 3%	▲ 7%	▲ 11%	▲ 27%	▲ 11%	▼ -4%
PM Peak	\$3.35	\$6.31	\$3.02	\$0.28	\$6.26	\$5.91
% Increase from 2017-18	▲ 1%	▲ 5%	▲ 12%	▲ 11%	▲ 40%	▲ 42%

Average Travel Time Savings (min.)

AM Peak	1	1	1	3	5	2
PM Peak	6	9	3	1	12	11

Note: All stats are for Year Two Operations: October 2018 - August 2019; "2017-18" corresponds to November 2017 - September 2018; AM Peak: 6:30-9:30 a.m.; PM Peak: 3:30-6:30 p.m.

WHO'S USING THE EXPRESS LANE?

FORD **15%**



TOYOTA **13%**



CHEVROLET **11%**



HONDA **9%**



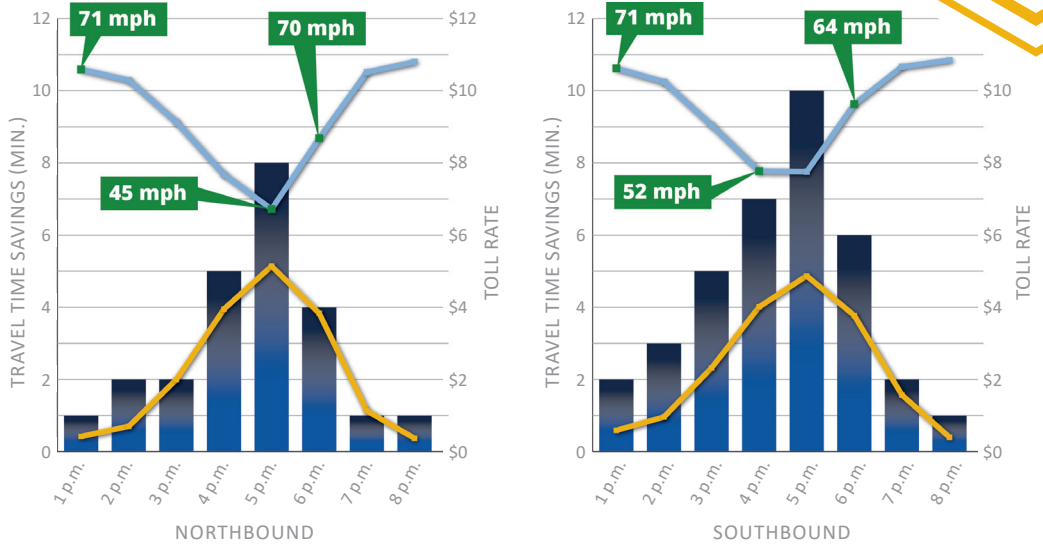
NISSAN **7%**



HOW DOES THE TOLL RATE CHANGE?*

Toll rates rise when speed in the express lanes declines. As rates go up, there is less demand and travel time savings are preserved.

Travel Time Savings (min.) | Toll Rate | Speed



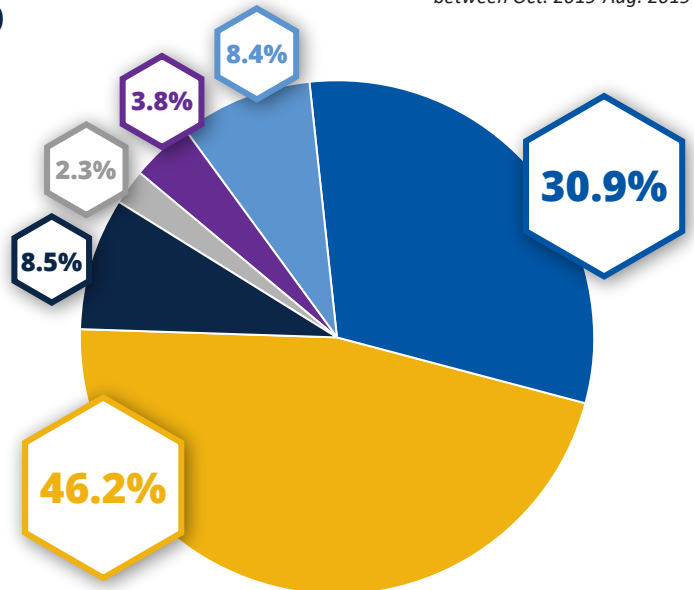
*All values are for average weekday between Oct. 2019-Aug. 2019

HOW OFTEN DO USERS TAKE THE LANE?

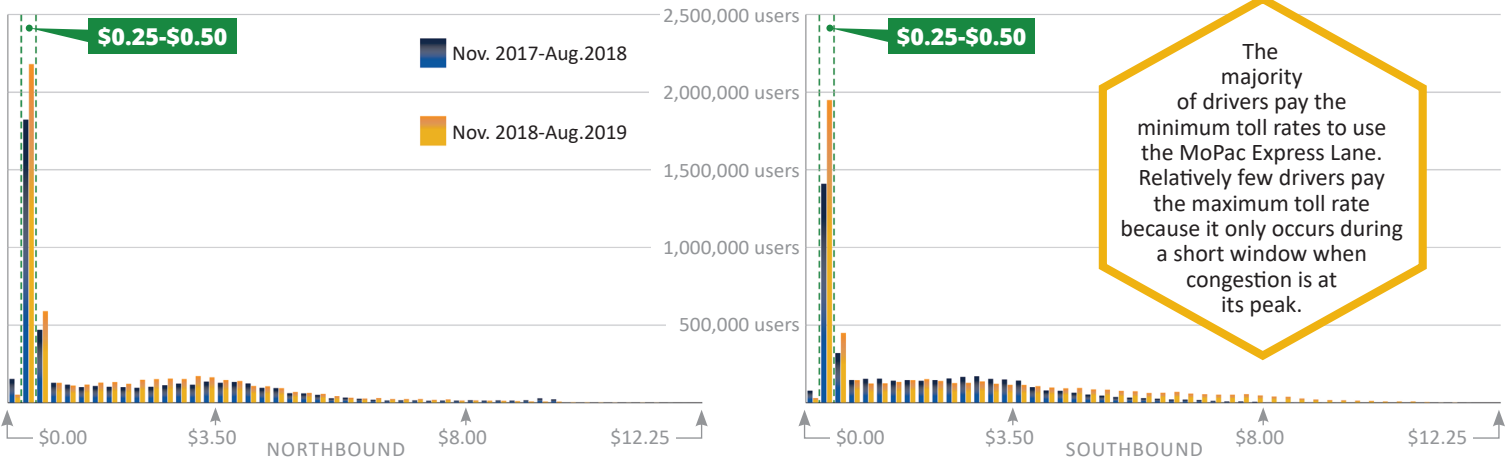
Most people use the Express Lane as intended – only if they really need it.

- 1 Use
- 2-5 Uses
- 6-10 Uses
- 11-15 Uses
- 16-20 Uses
- 21+ Uses

Includes vehicles that used MoPac Express Lanes between Oct. 2018 - Aug. 2019



HOW MUCH DO USERS PAY?*



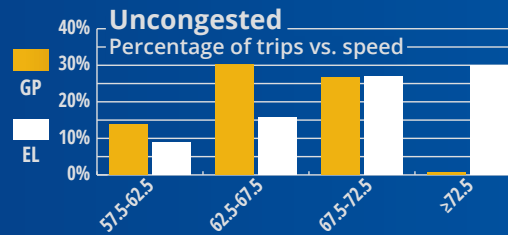
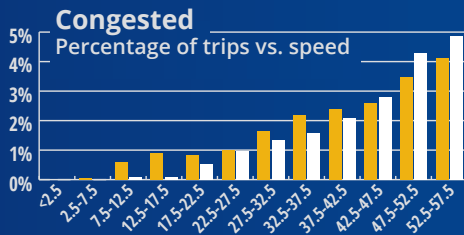
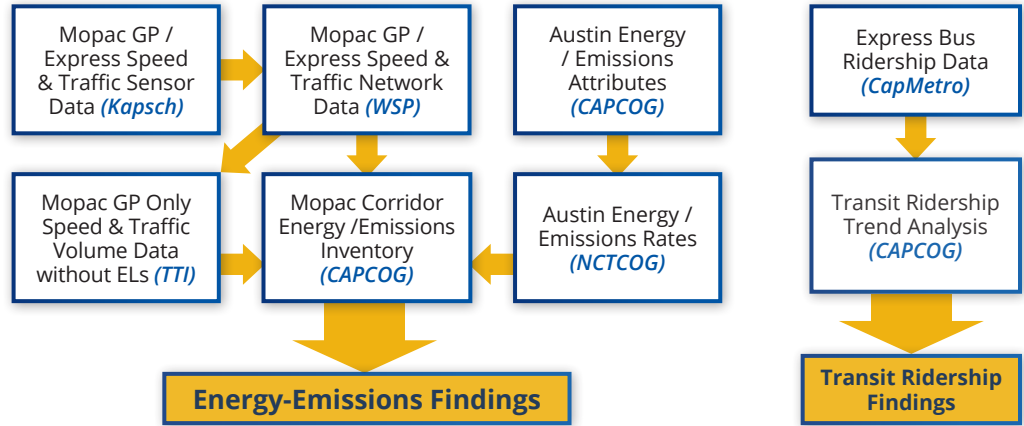
*All values are for average weekday

MoPac Express Lanes

Energy-Emissions Analysis - Pollutants

Study Tasks

- » Mopac Energy & Emissions Before & After Express Lanes
- » CapMetro Express Bus Ridership Changes After Express Lanes



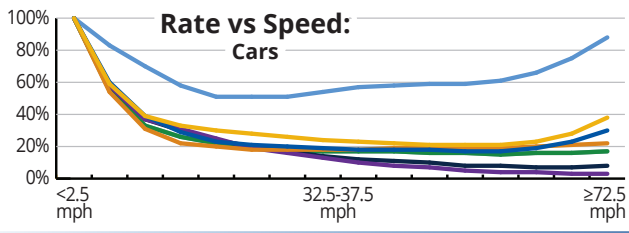
Speed Distribution

The congested graph shows that when congestion is present in both general purpose (GP) and express (EL) lanes, the ELs tend to carry more trips at higher speeds than the GP lanes. Both graphs show more EL traffic operates at higher speeds than the GP lanes.

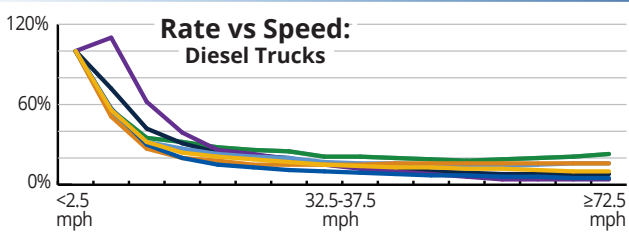
Primary Pollutants

The graphs to the right show how pollutants, color-coded below, respond to traffic conditions, vehicle fleet (trucks vs. cars) and atmospheric conditions.

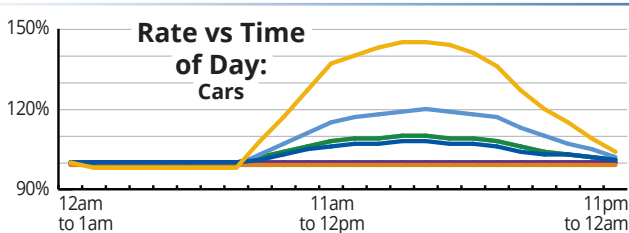
- CO Carbon Monoxide**
Consumes Oxygen
- HC Hydro Carbons**
Eye & Respiratory Irritant
- CO₂ Carbon Dioxide**
- NH₃ Ammonia**
Skin & Eye Irritant
- NO_x Nitrogen Oxides**
Ozone Precursor, Acid Rain
- PM₁₀ Particulate Matter < 10 microns**
Soot
- PM_{2.5} Particulate Matter < 2.5 microns**
Lung Irritant
- SO₂ Sulfur Dioxide**
Acid Rain
- TEC Total Energy Consumption**
Equivalent Gallons of Gasoline



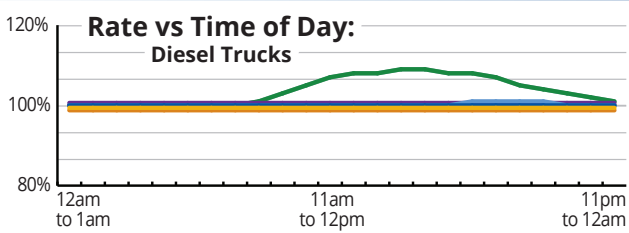
For cars, most pollutants decrease as speed increased, but those containing carbon increase at high speeds due to their source, fuel consumption.



Both fuel consumption and pollutant emissions decline or remain nearly level with increasing speed for diesel trucks, which make up 2% of EL traffic.



Fuel consumption can be up to 20% higher during the the day than during night time conditions for cars — this is due to higher temperatures.



Fuel consumption can be up to 10% higher during the day than during night time conditions, but overall, trucks have less sensitivity to temperatures than cars.

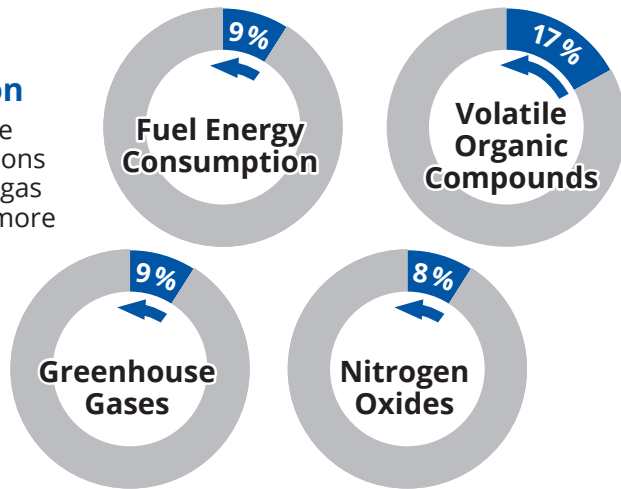
MoPac Express Lanes

Energy-Emissions Analysis - Reduced Congestion

Energy-Emissions Reduction due to Reduced Congestion

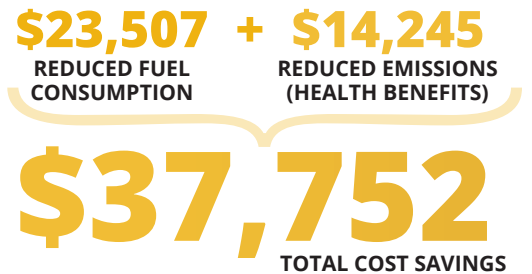
Over a 61 day period, the study found that reductions in VOC and greenhouse gas (carbon dioxide) — the more important pollutants — are strongly related to reduced fuel consumption.

The 8% reduction in NOx is important to regional air quality conformity.



Monetized Daily Benefits

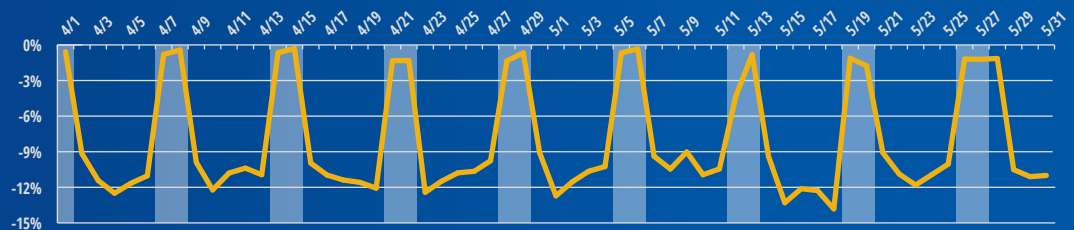
The magnitude of these monetary savings are similar to the daily tolls collected by the express lanes, indicating that these two benefits alone reimburse Mopac Expressway users at large with tangible benefits funded by express lane users.



Reduction in Fuel Consumption by Date

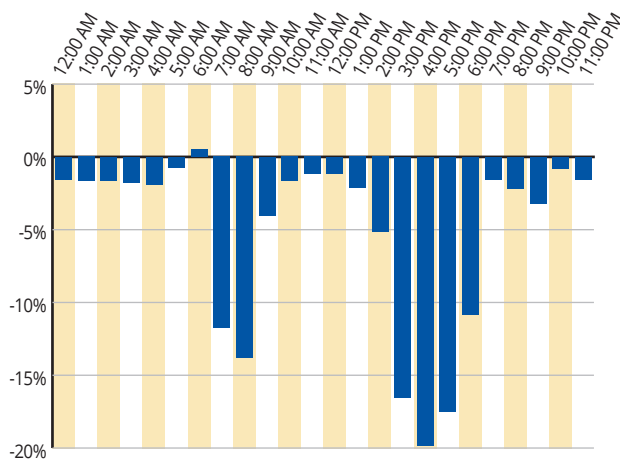
In spring of 2018, the largest savings in fuel consumption occurs during weekdays.

WEEKENDS



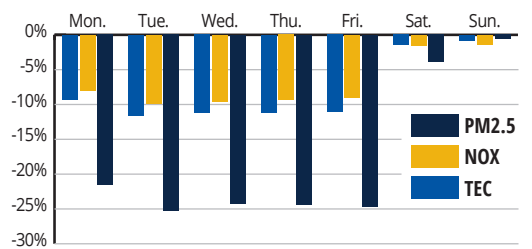
Reduction in Fuel Consumption by Hour of Day

Fuel consumption savings by time of day is greatest during the hours of the weekday peak periods. This graph shows typical AM peak reductions of 10-15% for two hours, and PM peak reductions of 15-20% for three hours.

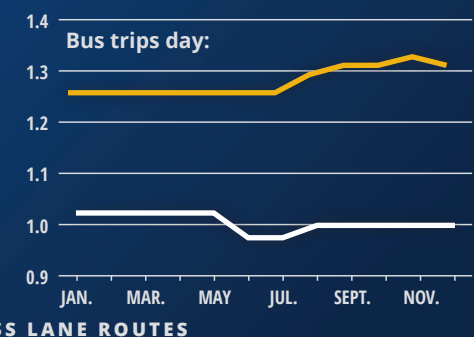
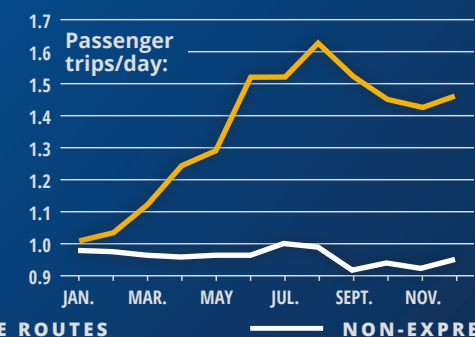
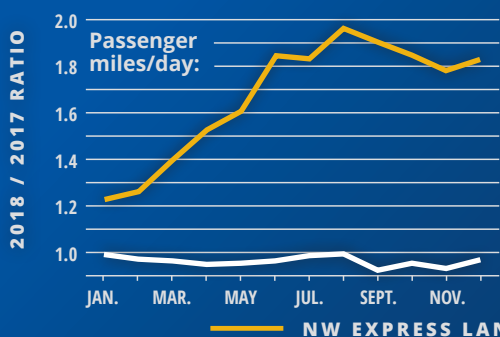


Energy-Emissions Reduction due to Reduced Congestion

Weekday reductions are higher than weekends due to the difference in congestion levels, where the express lanes have the greatest impact.



CapMetro Express Bus Routes: Express Lane vs. Other



Analysis of Emission and Fuel consumption Impacts of Speed Changes and Mode Shift due to MoPac Express Lanes

Research Summary

In spring 2019, the Capital Area Council of Governments (CAPCOG), with assistance from Capital Metropolitan Transportation Authority (CapMetro), the Texas Transportation Institute (TTI), and the North Central Texas Council of Governments (NCTCOG), completed a study to evaluate the emissions and fuel consumption impact of the Central Texas Regional Mobility Authority (CTRMA) MoPac (Texas State Highway Loop 1) Express Lanes.

The study included two distinct analyses: 1) evaluation of the impact of changes in vehicle speeds along MoPac as a result of the Express Lanes; and 2) evaluation of the impact of mode shift associated with the use of Express Lanes by CapMetro's MetroExpress commuter buses.

For this study, CAPCOG used traffic data and bus ridership data for April and May 2018, along with emissions and fuel consumption rates produced by the on-road emissions model approved by the U.S. Environmental Protection Agency (EPA) for use in state and regional air quality planning, as well as transportation conformity analyses.

Key Findings

Evaluation of the Impact of Speed Improvements on MoPac

- Overall, vehicles moved along the Express Lanes an average of 8 mph higher than speeds on the General Purpose lanes across the entire 61-day study period, but observed speed improvements were as much as +61 mph within the period analyzed.
- Compared to a "No Express Lane" scenario, MoPac with the Express Lanes achieved reductions in fuel consumption and emissions for all pollutants analyzed, particularly on weekdays.
- For the four key relevant environmental metrics in the Capital Area Metropolitan Planning Organization (CAMPO) 2040 Plan, the Express Lanes enabled MoPac to achieve the following reductions over the 61-day study period:
 - An 8% reduction in nitrogen oxides (NO_x) emissions;
 - A 17% reduction in volatile organic compound (VOC) emissions;
 - A 9% reduction in greenhouse gas (GHG) emissions; and
 - A 9% reduction in fuel consumption.

Evaluation of the Mode Shift Impact Associated with the use of Express Lanes by Capital Metro's MetroExpress commuter buses.

- Routes using the Express Lanes had 24-29% increases in ridership in April and May 2018 over April and May 2017 levels, while ridership on routes that did not use the Express Lanes declined by about 5% for these months, year-over-year.
- Ridership on routes using the Express Lanes experienced even larger year-over-year increases after May 2018 – ranging from 52-63% from June – August and from 42- 52% from September – December compared to the same months in 2017.

- The passenger-miles on routes using the Express Lanes increased even more dramatically—a 53% increase in April 2018 and 60% increase in May 2018 compared to the same months in 2017. This growth would be somewhat more modest (31 – 41%) if the increased length of Route 985 starting in January 2019 was factored out.
- CAPCOG estimated that the Express Lanes shifted an average of 12,266 passenger miles per weekday from single-occupancy vehicle (SOV) commuting to transit.

Emissions and Fuel Consumption Reductions

Summaries of the average weekday vehicle miles traveled (VMT), emissions, and fuel consumption reductions are shown in the following Table.

Table 1. Summary of Emissions and Fuel Consumption Reductions Resulting from Express Lanes for Average Weekday, April 1 – May 31, 2018

Statistic	From Speed Changes on MoPac	From Mode Shift to MetroExpress Buses	Total
VMT Reduced	0	12,265.68	12,265.68
CO Reduced (pounds/day)	544.08	102.65	646.73
NO _x Reduced (pounds/day)	115.07	6.42	121.49
NH ₃ Reduced (pounds/day)	4.62	0.59	5.21
PM ₁₀ Reduced (pounds/day)	80.13	1.03	81.16
PM _{2.5} Reduced (pounds/day)	16.05	0.25	16.30
SO ₂ Reduced (pounds/day)	1.17	0.06	1.23
VOC Reduced (pounds/day)	24.30	6.92	31.22
CO ₂ Reduced (pounds/day)	180,499.65	9,701.31	190,200.96
Fuel Consumption Reduced (gallons of gas equivalent/day)	8,161.13	516.27	8,677.40

CAPCOG also calculated the monetized benefits of the reductions in fuel consumption and emissions of selected emissions can also be monetized:

- Fuel consumption savings translated into an estimated \$23,507 per weekday.
- The value of avoided health and environmental impacts from reduced emissions is estimated to be approximately \$14,245 per weekday day.
- **The total estimated monetized benefits from emission reductions and fuel consumption during the study period was \$37,752 per weekday.**

Conclusions

This project provides an assessment of the fuel consumption and emission reductions impacts of congestion relief provided by the MoPac Express Lanes and the use of the Express Lanes by CapMetro's MetroExpress commuter transit buses. Major findings of this study include the following:

1. The availability of MoPac Express Lanes increased travel speeds for all vehicles, not just the ones using the Express Lanes.
2. The increased vehicle speeds during congested conditions can significantly reduce fuel consumption and emissions, particularly during peak periods.
3. There are situations in uncongested periods when higher average vehicle speeds along MoPac as a result of the Express Lanes can actually cause slight increases in vehicle fuel consumption and emissions.
4. On balance, it appears that substantial reductions in emissions and fuel consumption during congested periods significantly outweighs any increases that might occur during lower congestion.
5. CTRMA may want to consider targeting efforts to increase the use of the Express Lanes during the morning on Ozone Action Days when the NO_x reductions would be expected to have the highest impact on the region's ability to remain in compliance with federal air quality standards.
6. These fuel consumption and emissions reduction benefits due to speed improvements on MoPac appear to be substantial, overall, and adds significantly to the "benefit" side of the ledger when evaluating the costs and benefits of the MoPac Express Lane project.
7. CTRMA's partnership with CapMetro that allows the MetroExpress buses to use the Express Lanes for free has enabled CapMetro to significantly improve Commuter Bus service for the region, and this has led to significant increases in ridership on these routes.
8. There are significant fuel consumption and emission reduction impacts of the mode shift associated with the improved service for MetroExpress buses that use the Express Lanes.

MoPac Expressway

Metropia Carpool Analysis

DRAFT

Study Description

Query of Metropia App Users

- » MoPac General Purpose (GP) Lane Only Trips
- » MoPac GP and Express Lane or Express Lane Only Trips
- » Non-MoPac Trips

January – May of 2017, 2018, and 2019

- » Before, during, and after express lane opening

Carpool vs. All Users

- » Carpool users applied Metropia DUO feature (carpool trip matching)

Follow up questionnaire of app users after their trip

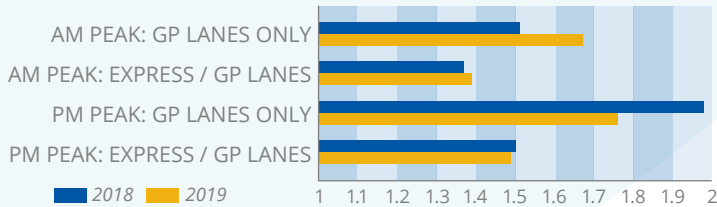
Most statistics were based on Metropia users only

- » Some comparisons with regional or national averages

Travel Time Index (TTI)

The ratio of congested travel time to free flow travel time, also known as **average delay**.

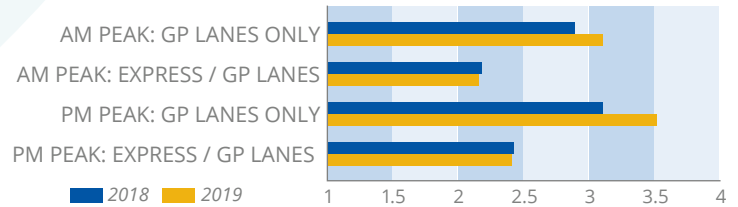
Express lanes maintained the same performance while the GP lanes experienced large variations in performance.



Planning Time Index (PTI)

The ratio of nearly the worst travel time to free flow travel time. Uses the 19th-worst out of 20 measurements (95th percentile) to measure **reliability**.

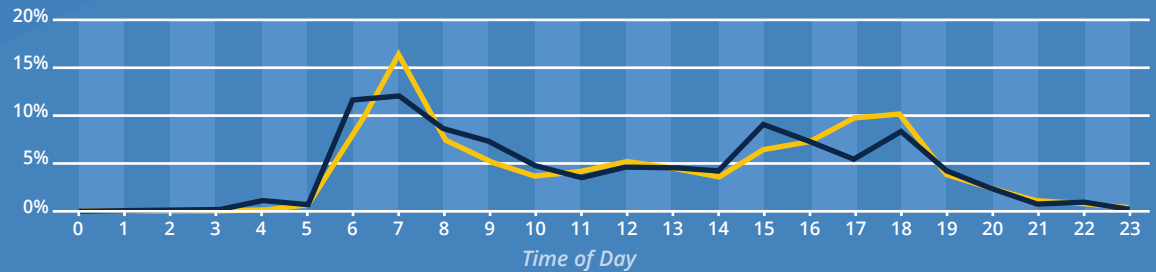
Express lanes provided improved travel time reliability relative to the GP lanes.



Departure Time: MoPac Express Lanes

These patterns are indicative of the growth in the severity of peak hour congestion in 2019.

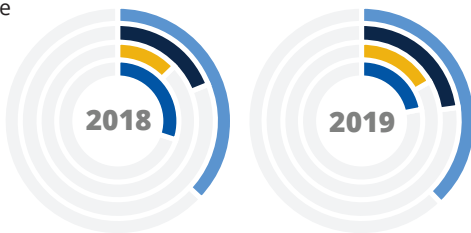
- 2018, EL
- 2019, EL



Express Lane Usage

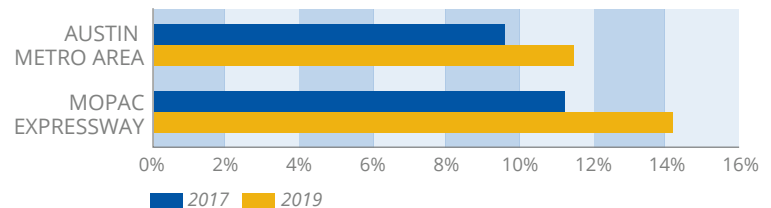
More users accessed the express lanes for one, two or three days a week, while fewer accessed it four or more days a week.

- One
- Two
- Three
- Four+



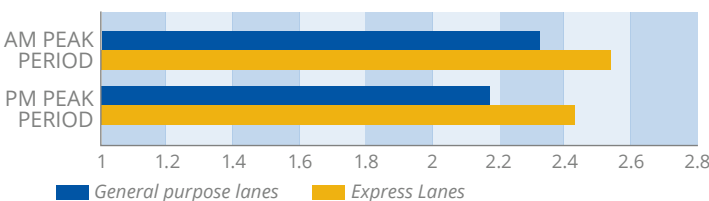
Portion of Carpool Trips

Both the portion and the growth of carpool trips on Mopac Expressway was higher than that of the metro area.



HOV Occupancy

The carpool vehicle occupancy of the express lane trips were higher than those of the GP lane trips during both peak periods.

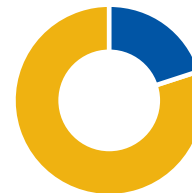


Departure Time and Carpooling

The majority of respondents said they changed their departure time due to congestion. The majority of those who carpooled did so for convenience.

Peak Spreading: Reason for Changing Departure Time:

- Avoid Congestion
- Other



Carpooling: Incentive to Choose Carpooling:

- Save money on tolls
- Convenience

