

Appendix A: CMAQ Analyses

Emission Reduction Analysis for City of El Paso Proposed CMAQ Project

Sunland Park Drive Shared Use Path

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Prepared for



By



Task Summary

The Texas A&M Transportation Institute (TTI) was tasked by the City of El Paso to perform a mobile source emissions analysis for a proposed project in the El Paso metropolitan region. The city is seeking funding from the Congestion Mitigation/Air Quality Improvement Program (CMAQ) to help implement the project.

The project will construct 0.63 miles of pedestrian and bike lane infrastructure improvements in the northwest region of the city along Sunland Park Drive.

Individual Project Analysis

The emissions analysis for the project is presented below. The project name is given along with a brief description of the project. Data sources and analysis assumptions are provided. The equation used from the *Texas Guide to Accepted Mobile Source Emission Reduction Strategies* (MOSERs Guide) is given for the strategy along with the variables of the equation and the equation itself. The results are then computed for the strategy.

It is recommended that the agency conduct a more detailed emissions study of the project as it develops further. The results presented below are valid for CMAQ applications, but more time and effort would increase the accuracy of the emissions benefits. As a result, this analysis should not be used for conformity purposes.

Sunland Park Shared Use Path

The Sunland Park Shared Use Path project will install 0.63 miles of pedestrian and bicycle trail improvements along a major arterial in the northwest El Paso region. The project will construct pedestrian and bicycle facilities to include signage, landscaping, furnishings, and illumination. The limits of the improvements are from Cadiz St. to Mesa St.

The project will serve the City of El Paso by increasing its regional transportation infrastructure coupled with existing transit projects, educational centers, and commercial developments. Bicycle facilities will support and provide connectivity to existing bicycle facilities Citywide with connection to mass transit facilities and provide an alternative method of transportation. The infrastructure will be installed within City right-of-way and no property acquisition is anticipated.

The components of the project are consistent with the August 2016 City of El Paso Bike Plan.

Data Sources

The City of El Paso provided the project description and project scope information. This resource provided the research team with a better understanding of the proposed project and potential emissions benefits.

TTI researchers utilized the U.S. EPA MOVES 3.1.0 model to generate emissions rates for the expected vehicle types affected by the project. Researchers used updated summer season inputs based on TCEQ's latest (2023) summer fuel survey, with adjustments for particular properties made to reflect latest expected "future year" values (i.e., consistent with the pertinent regulations and/or local observations, such as for Reid vapor pressure of gasoline, average sulfur content of gasoline and diesel, biodiesel ester volume, gasoline benzene content). Fuel supply consists of monthly inputs, for gasoline, one summer formulation and one winter formulation, assigned to months as appropriate, and for diesel, one formulation applied to all months. Gasoline is E10, or 10% ethanol, and diesel about 4-5% biodiesel. For winter gasoline, used the MOVES3.1 January default in the absence of local data.

Vehicle age distributions are consistent with prior analysis. For passenger vehicle source types, researchers used the latest estimates across 31 years based on latest available (end-of-year 2021) El Paso County TxDMV vehicle registration data.

TTI staff used American Community Survey data to compute a bicycle mode share for El Paso, along with a future growth rate for the mode in the region.

Analysis Methods

TTI staff used the analysis method provided in the August 2008 version of the MOSERs Guide, Equation 11.1 – *Bicycle and Pedestrian Lanes or Paths*.

Stated in words, the average annual daily traffic (AADT) of the corridor is multiplied by the percentage of drivers shifting to bicycle mode, multiplied by the bike facility length, and multiplied

by the speed-based running exhaust emission factor for participants' trips before utilizing the bike lane.

The detailed equation is provided below in Strategy Equation.

The analysis year used is 2031, the first year of operation. *For planning purposes, the emissions benefit of a static program will decline over time.* Without the increased use of the bike lanes over the project lifetime, any benefits accrued by the mode shift to bicycles may be negated by the increased emissions from potential higher traffic volumes in the corridor over time.

Assumptions in the MOVES3.1.0 output for the project included:

- Output created for VOC, CO, NO_x, and PM-10.
- Light-duty passenger vehicles and light-duty passenger trucks (SUVs), gasoline and diesel-fueled, are included according to a projected regional VMT fleet mix (Source Type ID 21, 31)
- Running exhaust and evaporative emissions and start emissions rates were calculated. (Process ID 1, 2, 11, 12, 13, 15)
- Considering the project area and the type of trips reduced through the strategy, emissions on Road Type 5, urban unrestricted access were analyzed.
- Overall average speed in the seven roadways is assumed to be 30 mph (Speed bin 7).
- The analysis period is from 7:00 a.m. to 7:00 p.m. on a winter weekday for CO; the same periods on a summer weekday for NO_x, VOC, and PM-10. Use of the bicycle lanes can occur throughout the day, but the greatest impact on emissions will occur with any peak hour or daytime mode shift.
- The vehicle-miles traveled (VMT) reduced because of the mode shift to bicycle were distributed proportionally across the 12 hours and by vehicle types and fuel types in line with the vehicle fleet mix in the El Paso region.

TTI staff reviewed the project information to determine values for the individual variables in the MOSERS equation. The MOSERS Guide encourages planners to make conservative, justifiable assumptions about projects. TTI staff determined a valid percentage mode shift from automobile to bicycle by participants in El Paso region. The characteristics of this new facility may provide impetus for significant mode shift, but planners should use available data.

The following assumptions were made for the project:

- Light-duty passenger vehicle and light-duty passenger truck AADT in the project area of 2,920 is estimated. This figure is based on 2022 AADT and ADT traffic counts from TxDOT and the City of El Paso. AADT is estimated based on the data plus a professional estimate of traffic growth and an averaging of the counts. It assumes 80% of the daily traffic along the roadways occurs in the 12-hour daytime period under analysis. It assumes 86% of the traffic is passenger vehicles.
- Most of the future users of the facility will generate and replace trips from the residential areas to the north and south of Sunland Park Drive for use of local businesses and facilities. Greater connectedness to the developed bike lane infrastructure in the area will attract riders from adjacent neighborhoods and increase the use of the path and emissions benefits.

- The current percent bicycle mode share for the El Paso region is estimated to be 2.0% and can serve as an optimistic mode share increase for the new bike facilities.
- The 0.02 increase in mode share represents new cyclists (vehicle trips replaced).
- Bike lane facility length of 0.63 miles is computed.

The emission reductions are presented in kilograms per day (kg/day) in accordance with CMAQ project reporting requirements.

Strategy Equation

Equation 11.1, Bicycle and Pedestrian Lanes or Paths

$$\text{Daily Emission Reduction} = \text{AADT} * \text{PMS} * \text{L} * \text{EF}_B$$

The average annual daily traffic of the corridor multiplied by the percentage of drivers shifting to bike/pedestrian multiplied by the average bicycle trip length multiplied by the speed-based running exhaust emission factor for participants' trip before participating in the bike/pedestrian program.

Final unit of measure: grams/day

Source: Capitol Area MPO (CAMPO)

Variables: **AADT:** Average annual daily traffic in corridor (vehicles/day)

EF_B: Speed-based running exhaust emission factor for participants' trip before participating in the bike/pedestrian program (NO_x, VOC, or CO) (grams/mile)

L: Length of facility (miles)

PMS: Percentage mode shift from driving to bike/pedestrian (decimal)

Analysis

Results

$$\text{Daily Emission Reduction} = \text{AADT} * \text{PMS} * \text{L} * \text{EF}_B$$

Note: Due to the large amount of data generated by the MOVES model and the required off-model computations, for presentation purposes the individual emissions rates are not provided in the results below.

For CO:

$$2,920 * 0.02 * 0.63 * \text{EF}_B = 1851.247 \text{ grams/day}$$

Daily emission reduction is equal to 1.851 kg/day

For NO_x:

$$2,920 * 0.02 * 0.63 * EF_B = 25.116 \text{ grams/day}$$

Daily emission reduction is equal to 0.025 kg/day

For VOC:

$$2,920 * 0.02 * 0.63 * EF_B = 38.994 \text{ grams/day}$$

Daily emission reduction is equal to 0.039 kg/day

For PM-10:

$$2,920 * 0.02 * 0.63 * EF_B = 18.082 \text{ grams/day}$$

Daily emission reduction is equal to 0.018 kg/day

Summary of Results

The overall emissions analysis results for the project are shown in Table 1. The estimated emissions benefits from the pedestrian and bicycle facilities are modest and are dependent on the increased use of bicycles as a travel mode in the city and region. An emissions benefit for the El Paso region can be expected from this project.

Table 1. Estimated Emissions Benefits from Sunland Park Shared Use Path

Pollutant	Emissions Reduction (kg/day)
CO	1.851
NO _x	0.025
VOC	0.039
PM ₁₀	0.018



Congestion Mitigation and Air Quality (CMAQ) Analysis-Edgemere/John Hayes Roundabout

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1. TASK SUMMARY

The City of El Paso (“City”) requested technical assistance from the Texas A&M Transportation Institute (TTI) in developing a Congestion Mitigation and Air Quality (CMAQ) analysis for its roundabout project at Edgemere and John Hayes (See Figure 1 for a spatial location). This analysis estimated emissions benefits from the project’s key components, including potential improvements to bicycle lanes and roundabouts.

The primary objective of this analysis was to assist the City of El Paso in preparing an updated CMAQ report for submission to the MPO and other relevant agencies. This report included new emissions estimates and a summary of the project’s anticipated benefits, supporting the City of El Paso’s CMAQ funding application.

The emissions analysis for the project is presented below. The strategy name is given along with a brief description of the project. Data sources and assumptions for the analysis are provided. The equation from the Texas Guide to Accept Mobile Source Emission Reduction Strategies (MOSERs Guide) is provided for the strategy, along with the equation's variables and the equation itself. The results are then computed for the strategy equation.

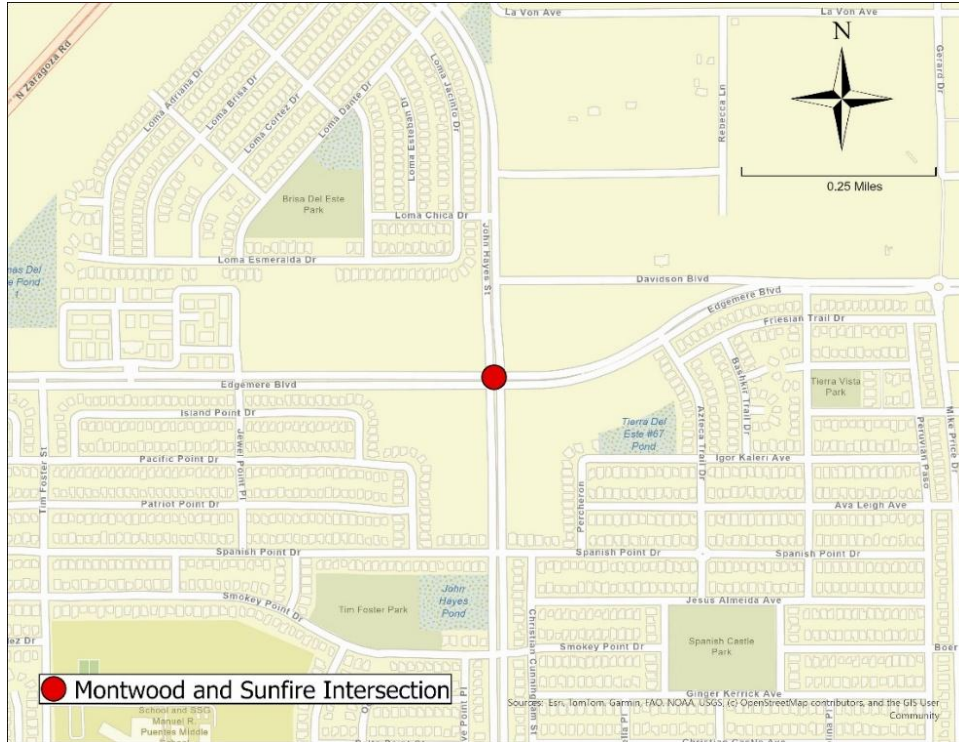


Figure 1. Edgemere Blvd and John Hayes St Intersection

2. STRATEGIES AND METHODOLOGY

The Texas Guide to Accepted Mobile Source Emission Reduction Strategies (commonly known as the MOSERS Guide) is a set of reference documents and tools for Texas transportation practitioners undertaking air quality planning. The intent of MOSERS is to provide guidance and resources for transportation of air quality practitioners to understand and evaluate mobile-source emissions-reduction strategies. The MOSERS guide was originally developed by TTI in 2003 and updated subsequently in 2007, and 2020. After a thorough review by the research team, the strategies implemented in the roundabout project at Edgemere and John Mayes intersection are “Bicycle and Pedestrian” (strategy 3.2) and “Roundabouts” (strategy 5.8)

2.1 BICYCLE AND PEDESTRIAN

Bicycle and pedestrian programs reduce vehicle trips, vehicle miles traveled (VMT), and emissions by shifting a portion of short local travel from cars to walking and bicycling. In

the context of the Edgemere Blvd. and John Mayes St, intersection in El Paso, where an all-way stop is being converted to a roundabout, this strategy applies through the addition of bicycle facilities (e.g., a bike path or bike-pedestrian shared path) that provide a safer, more direct, and more comfortable option for cyclists. By improving connectivity and reducing conflicts with vehicle traffic, the bike facility is expected to attract some trips that would otherwise be made by car, particularly short neighborhood-to-commercial or neighborhood-to-neighborhood trips. The emissions benefit is quantified by estimating the number of vehicle trips and VMT that are avoided due to mode shift, then translating those avoided vehicle activities into reductions in pollutants and greenhouse gases using the MOSERS methodology.

This strategy is most applicable in areas with existing or planned bicycle/pedestrian connectivity (sidewalks, trails, low-stress routes, nearby destinations) that can support regular use. The effectiveness depends primarily on how many travelers shift from driving to biking or walking, and on the typical trip lengths replaced, especially during peak periods.

Emissions Equations:

$$\text{Daily Emission Reduction (g/day)} = A + B$$

Reduction in auto start emissions from reduced trips: $A = VT_R \times TEF_{AUTO}$

Reduction in auto-running exhaust emissions from a reduction in vehicle miles traveled:

$$B = VMT_R \times EF_B$$

Where:

$$VT_R = VT_P + VT_{OP}$$

$$VMT_R = VMT_P + VMT_{OP}$$

Activity (mode-shift) calculations:

$$VT_P = N_{HH} \times n_v \times p_p \times \frac{n_p}{O_{auto}}$$

$$VT_{OP} = N_{HH} \times n_v \times p_{op} \times \frac{n_{op}}{O_{auto}}$$

$$VMT_P = VT_P \times LV_P$$

$$VMT_{OP} = VT_{OP} \times LV_{OP}$$

The calculator requires basic information, such as the area type, area size, and number of households or population of the service area where the new bike-ped facility will be constructed. It also requires trip information, such as the average trip length before the bike-ped program, the average number of trips during peak hours, and the average number of trips during off-peak hours. It also needs an estimated percentage of new program participants who previously were single-occupancy drivers. The methodology assumes that a certain percentage of people are attracted to choose cycling or walking over driving vehicles when a bike-ped facility is available. Bike-ped users are estimated based on the number of households, the number of vehicles per household, and auto occupancy. Trips shifted to bike or walk reduce vehicle trips and associated VMT. All the variables and their definitions are provided in Table 1.

Table 1. Bicycle and Pedestrian Variables and Definitions

Variable	Unit	Definition / Notes
Daily Emission Reduction	g/day	Total daily reduction in emissions from auto activity reduced (sum of trip-end + running).
A	g/day	Reduction in auto trip-end emissions due to fewer auto trips.
B	g/day	Reduction in running exhaust emissions due to fewer auto miles traveled.
TEF _{AUTO}	g/trip	Auto trip-end emission factor (pollutant-specific: NO _x , VOC, PM, CO).
EF _B	g/mile	Speed-based running exhaust emission factor for the average pre-project auto speed (pollutant-specific: NO _x , VOC, PM, CO).
VT _R	trips/day	Reduction in total daily auto trips (peak + off-peak).
VMT _R	miles/day	Reduction in total daily auto VMT (peak + off-peak).
VT _P	trips/day	Peak-period auto trips reduced due to mode shift.

VT_{OP}	trips/day	Off-peak auto trips reduced due to mode shift.
VMT_P	miles/day	Peak-period auto VMT reduced.
VMT_{OP}	miles/day	Off-peak auto VMT reduced.
N_{HH}	households	Number of households within the bike facility service area.
n_v	vehicles/household	Average vehicles per household (default commonly used: 1.9; local data preferred if available).
O_{auto}	persons/vehicle	Average auto occupancy (default commonly used: 1.13; may be set to 1.0 if assuming SOV only).
p_p	percent	Share of new bike/ped users during peak who would have otherwise driven (SOV).
p_{op}	percent	Share of new bike/ped users during off-peak who would have otherwise driven (SOV).
n_p	trips/participant	Average number of peak-period trips per participant (that are assumed shifted from auto).
n_{op}	trips/participant	Average number of off-peak trips per participant (that are assumed shifted from auto).
LV_P	miles/trip	Average pre-project auto trip length for shifted peak-period trips.
LV_{OP}	miles/trip	Average pre-project auto trip length for shifted off-peak trips.

2.2 ROUNDABOUTS

Roundabouts can reduce emissions at intersections by reducing the time vehicles spend idling and by smoothing stop-and-go traffic. A roundabout operates with vehicles circulating counterclockwise around a central island and entering traffic yielding to vehicles already in the circle. Compared to an all-way stop or a signal, especially under

moderate traffic conditions, this yield-on-entry control typically reduces full stops, shortens queues, and lowers average delay. As a result, vehicles spend less time idling and less time accelerating from a stop, which can translate into lower emissions at the intersection.

This strategy is most applicable on arterials or low- to medium-capacity roadways where traffic is currently controlled by stop signs or signals, and where intersection geometry and right-of-way can accommodate a roundabout. In MOSERS, the roundabout method is applied at the individual intersection level to estimate emission benefits associated with reduced delay and idling.

Emissions Equations:

$$\text{Daily Emission Reduction } \left(\frac{g}{\text{day}} \right) = A + B$$

$$A = (D_{B,P} - D_{A,P}) \times EF_I \times VD_P$$

$$B = (D_{B,OP} - D_{A,OP}) \times EF_I \times VD_{OP}$$

The variables displayed above are described in Table 2

Table 2. Roundabouts Variables and Definitions

Variable	Unit	Definition
$D_{A,P}$	hour/vehicle	Average vehicle delay at the intersection after implementation during peak hours (convert from sec/veh if needed).
$D_{B,P}$	hour/vehicle	Average vehicle delay at the intersection before implementation during peak hours (convert from sec/veh if needed).
$D_{A,OP}$	hour/vehicle	Average vehicle delay at the intersection after implementation during off-peak hours (convert from sec/veh if needed).

$D_{B,OP}$	hour/vehicle	Average vehicle delay at the intersection before implementation during off-peak hours (convert from sec/veh if needed).
EF_i	grams/hour	Idling emission factor for the pollutant of interest (NO _x , VOC, PM, or CO).
VD_P	vehicles/day	Traffic volume represented during peak hours (vehicles processed during peak period).
VD_{OP}	vehicles/day	Traffic volume represented during off-peak hours (vehicles processed during off-peak period).
A	grams/day	Change in idling emissions from reduced vehicle delay during the peak period.
B	grams/day	Change in idling emissions from reduced vehicle delay during the off-peak period.

For the activity methodologies, the following equations were used:

Peak/off-peak hourly volumes (with truck adjustment)

$$V_{P,H} = \frac{V_{P,H,V}}{1 + \frac{T}{100}}$$

$$V_{OP,H} = \frac{V_D - V_{P,H,V} \times N_P}{N_{OP} \times \frac{1}{1 + \frac{T}{100}}}$$

Conflicting volumes (peak and off-peak)

$$V_{C,P} = (1 - P_{RT,n-1}) \times V_{P,n-1} + (P_{LT,n-2} + P_{UT,n-2}) \times V_{P,n-2} + P_{UT,n-3} \times V_{P,n-3}$$

$$V_{C,OP} = (1 - P_{RT,n-1}) \times V_{OP,n-1} + (P_{LT,n-2} + P_{UT,n-2}) \times V_{OP,n-2} + P_{UT,n-3} \times V_{OP,n-3}$$

Capacity (HCM-based form used by the roundabout method)

For this analysis, only equations relevant to two-lane approaches and two-lane circulating roundabouts will be utilized. This is based on observations that the project site's approaches are configured with two lanes (as shown in Figure 2), which is the typical design standard for roundabouts in urban areas.



Figure 2. Edgemere and John Hayes intersection, Google Streetview

When $NCL = 2, N = 2$:

$$C_P = 1130 \times e^{-0.7 \times 10^{-3} \times V_{C,P}} + 1130 \times e^{-0.75 \times 10^{-3} \times V_{C,P}}$$

$$C_{OP} = 1130 \times e^{-0.7 \times 10^{-3} \times V_{C,OP}} + 1130 \times e^{-0.75 \times 10^{-3} \times V_{C,OP}}$$

Delay after implementation (peak and off-peak)

$$D_{A,P} = \frac{3600}{C_P} + 900 \times \left(\frac{V_{P,H}}{C_P} - 1 + \sqrt{\left(\frac{V_{P,H}}{C_P} - 1 \right)^2 + \frac{3600 \times \frac{V_{P,H}}{C_P}}{450 \times C_P}} \right) + 5 \times \text{MIN} \left(\frac{V_{P,H}}{C_P}, 1 \right)$$

$$D_{A,OP} = \frac{3600}{C_{OP}} + 900 \times \left(\frac{V_{OP,H}}{C_{OP}} - 1 + \sqrt{\left(\frac{V_{OP,H}}{C_{OP}} - 1 \right)^2 + \frac{3600 \times \frac{V_{OP,H}}{C_{OP}}}{450 \times C_{OP}}} \right) + 5 \times \text{MIN} \left(\frac{V_{OP,H}}{C_{OP}}, 1 \right)$$

Delay reduction (per vehicle)

$$DR_P = D_{B,P} - D_{A,P}$$

$$DR_{OP} = D_{B,OP} - D_{A,OP}$$

With the equations described above, Table 3 displays the input variables needed for the equations, while Table 4 describes the derived/output variables

Table 3. Roundabouts Input Variables

Input	Unit	Definition / Input Guidance
NCL	—	Number of circulating lanes in the roundabout (e.g., 1-lane or 2-lane circulating).
N	lanes	Number of lanes on the approach being evaluated.
VD	vehicles/day	Approach AADT (or daily volume used for the approach).
$D_{B,P}$	sec/vehicle	Existing (before) peak-hour control delay per vehicle on the approach (convert to hr/veh for emissions equation).
$D_{B,OP}$	sec/vehicle	Existing (before) off-peak control delay per vehicle on the approach (convert to hr/veh for emissions equation).
T	percent	Truck percentage on the approach.
PRT	percent	Right-turn percentage on the approach.
PLT	percent	Left-turn percentage on the approach.
PUT	percent	U-turn percentage on the approach.
N_P	hours/day	Number of peak hours per day (default: 6, unless local data is available).

N_{OP}	hours/day	Number of off-peak hours per day (default: 18, unless local data is available).
$VP_{H,V}$	vehicles/hour	Default or locally provided peak-hour volume basis used by the method.
EF_I	grams/hour	Idling emission factor for the pollutant and region (NO _x , VOC, PM, CO).

Table 4. Roundabouts Derived/Output Variables

Variable	Unit	Definition
VP_H	vehicles/hour	Peak-hour volume adjusted for trucks.
VOP_H	vehicles/hour	Off-peak hourly volume adjusted for trucks.
VC_P	vehicles/hour	Peak-hour conflicting volume is used for capacity.
VC_{OP}	vehicles/hour	Off-peak conflicting volume used for capacity.
C_P	vehicles/hour	Peak-hour approach capacity.
C_{OP}	vehicles/hour	Off-peak approach capacity.
$D_{A,P}$	sec/vehicle	Peak-hour delay per vehicle after implementation (roundabout).
$D_{A,OP}$	sec/vehicle	Off-peak delay per vehicle after implementation (roundabout).
DR_P	sec/vehicle	Peak-hour delay reduction per vehicle.
DR_{OP}	sec/vehicle	Off-peak delay reduction per vehicle.

For the Edgemere Blvd. and John Hayes St. intersection in El Paso, the roundabout strategy is evaluated as an operational improvement that reduces intersection control delay. Converting the existing all-way stop to a roundabout is expected to improve traffic flow by reducing full stops and shortening queues, which lowers the average time vehicles spend idling at the intersection. MOSERS estimates daily emission benefits by comparing before- and after-control delays under peak and off-peak conditions and applying an idling emission factor to the traffic volume represented in each period.

The method requires roadway and traffic input for each approach (e.g., approach lanes, circulating lanes, AADT/volumes, existing peak/off-peak delay, and truck percentage). Peak and off-peak approach volumes are estimated using default peak-hour assumptions (or local counts if available). Roundabout approach capacity is calculated using an HCM-based formulation driven by conflicting volumes, and after-implementation delay is then computed from the demand-to-capacity relationship. The difference between before- and after-delays is converted into emission reductions using pollutant-specific idling emission factors appropriate for the project location.

3. INPUT DATA AND ASSUMPTIONS

To estimate emission reductions for the proposed roundabout (and associated bicycle facility) at Edgemere Blvd. and John Hayes St., the MOSERS tool requires a set of project-specific inputs for each strategy described in Section 2. This section summarizes the input data used in the analysis and documents the key assumptions applied to the Bicycle and Pedestrian Programs strategy and the Roundabouts strategy.

3.1 BICYCLE AND PEDESTRIAN

The input values in Table 5 were developed using a combination of (1) project- and location-specific information from local agencies, (2) nationally recognized travel behavior datasets, (3) prior CMAQ analysis prepared for the El Paso region, and (4) engineering judgment from the TTI research team where local data were not available at the level needed for MOSERS. Specifically, the analysis year reflects the City of El Paso's expected project delivery timeframe. The bike/ped impact area was defined using an estimated service-area population and an average household size to convert to households, which

is the required MOSERS input; this approach provides a transparent, replicable method tied to publicly available demographic data. Households were estimated by dividing the service-area population (5,040 residents) by the City of El Paso for average persons-per-household (2.7), yielding approximately 1,867 households for the MOSERS input. The assumed shares of new bicycle/pedestrian participants who previously drove were based on the El Paso MPO CMAQ supporting documentation, which references the region's existing bicycle mode share as a reasonable (and intentionally optimistic) basis for participation in new facilities; applying slightly different peak vs. off-peak percentages reflects typical differences in travel patterns by time of day. Where detailed local bicycle trip frequency data were not available, the TTI research team assumed a minimum of a round trip for commuting and a minimum of a round trip for essential non-work travel to avoid overstating benefits. Average pre-project auto trip lengths were taken from the most recent National Household Travel Survey trip-length statistics by trip purpose, which is a standard national reference when corridor-level observed trip lengths are not available. Finally, representative peak and off-peak operating speeds were derived from local arterial speed/profile information to capture congested versus free-flow conditions, ensuring emission factors are applied using speeds that reflect how the corridor operates by time period. Overall, the assumptions were selected to be defensible, transparent, and consistent with MOSERS input requirements, while prioritizing local sources whenever feasible and relying on national defaults only when local data were not available.

Table 5. Bicycle and Pedestrian Strategy: MOSERS Inputs, Assumptions, and References

Strategy	Input data Description	Data	Units	Assumption	Source
3.2 Bicycle and Pedestrian	Year	2030	-	Estimated completion year of the project	City of El Paso
	Number of households in bike/pedestrian program impact area	1867	household	# of residents/ average persons by household - -> $5040/2.7 = 1867$	US census data. Census Tract 101.03

<p>Percentage of new bike/pedestrian program participants who previously drove during peak hours</p>	<p>2</p>	<p>percent</p>	<p>In the El Paso MPO CMAQ appendix, It's assumed "the current percent bicycle mode share for the El Paso region is 2.0% and can serve as an optimistic mode share increase for the new bike facilities," and it's treated 0.02 as new cyclists (vehicle trips replaced), during peak hours</p>	<p>CMAQ Analysis by TTI Jan 2024</p>
<p>Percentage of new bike/pedestrian program participants who previously drove during off peak hours</p>	<p>1.75</p>	<p>percent</p>	<p>In the El Paso MPO CMAQ appendix, it's assumed "the current percent bicycle mode share for the El Paso region is 2.0% and can serve as an optimistic mode share increase for the new bike facilities," and it's treated 0.02 as new cyclists (vehicle trips replaced), during off-peak hours</p>	<p>CMAQ Analysis by TTI Jan 2024</p>
<p>Average number of trips per participant during peak hours</p>	<p>2</p>	<p>trip</p>	<p>At least a round trip from/to home/work</p>	<p>TTI Research Team</p>
<p>Average number of trips per participant during off peak hours</p>	<p>2</p>	<p>trip</p>	<p>At least a round trip from/to daily necessary locations besides work</p>	<p>TTI Research Team</p>
<p>Average auto trip length of participants before participating in the bike/pedestrian program during peak hours</p>	<p>13.4</p>	<p>mile</p>	<p>based on 2022 NHTS average person trip length by trip purpose</p>	<p>National Household Travel Survey</p>

Average auto trip length of participants before participating in the bike/pedestrian program during off-peak hours	12.3	mile	based on 2022 NHTS avg person trip length by trip purpose	National Household Travel Survey
Average trip speed in the service zone during peak hours	30	mph	congested speed, a fraction of the free flow (posted speed)	2020 arterial segment profiles, EIP MPO
Average trip speed in the service zone during off-peak hours	40	mph	free-flow uncongested speed	2020 arterial segment profiles, EIP MPO

3.2 ROUNDABOUTS

The roundabout inputs in Table 6 were developed using a combination of local project information, official traffic count data, and documented default assumptions from prior research where approach-specific field measurements were not available. The analysis year (2030) reflects the anticipated project delivery timeframe provided by the City of El Paso. Because MOSERS evaluates roundabout benefits at the approach level (north, south, east, and west), the table inputs are applied to each approach; the only approach-specific value is the AADT, while the remaining parameters (geometry, delay assumptions, truck share, and turning movement percentages) are held constant across approaches to maintain consistency and because no evidence suggested materially different conditions by approach for those inputs.

Approach-level AADT for the analysis year was developed from TxDOT traffic count data, projected to 2030 using a linear regression based on historical counts. Geometric inputs such as circulating lanes and approach lanes were defined using a combination of standard roundabout assumptions (circulating lanes) and existing conditions observed in Google Street View (approach lanes). Existing control delay values represent planning-

level “before” conditions for an all-way stop at a busier arterial intersection and were selected from published ranges used by TxDOT/VDOT references. The truck percentage (6%) was derived from the El Paso District conformity VMT mix developed for MOVES4.0.3. Specifically, the VMT mix table was filtered to a weekday and time-of-day = “day”, then all truck-related MOVES source types were isolated, and their VMT mix fractions were summed to obtain the total truck share used as the input in MOSERS. Turning movement percentages (right, left, and U-turn) were taken from published studies and guidance (UT Austin CTR and TTI roundabout research) as reasonable planning-level values. Overall, the assumptions were selected to be transparent, repeatable, and consistent with MOSERS input requirements, relying on local data for volumes and regional conformity inputs where available and using established literature-based defaults for parameters that typically require dedicated turning-movement and delay counts.

Table 6. Roundabouts Strategy: MOSERS Inputs, Assumptions, and References

Strategy	Input data Description	Data	Units	Assumption	Source
5.8 Roundabouts	Year	2030	-	Estimated completion year of the project	City of El Paso
	Number of Circulating Roundabout Lanes	2	lanes	average # of lanes in a standard roundabout	TTI
	Number of Lanes	2	lanes	# of lanes spotted in google Streetview	Google Maps
	Annual Average Daily Traffic for the analysis year	Different for each approach	veh/day	AADT projected based on past years, linear regression	Traffic count TxDOT
	Existing Peak-hour Delay per Vehicle	35	sec/veh	based on AWSC for busy roads	TxDOT and VDOT
	Existing Off-Peak hour Delay per Vehicle	15	sec/veh	based on AWSC for non-busy roads	TxDOT and VDOT
	Existing Truck Percentage	6	percent	% estimated based on the VMT Mix used for ELP conformity	TTI VMT Mix
	Existing Right Turn Percentage	10	percent	typical percentage estimated by the source study	UT Austin CTR

	Existing Left Turn Percentage	10	percent	typical percentage estimated by the source study	UT Austin CTR
	Existing U-Turn Percentage	3	percent	Research and Findings on Roundabouts and Innovative Intersections for High-Speed and Rural Locations	TTI

3.2.1 AADT for Each Roundabout approach

Traffic volumes used in this CMAQ analysis were developed to represent 2030 conditions at the proposed roundabout intersection of Edgemere Road and John Hayes Drive in El Paso, Texas. The objective was to produce a defensible, transparent set of approach-leg AADT values for the roundabout while preserving directional information needed for quality assurance and for documenting how totals were constructed. The roundabout has four approach legs, Edgemere West, Edgemere East, John Hayes North, and John Hayes South. Each approach leg carries two directions of travel, which results in eight directional AADT series that were estimated and projected to the analysis year. The eight directional 2030 values are summarized in Table 10, and the final four approach-leg AADT values used for the roundabout are summarized in Table 11.

Directional distributions were developed first using the TxDOT Traffic Count Database System (TCDS). The TCDS map was used to identify the closest available traffic counters on each of the four approach legs, and the locations of the selected devices are shown in Figure 3. As shown in Table 7, these counters provided usable directional data for years 2017 and 2022. For each counter-year, total AADT and the corresponding directional AADT values were extracted. Directional percentages were computed as the ratio of directional AADT to the total AADT for that counter-year using Equation below. These directional percentages represent the observed share of total traffic traveling in each direction on each approach leg and are reported in Table 7.

$$\%_{Dir} = \frac{AADT_{Dir}}{AADT_{Total}}$$

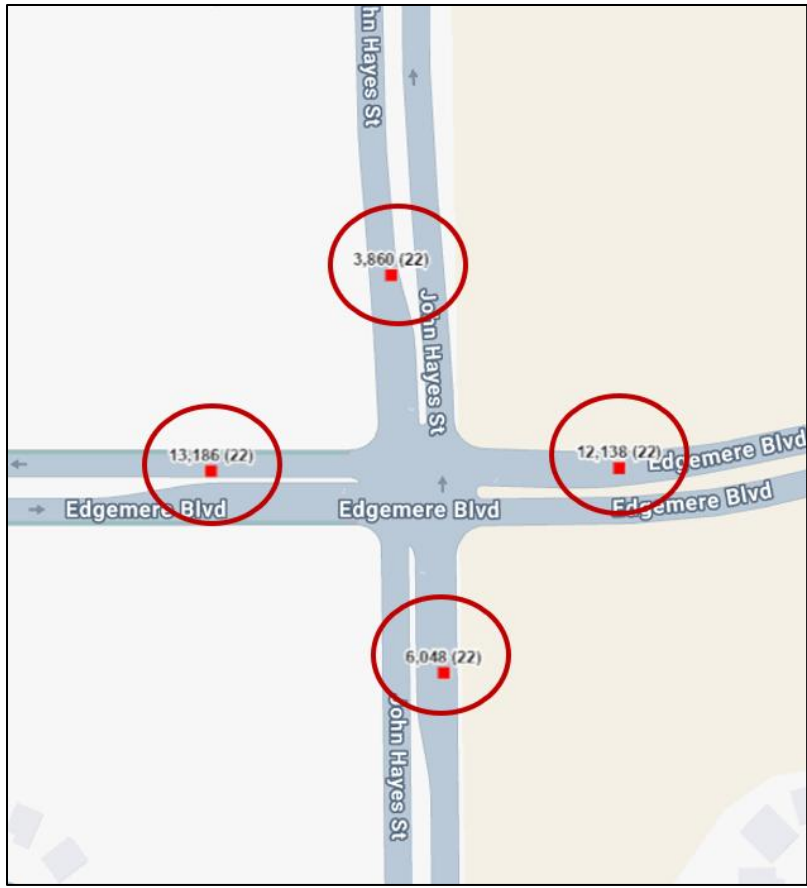


Figure 3. Traffic counter device’s location

Table 7. TCDS counter extraction and computed directional percentages

Device ID	location	year	total AADT	EB AADT	EB %	WB AADT	WB %
72u241	Edgemere West	2022	13186	6649	0.5042	6537	0.4958
72u241	Edgemere West	2017	9559	4760	0.4980	4799	0.5020
72U240	Edgemere East	2022	12138	5992	0.4937	6146	0.5063
72U240	Edgemere East	2017	5046	2564	0.5081	2482	0.4919

deviceID	location	year	total AADT	NB AADT	NB %	SB AADT	SB %
72U239	John Hayes South	2022	6048	2857	0.4724	3191	0.5276
72U239	John Hayes South	2017	6537	3186	0.4874	3350	0.5125
72U238	John Hayes North	2022	3860	1918	0.4969	1942	0.5031
72U238	John Hayes North	2017	4575	2182	0.4769	2394	0.5233

Because directional information was available for only two years, a single representative directional distribution was defined for each approach leg as the average of the 2017 and 2022 directional percentages. This averaging reduces sensitivity to any single-year anomaly and produces one stable directional split to apply to the Roadway Inventory AADT series. The averaged directional splits used in subsequent calculations are shown in Table 8 and were computed using Equation below.

$$\overline{\%_{Dir}} = \frac{\%_{Dir,2017} + \%_{Dir,2022}}{2}$$

Table 8. Directional splits applied to Roadway Inventory totals, average of 2017 and 2022

approach leg	direction 1	avg %	direction 2	avg %
Edgemere West	EB	0.5011	WB	0.4989
Edgemere East	EB	0.5009	WB	0.4991

John Hayes South	NB	0.4799	SB	0.5200
John Hayes North	NB	0.4869	SB	0.5132

After directional splits were established, total approach-leg AADT by year was obtained from TxDOT Roadway Inventory. Roadway Inventory provides link-level annual total AADT values for the roadway segments that represent each of the four approach legs. The annual total AADT series selected for this effort is summarized in Table 9. These totals represent combined bidirectional traffic on each selected approach link for each year listed.

Table 9. Roadway Inventory total AADT series used for the four approach legs

approach leg	year	total AADT
Edgemere West	2024	17750
Edgemere West	2023	17750
Edgemere West	2022	17306
Edgemere West	2021	17306
Edgemere West	2020	17306
Edgemere East	2024	12138
Edgemere East	2023	12138
Edgemere East	2022	17306
Edgemere East	2021	17306

Edgemere East	2020	17306
John Hayes South	2024	6838
John Hayes South	2023	6704
John Hayes South	2022	6704
John Hayes South	2021	4253
John Hayes South	2020	3731
John Hayes South	2019	5049
John Hayes South	2018	4615
John Hayes South	2017	4365
John Hayes North	2024	6838
John Hayes North	2023	6704
John Hayes North	2022	6704

John Hayes North	2021	4253
John Hayes North	2020	3731
John Hayes North	2019	5049
John Hayes North	2018	4615
John Hayes North	2017	4365

Directional AADT time series were then computed by combining the Roadway Inventory total AADT values in Table 9 with the averaged directional splits in Table 8. For each approach leg and year, directional AADT was calculated by multiplying the total AADT by the applicable average directional percentage using equation below. Applying such equation 3 across all years in Table 9 produced eight directional AADT time series, two for each approach leg. These eight-directional series form the basis for the 2030 traffic projections summarized in Table 10.

$$AADT_{(Dir)(y)} = AADT_{(Total)(y)} * \overline{\%Dir}$$

Directional AADT values were projected to the 2030 analysis year separately for each of the eight-directional series. For approach legs where the Roadway Inventory totals and the derived directional AADT series behaved consistently over time, a linear trend was fit and extrapolated to 2030 using equation below. This approach was applied independently to Edgemere West eastbound and westbound, John Hayes North northbound and southbound, and John Hayes South northbound and southbound, and the results are reported in Table 10.

$$AADT_{(Dir)(y)} = a * y + b$$

For Edgemere East, the Roadway Inventory totals shown in Table 9 exhibit a discontinuity between the stable 2020 to 2022 period and the lower 2023 to 2024 values. Applying a linear regression through a discontinuous series yields an unrealistically steep decline and implausibly low 2030 estimates. Because a demand collapse of that magnitude is not expected for this corridor and because discontinuities can reflect link definition or segmentation differences rather than true traffic change, a stability override was applied for Edgemere East. Specifically, Edgemere East 2030 directional AADT values were held constant at the stable 2022 directional values computed from the 2022 Roadway Inventory total AADT and the averaged Edgemere East directional split shown in Table 8. This stability assumption is expressed in the equation below, and the resulting Edgemere East directional 2030 values are included in Table 10.

$$AADT_{(EdgE,EB)(2030)} = AADT_{(EdgE,EB)(2022)}$$

$$AADT_{(EdgE,WB)(2030)} = AADT_{(EdgE,WB)(2022)}$$

The methodology above yields eight directional AADT values for 2030, which are listed in Table 10 along with the forecast method used for each directional series. These values provide the directional detail needed for QA and documentation.

Figure 4 summarizes the directional AADT time series and 2030 projections for the Edgemere Road approaches to the roundabout (Edgemere West EB/WB and Edgemere East EB/WB). The plotted points reflect directional AADT developed by applying the averaged TCDS splits (Table 8) to Roadway Inventory totals (Table 9). Edgemere West EB/WB is projected to 2030 using linear extrapolation, while Edgemere East EB/WB is held constant at the stable 2022 level consistent with the stability override; these assumptions support the 2030 values reported in Table 10 and the approach-leg values in Table 11.

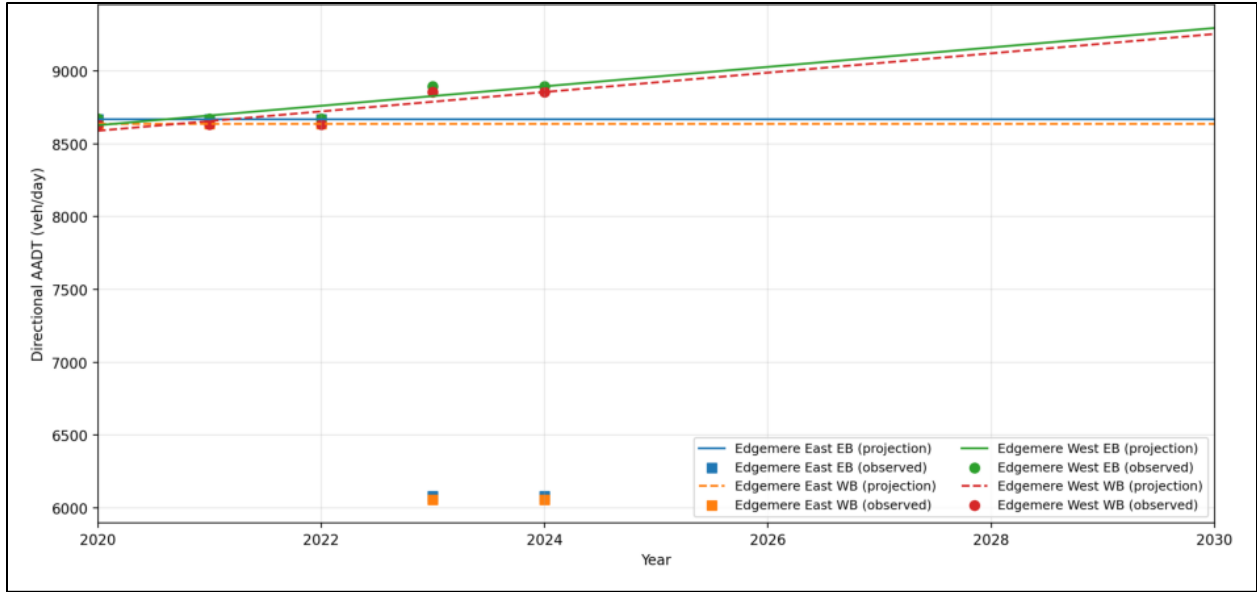


Figure 4. Edgemere Road directional AADT series and 2030 projection (4 directional components)

Table 10. Directional AADT values for 2030, eight directional components

approach leg	direction	2030 directional AADT (vpd)	forecasting method
Edgemere West	EB	9295	linear extrapolation
Edgemere West	WB	9254	linear extrapolation
Edgemere East	EB	8668	hold constant at 2022 stable level
Edgemere East	WB	8638	hold constant at 2022 stable level

John Hayes North	NB	4403	linear extrapolation
John Hayes North	SB	4640	linear extrapolation
John Hayes South	NB	4339	linear extrapolation
John Hayes South	SB	4702	linear extrapolation

Finally, a single approach-leg AADT value was computed for each of the four roundabout approach legs by averaging the two directional AADT values within each approach leg. This averaging step provides the four approach-leg AADT values used for subsequent calculations and reporting while maintaining traceability back to the directional components. The approach-leg averaging calculation is shown in the equation below, and the resulting four 2030 approach-leg AADT values are presented in Table 11.

$$AADT_{(Approach)(2030)} = \frac{AADT_{(Dir1)(2030)} + AADT_{(Dir2)(2030)}}{2}$$

Table 11. Final 2030 roundabout approach-leg AADT values, four values

roundabout approach leg	2030 AADT, average of two directions (vpd)	calculation
West approach, Edgemere West	9274	$(9295 + 9254) / 2$
East approach, Edgemere East	8653	$(8668 + 8638) / 2$
North approach, John Hayes North	4522	$(4403 + 4640) / 2$

South approach, John Hayes
South

4520

$$\frac{(4339 + 4702)}{2}$$

3.3 EMISSIONS FACTORS

Emission factors used in the MOSERS analysis were developed using the EPA MOVES model (version 4.0.3) to remain consistent with the emissions modeling framework used for conformity in the El Paso region. MOVES was executed to generate pollutant- and process-specific emission rates representative of local conditions for the analysis year (2030). The resulting outputs were then post-processed and formatted as emission rate lookup tables (ERLTs) (see Appendix B) so they could be imported into MOSERS and applied directly within the tool. These lookup tables provide the emission factors needed to quantify changes in emissions associated with the project strategies, including running exhaust (used with VMT reductions) and start/trip-end emissions (used with reductions in vehicle trips), ensuring that MOSERS calculations are based on MOVES-derived rates aligned with regional conformity assumptions.

For the Bicycle and Pedestrian strategy, the running exhaust emission factors used in the calculations were obtained from *ERLT_Running*, while the auto trip-end (start) emission factors were obtained from *ERLT_Starts*. For the Roundabouts strategy, the idling emission factors were obtained from *ERLT_Idling*. To develop these ERLTs, MOVES emission-rate runs were completed for both summer and winter seasonal conditions. To represent a conservative analysis, the ERLTs were populated using the maximum emission rate observed across the seasonal runs for each pollutant/process combination.

To retrieve the specific emission factors applied in the MOSERS workbooks (Appendix A), the ERLTs were filtered consistently to match the project context. For all ERLTs, records were filtered by Source Type Name = "Auto" and then limited to Road Type ID = 4, which represents Urban Restricted Access (urban freeway) conditions in MOVES. For *ERLT_Running* (used in the Bicycle and Pedestrian calculations), the table was further filtered by speed to select 35 mph, representing the approximate average operating speed between the assumed peak-hour and off-peak-hour speeds used in the analysis. This consistent filtering approach ensures the emission factors applied by MOSERS reflect the roadway and operating conditions assumed for the Edgemere Blvd. and John Hayes St. project while maintaining alignment with regional MOVES-based conformity inputs

4. SUMMARY OF RESULTS

The emissions analysis results are summarized in Table 12, which presents the estimated daily emission reductions by pollutants for both the Bicycle and Pedestrian strategy and the Roundabouts strategy. These values were taken directly from the MOSERS outputs and reflect the methods described in Section 2, using the project-specific input data and assumptions documented in Section 3. The MOSERS calculation workbooks used to generate these results are included in Appendix A for reference. Overall, the results indicate that implementing the proposed improvements at Edgemere Blvd. and John Hayes St. is expected to produce measurable air quality benefits across the pollutants evaluated.

Table 12. CMAQ Analysis Emissions Reductions

Pollutant	Bicycle and Pedestrian (Kg/day)	Bicycle and Pedestrian (lbs/day)	Roundabouts (Kg/day)	Roundabouts (lbs/day)
CO	6.281	13.847	0.783	1.726
CO ₂	853	1,881	1,775.23	3,913.706
NO _x	0.201	0.442	0.184	0.406
VOC	0.148	0.325	0.046	0.1
PM ₁₀	0.007	0.015	0.012	0.026

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APPENDIX A: MOSERS WORKBOOKS FOR BICYCLE AND PEDESTRIAN AND ROUNDABOUTS (ELECTRONIC ONLY)

APPENDIX B: EMISSIONS LOOKUP TABLES (ERLT) FOR MOSERS INPUT (ELECTRONIC ONLY)



Congestion Mitigation and Air Quality (CMAQ) Analysis- Montwood/Sunfire Roundabout

Prepared for City of El Paso

January 2026

Texas A&M Transportation Institute



TECHNICAL REPORT

Task 5 – Technical Documentation

DATE: January 16th, 2026

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1. TASK SUMMARY

The City of El Paso (“City”) requested technical assistance from the Texas A&M Transportation Institute (TTI) in developing a Congestion Mitigation and Air Quality (CMAQ) analysis for its roundabout project at Montwood & Sunfire (See Figure 1 for a spatial location). This analysis estimated emissions benefits from the project’s key components, including potential improvements to bicycle lanes and roundabouts.

The primary objective of this analysis was to assist the City of El Paso in preparing an updated CMAQ report for submission to the MPO and other relevant agencies. This report included new emissions estimates and a summary of the project’s anticipated benefits, supporting the City of El Paso’s CMAQ funding application.

The emissions analysis for the project is presented below. The strategy name is given along with a brief description of the project. Data sources and assumptions for the analysis are provided. The equation from the Texas Guide to Accept Mobile Source Emission Reduction Strategies (MOSERs Guide) is provided for the strategy, along with the equation's variables and the equation itself. The results are then computed for the strategy equation.

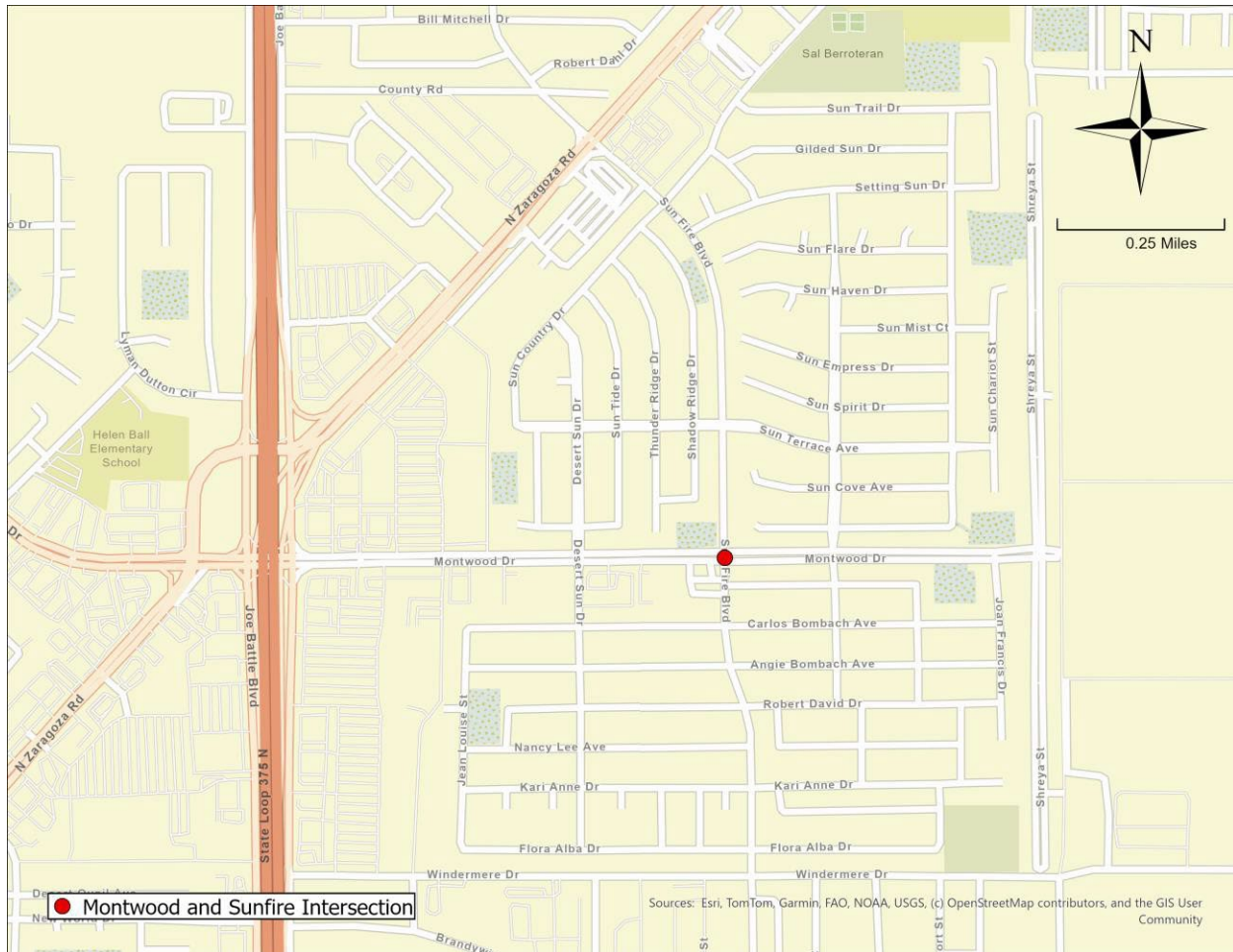


Figure 1. Montwood and Sunfire Intersection

2. STRATEGIES AND METHODOLOGY

The Texas Guide to Accepted Mobile Source Emission Reduction Strategies (commonly known as the MOSERS Guide) is a set of reference documents and tools for Texas transportation practitioners undertaking air quality planning. The intent of MOSERS is to provide guidance and resources for transportation air quality practitioners to understand and evaluate mobile-source emissions-reduction strategies. The MOSERS guide was originally developed by TTI in 2003 and updated subsequently in 2007, and 2020. After a thorough review by the research team, the strategies implemented in the roundabout project at Montwood and Sunfire intersection are “Bicycle and Pedestrian” (strategy 3.2) and “Roundabouts” (strategy 5.8)

2.1 BICYCLE AND PEDESTRIAN

Bicycle and pedestrian programs reduce vehicle trips, vehicle miles traveled (VMT), and emissions by shifting a portion of short local travel from cars to walking and bicycling. In the context of the Montwood Dr. and Sunfire Blvd, intersection in El Paso, where an all-way stop is being converted to a roundabout, this strategy applies through the addition of bicycle facilities (e.g., a bike path or bike-pedestrian shared path) that provide a safer, more direct, and more comfortable option for cyclists. By improving connectivity and reducing conflicts with vehicle traffic, the bike facility is expected to attract some trips that would otherwise be made by car, particularly short neighborhood-to-commercial or neighborhood-to-neighborhood trips. The emissions benefit is quantified by estimating the number of vehicle trips and VMT that are avoided due to mode shift, then translating those avoided vehicle activities into reductions in pollutants and greenhouse gases using the MOSERS methodology.

This strategy is most applicable in areas with existing or planned bicycle/pedestrian connectivity (sidewalks, trails, low-stress routes, nearby destinations) that can support regular use. The effectiveness depends primarily on how many travelers shift from driving to biking or walking, and on the typical trip lengths replaced, especially during peak periods.

Emissions Equations

$$\text{Daily Emission Reduction (g/day)} = A + B$$

Reduction in auto start emissions from reduced trips: $A = VT_R \times TEF_{AUTO}$

Reduction in auto-running exhaust emissions from a reduction in vehicle miles traveled:

$$B = VMT_R \times EF_B$$

Where:

$$VT_R = VT_P + VT_{OP}$$

$$VMT_R = VMT_P + VMT_{OP}$$

Activity (mode-shift) calculations:

$$VT_P = N_{HH} \times n_v \times p_p \times \frac{n_p}{O_{auto}}$$

$$VT_{OP} = N_{HH} \times n_v \times p_{op} \times \frac{n_{op}}{O_{auto}}$$

$$VMT_P = VT_P \times LV_P$$

$$VMT_{OP} = VT_{OP} \times LV_{OP}$$

The calculator requires basic information, such as the area type, area size, and number of households or population of the service area where the new bike-ped facility will be constructed. It also requires trip information, such as the average trip length before the bike-ped program, the average number of trips during peak hours, and the average number of trips during off-peak hours. It also needs an estimated percentage of new program participants who previously were single-occupancy drivers. The methodology assumes that a certain percentage of people are attracted to choose cycling or walking over driving vehicles when a bike-ped facility is available. Bike-ped users are estimated based on the number of households, the number of vehicles per household, and auto occupancy. Trips shifted to bike or walk reduce vehicle trips and associated VMT. All the variables and their definitions are provided in Table 1.

Table 1. Bicycle and Pedestrian Variables and Definitions

Variable	Unit	Definition / Notes
Daily Emission Reduction	g/day	Total daily reduction in emissions from auto activity reduced (sum of trip-end + running).
A	g/day	Reduction in auto trip-end emissions due to fewer auto trips.
B	g/day	Reduction in running exhaust emissions due to fewer auto miles traveled.
TEF _{AUTO}	g/trip	Auto trip-end emission factor (pollutant-specific: NO _x , VOC, PM, CO).
EF _B	g/mile	Speed-based running exhaust emission factor for the average pre-project auto speed (pollutant-specific: NO _x , VOC, PM, CO).
VT _R	trips/day	Reduction in total daily auto trips (peak + off-peak).

VMT_R	miles/day	Reduction in total daily auto VMT (peak + off-peak).
VT_P	trips/day	Peak-period auto trips reduced due to mode shift.
VT_{OP}	trips/day	Off-peak auto trips reduced due to mode shift.
VMT_P	miles/day	Peak-period auto VMT reduced.
VMT_{OP}	miles/day	Off-peak auto VMT reduced.
N_{HH}	households	Number of households within the bike facility service area.
n_v	vehicles/household	Average vehicles per household (default commonly used: 1.9; local data preferred if available).
O_{auto}	persons/vehicle	Average auto occupancy (default commonly used: 1.13; may be set to 1.0 if assuming SOV only).
p_p	percent	Share of new bike/ped users during peak who would have otherwise driven (SOV).
p_{op}	percent	Share of new bike/ped users during off-peak who would have otherwise driven (SOV).
n_p	trips/participant	Average number of peak-period trips per participant (that are assumed shifted from auto).
n_{op}	trips/participant	Average number of off-peak trips per participant (that are assumed shifted from auto).
LV_P	miles/trip	Average pre-project auto trip length for shifted peak-period trips.
LV_{OP}	miles/trip	Average pre-project auto trip length for shifted off-peak trips.

2.2 ROUNDABOUTS

Roundabouts can reduce emissions at intersections by reducing the time vehicles spend idling and by smoothing stop-and-go traffic. A roundabout operates with vehicles circulating counterclockwise around a central island and entering traffic yielding to vehicles already in the circle. Compared to an all-way stop or a signal, especially under moderate traffic conditions, this yield-on-entry control typically reduces full stops, shortens queues, and lowers average delay. As a result, vehicles spend less time idling and less time accelerating from a stop, which can translate into lower emissions at the intersection.

This strategy is most applicable on arterials or low- to medium-capacity roadways where traffic is currently controlled by stop signs or signals, and where intersection geometry and right-of-way can accommodate a roundabout. In MOSERS, the roundabout method is applied at the individual intersection level to estimate emission benefits associated with reduced delay and idling.

Emissions Equations

$$\text{Daily Emission Reduction } \left(\frac{g}{\text{day}}\right) = A + B$$

$$A = (D_{B,P} - D_{A,P}) \times EF_I \times VDP$$

$$B = (D_{B,OP} - D_{A,OP}) \times EF_I \times V Dop$$

The variables displayed above are described in Table 2

Table 2. Roundabouts Variables and Definitions

Variable	Unit	Definition
$D_{A,P}$	hour/vehicle	Average vehicle delay at the intersection after implementation during peak hours (convert from sec/veh if needed).
$D_{B,P}$	hour/vehicle	Average vehicle delay at the intersection before implementation during peak hours (convert from sec/veh if needed).

$D_{A,OP}$	hour/vehicle	Average vehicle delay at the intersection after implementation during off-peak hours (convert from sec/veh if needed).
$D_{B,OP}$	hour/vehicle	Average vehicle delay at the intersection before implementation during off-peak hours (convert from sec/veh if needed).
EF_i	grams/hour	Idling emission factor for the pollutant of interest (NO _x , VOC, PM, or CO).
VD_P	vehicles/day	Traffic volume represented during peak hours (vehicles processed during peak period).
VD_{OP}	vehicles/day	Traffic volume represented during off-peak hours (vehicles processed during off-peak period).
A	grams/day	Change in idling emissions from reduced vehicle delay during the peak period.
B	grams/day	Change in idling emissions from reduced vehicle delay during the off-peak period.

For the activity methodologies, the following equations were used:

Peak/off-peak hourly volumes (with truck adjustment)

$$V_{P,H} = \frac{V_{P,H,V}}{1 + \frac{T}{100}}$$

$$V_{OP,H} = \frac{V_D - V_{P,H,V} \times N_P}{N_{OP} \times \frac{1}{1 + \frac{T}{100}}}$$

Conflicting volumes (peak and off-peak)

$$V_{C,P} = (1 - P_{RT,n-1}) \times V_{P,n-1} + (P_{LT,n-2} + P_{UT,n-2}) \times V_{P,n-2} + P_{UT,n-3} \times V_{P,n-3}$$

$$V_{C,OP} = (1 - P_{RT,n-1}) \times V_{OP,n-1} + (P_{LT,n-2} + P_{UT,n-2}) \times V_{OP,n-2} + P_{UT,n-3} \times V_{OP,n-3}$$

Capacity (HCM-based form used by the roundabout method)

For this analysis, only equations relevant to two-lane approaches and two-lane circulating roundabouts will be utilized. This is based on observations that the project site's approaches are configured with two lanes (as shown in Figure 2), which is the typical design standard for roundabouts in urban areas.



Figure 2. Montwood and Sunfire intersection, Google Streetview

When $NCL = 2, N = 2$:

$$C_P = 1130 \times e^{-0.7 \times 10^{-3} \times V_{C,P}} + 1130 \times e^{-0.75 \times 10^{-3} \times V_{C,P}}$$

$$C_{OP} = 1130 \times e^{-0.7 \times 10^{-3} \times V_{C,OP}} + 1130 \times e^{-0.75 \times 10^{-3} \times V_{C,OP}}$$

Delay after implementation (peak and off-peak)

$$D_{A,P} = \frac{3600}{C_P} + 900 \times \left(\frac{V_{P,H}}{C_P} - 1 + \frac{\sqrt{V_{P,H} - 1)^2 + \frac{3600 \times V_{P,H}}{450 \times C_P}}}{\frac{C_P}{450 \times C_P}} + 5 \times \text{MIN} \left(\frac{V_{P,H}}{C_P}, 1 \right) \right)$$

$$D_{A,OP} = \frac{3600}{C_{OP}} + 900 \times \left(\frac{V_{OP,H}}{C_{OP}} - 1 + \frac{\sqrt{V_{OP,H} - 1)^2 + \frac{3600 \times V_{OP,H}}{450 \times C_{OP}}}}{\frac{C_{OP}}{450 \times C_{OP}}} + 5 \times \text{MIN} \left(\frac{V_{OP,H}}{C_{OP}}, 1 \right) \right)$$

Delay reduction (per vehicle)

$$DR_P = D_{B,P} - D_{A,P}$$

$$DR_{OP} = D_{B,OP} - D_{A,OP}$$

With the equations described above, Table 3 displays the input variables needed for the equations, while Table 4 describes the derived/output variables

Table 3. Roundabouts Input Variables

Input	Unit	Definition / Input Guidance
NCL	—	Number of circulating lanes in the roundabout (e.g., 1-lane or 2-lane circulating).
N	lanes	Number of lanes on the approach being evaluated.
VD	vehicles/day	Approach AADT (or daily volume used for the approach).
D _{B,P}	sec/vehicle	Existing (before) peak-hour control delay per vehicle on the approach (convert to hr/veh for emissions equation).
D _{B,OP}	sec/vehicle	Existing (before) off-peak control delay per vehicle on the approach (convert to hr/veh for emissions equation).

T	percent	Truck percentage on the approach.
PRT	percent	Right-turn percentage on the approach.
PLT	percent	Left-turn percentage on the approach.
PUT	percent	U-turn percentage on the approach.
N _P	hours/day	Number of peak hours per day (default: 6, unless local data available).
N _{OP}	hours/day	Number of off-peak hours per day (default: 18, unless local data available).
VP _{H,V}	vehicles/hour	Default or locally provided peak-hour volume basis used by the method.
EF _I	grams/hour	Idling emission factor for the pollutant and region (NO _x , VOC, PM, CO).

Table 4. Roundabouts Derived/Output Variables

Variable	Unit	Definition
VP _H	vehicles/hour	Peak-hour volume adjusted for trucks.
VOP _H	vehicles/hour	Off-peak hourly volume adjusted for trucks.
VC _P	vehicles/hour	Peak-hour conflicting volume used for capacity.
VC _{OP}	vehicles/hour	Off-peak conflicting volume used for capacity.
C _P	vehicles/hour	Peak-hour approach capacity.
C _{OP}	vehicles/hour	Off-peak approach capacity.

$D_{A,P}$	sec/vehicle	Peak-hour delay per vehicle after implementation (roundabout).
$D_{A,OP}$	sec/vehicle	Off-peak delay per vehicle after implementation (roundabout).
DR_P	sec/vehicle	Peak-hour delay reduction per vehicle.
DR_{OP}	sec/vehicle	Off-peak delay reduction per vehicle.

For the Montwood Dr. and Sunfire Blvd. intersection in El Paso, the roundabout strategy is evaluated as an operational improvement that reduces intersection control delay. Converting the existing all-way stop to a roundabout is expected to improve traffic flow by reducing full stops and shortening queues, which lowers the average time vehicles spend idling at the intersection. MOSERS estimates daily emission benefits by comparing before- and after-control delays under peak and off-peak conditions and applying an idling emission factor to the traffic volume represented in each period.

The method requires roadway and traffic input for each approach (e.g., approach lanes, circulating lanes, AADT/volumes, existing peak/off-peak delay, and truck percentage). Peak and off-peak approach volumes are estimated using default peak-hour assumptions (or local counts if available). Roundabout approach capacity is calculated using an HCM-based formulation driven by conflicting volumes, and after-implementation delay is then computed from the demand-to-capacity relationship. The difference between before- and after-delays is converted into emission reductions using pollutant-specific idling emission factors appropriate for the project location.

3. INPUT DATA AND ASSUMPTIONS

To estimate emission reductions for the proposed roundabout (and associated bicycle facility) at Montwood Dr. and Sunfire Blvd., the MOSERS tool requires a set of project-specific inputs for each strategy described in Section 2. This section summarizes the input data used in the analysis and documents the key assumptions applied to the Bicycle and Pedestrian Programs strategy and the Roundabouts strategy.

3.1 BICYCLE AND PEDESTRIAN

The input values in Table 5 were developed using a combination of (1) project- and location-specific information from local agencies, (2) nationally recognized travel behavior datasets, (3) prior CMAQ analysis prepared for the El Paso region, and (4) engineering judgment from the TTI research team where local data were not available at the level needed for MOSERS. Specifically, the analysis year reflects the City of El Paso's expected project delivery timeframe. The bike/ped impact area was defined using an estimated service-area population and an average household size to convert to households, which is the required MOSERS input; this approach provides a transparent, replicable method tied to publicly available demographic data. The assumed shares of new bicycle/pedestrian participants who previously drove were based on the El Paso MPO CMAQ supporting documentation, which references the region's existing bicycle mode share as a reasonable (and intentionally optimistic) basis for participation in new facilities; applying slightly different peak vs. off-peak percentages reflects typical differences in travel patterns by time of day. Where detailed local bicycle trip frequency data were not available, the TTI research team assumed a minimum of a round trip for commuting and a minimum of a round trip for essential non-work travel to avoid overstating benefits. Average pre-project auto trip lengths were taken from the most recent National Household Travel Survey trip-length statistics by trip purpose, which is a standard national reference when corridor-level observed trip lengths are not available. Finally, representative peak and off-peak operating speeds were derived from local arterial speed/profile information to capture congested versus free-flow conditions, ensuring emission factors are applied using speeds that reflect how the corridor actually operates by time period. Overall, the assumptions were selected to be defensible, transparent, and consistent with MOSERS input requirements, while prioritizing local sources whenever feasible and relying on national defaults only when local data were not available.

Table 5. Bicycle and Pedestrian Strategy: MOSERS Inputs, Assumptions, and References

Strategy	Input data Description	Data	Units	Assumption	Source
	Year	2030	-	Estimated completion year of the project	City of El Paso

3.2 Bicycle and Pedestrian	Number of households in bike/pedestrian program impact area	1200	household	# of residents/ average persons by household - -> 3235/2.7 = 1200	NextDoor and US census data
	Percentage of new bike/pedestrian program participants who previously drove during peak hours	2	percent	In the El Paso MPO CMAQ appendix, It's assumed "the current percent bicycle mode share for the El Paso region is 2.0% and can serve as an optimistic mode share increase for the new bike facilities," and it's treated 0.02 as new cyclists (vehicle trips replaced), during peak hours	CMAQ Analysis by TTI Jan 2024
	Percentage of new bike/pedestrian program participants who previously drove during off peak hours	1.75	percent	In the El Paso MPO CMAQ appendix, It's assumed "the current percent bicycle mode share for the El Paso region is 2.0% and can serve as an optimistic mode share increase for the new bike facilities," and it's treated 0.02 as new cyclists (vehicle trips replaced), during off-peak hours	CMAQ Analysis by TTI Jan 2024
	Average number of trips per participant during peak hours	2	trip	At least a round trip from/to home/work	TTI Research Team
	Average number of trips per participant during off peak hours	2	trip	At least a round trip from/to daily necessary locations besides work	TTI Research Team

Average auto trip length of participants before participating in the bike/pedestrian program during peak hours	13.4	mile	based on 2022 NHTS average person trip length by trip purpose	National Household Travel Survey
Average auto trip length of participants before participating in the bike/pedestrian program during off-peak hours	12.3	mile	based on 2022 NHTS avg person trip length by trip purpose	National Household Travel Survey
Average trip speed in the service zone during peak hours	25	mph	congested speed, a fraction of the free flow (posted speed)	2020 arterial segment profiles, EIP MPO
Average trip speed in the service zone during off-peak hours	35	mph	free-flow uncongested speed	2020 arterial segment profiles, EIP MPO

3.2 ROUNDABOUTS

The roundabout inputs in Table 6 were developed using a combination of local project information, official traffic count data, and documented default assumptions from prior research where approach-specific field measurements were not available. The analysis year (2030) reflects the anticipated project delivery timeframe provided by the City of El Paso. Because MOSERS evaluates roundabout benefits at the approach level (north, south, east, and west), the table inputs are applied to each approach; the only approach-specific value is the AADT, while the remaining parameters (geometry, delay assumptions, truck share, and turning movement percentages) are held constant across approaches to maintain consistency and because no evidence suggested materially different conditions by approach for those inputs.

Approach-level AADT for the analysis year was developed from TxDOT traffic count data, projected to 2030 using a linear regression based on historical counts. Geometric inputs such as circulating lanes and approach lanes were defined using a combination of standard roundabout assumptions (circulating lanes) and existing conditions observed in Google Street View (approach lanes). Existing control delay values represent planning-level “before” conditions for an all-way stop at a busier arterial intersection and were selected from published ranges used by TxDOT/VDOT references. The truck percentage (6%) was derived from the El Paso District conformity VMT mix developed for MOVES4.0.3. Specifically, the VMT mix table was filtered to a weekday and time-of-day = “day”, then all truck-related MOVES source types were isolated and their VMT mix fractions were summed to obtain the total truck share used as the input in MOSERS. Turning movement percentages (right, left, and U-turn) were taken from published studies and guidance (UT Austin CTR and TTI roundabout research) as reasonable planning-level values. Overall, the assumptions were selected to be transparent, repeatable, and consistent with MOSERS input requirements, relying on local data for volumes and regional conformity inputs where available and using established literature-based defaults for parameters that typically require dedicated turning-movement and delay counts.

Table 6. Roundabouts Strategy: MOSERS Inputs, Assumptions, and References

Strategy	Input data Description	Data	Units	Assumption	Source
5.8 Roundabouts	Year	2030	-	Estimated completion year of the project	City of El Paso
	Number of Circulating Roundabout Lanes	2	lanes	average # of lanes in a standard roundabout	TTI
	Number of Lanes	2	lanes	# of lanes spotted in google Streetview	Google Maps
	Annual Average Daily Traffic for the analysis year	Different for each approach	veh/day	AADT projected based on past years, linear regression	Traffic count TxDOT
	Existing Peak-hour Delay per Vehicle	35	sec/veh	based on AWSC for busy roads	TxDOT and VDOT
	Existing Off-Peak hour Delay per Vehicle	15	sec/veh	based on AWSC for non-busy roads	TxDOT and VDOT

Existing Truck Percentage	6	percent	% estimated based on the VMT Mix used for ELP conformity	TTI VMT Mix
Existing Right Turn Percentage	10	percent	typical percentage estimated by the source study	UT Austin CTR
Existing Left Turn Percentage	10	percent	typical percentage estimated by the source study	UT Austin CTR
Existing U-Turn Percentage	3	percent	Research and Findings on Roundabouts and Innovative Intersections for High-Speed and Rural Locations	TTI

3.2.1 AADT for Each Roundabout approach

Figure 3 shows the TxDOT AADT count locations used to characterize traffic volumes near the Montwood Dr. and Sunfire Blvd. intersection. The northbound and southbound count station is located along Montwood Dr. near the intersection with N. Zaragoza Rd., while the eastbound and westbound count station is located along Montwood Dr. near the intersection with Joe Battle Blvd.

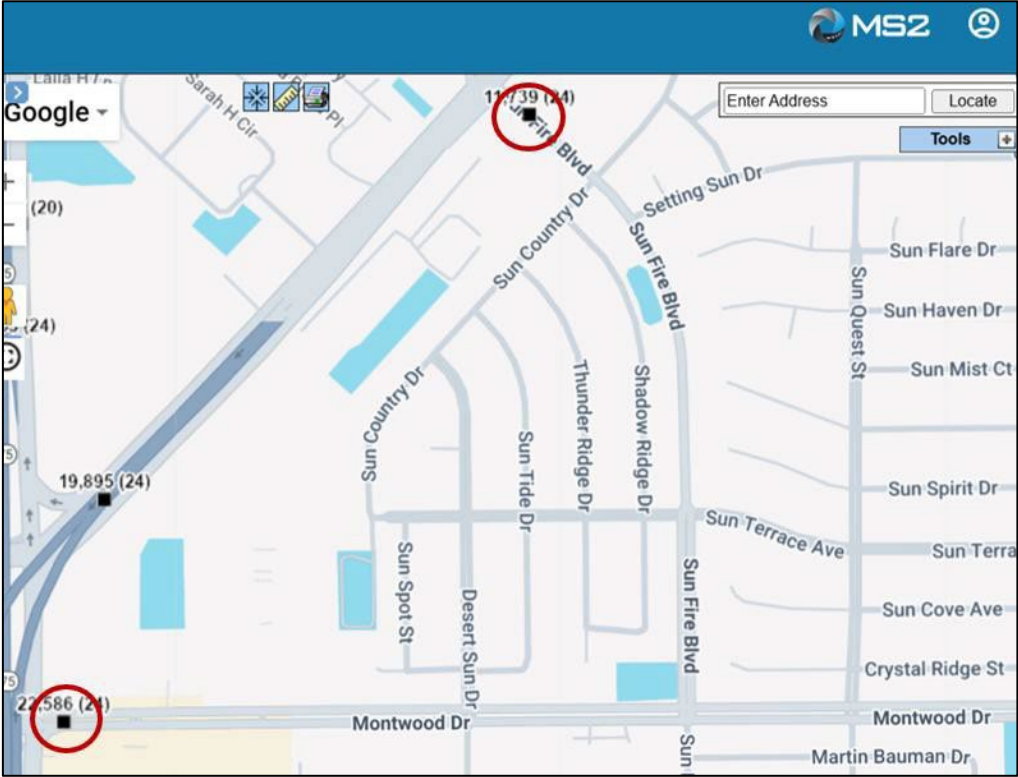


Figure 3. Traffic counter device’s location

Table 7 summarizes the historical TxDOT traffic count data extracted from the two nearby AADT stations identified in Figure 3 and organized by approach direction for use in the roundabout analysis. Counts for the northbound (NB) and southbound (SB) approaches come from station 72HP1187A, while counts for the eastbound (EB) and westbound (WB) approaches come from station 72UN189A. For each approach, the table lists the observed AADT by year and the corresponding annual growth rate calculated between consecutive available count years.

Table 7. AADT and Growth rate by TCDS devices

Traffic Count ID	Approach	Year	AADT	Annual Growth
72HP1187A	NB	2017	4805	-
72HP1187A	NB	2018	5568	0.16
72HP1187A	NB	2019	5568	-
72HP1187A	NB	2022	8178	0.14
72HP1187A	NB	2023	4308	-0.47

72HP1187A	NB	2025	-	0.28
72HP1187A	SB	2018	4494	-
72HP1187A	SB	2019	4494	-
72HP1187A	SB	2021	2302	-0.28
72HP1187A	SB	2022	6105	1.65
72HP1187A	SB	2023	3822	-0.37
72HP1187A	SB	2025	-	0.19
72UN189A	EB	2017	11327	-
72UN189A	EB	2020	9451	-0.06
72UN189A	EB	2022	14291	0.23
72UN189A	EB	2023	12225	-0.14
72UN189A	EB	2024	12470	0.02
72UN189A	EB	2025	-	0.28
72UN189A	WB	2017	9326	-
72UN189A	WB	2020	7858	-0.06
72UN189A	WB	2022	11681	0.22
72UN189A	WB	2023	9919	-0.15
72UN189A	WB	2024	10117	0.02
72UN189A	WB	2025	-	0.15

Figure 4 presents the data summarized in Table 7 plotted by year for each approach (NB, SB, EB, and WB). The figure also includes a separate linear regression trendline for each approach, developed using only the years with non-blank observed AADT values. These regressions were used to project approach-level AADT to the analysis year (2030). Based on the fitted trendlines, the projected 2030 AADT values are 7,149 (NB), 4,115 (SB), 14,650 (EB), and 11,760 (WB).

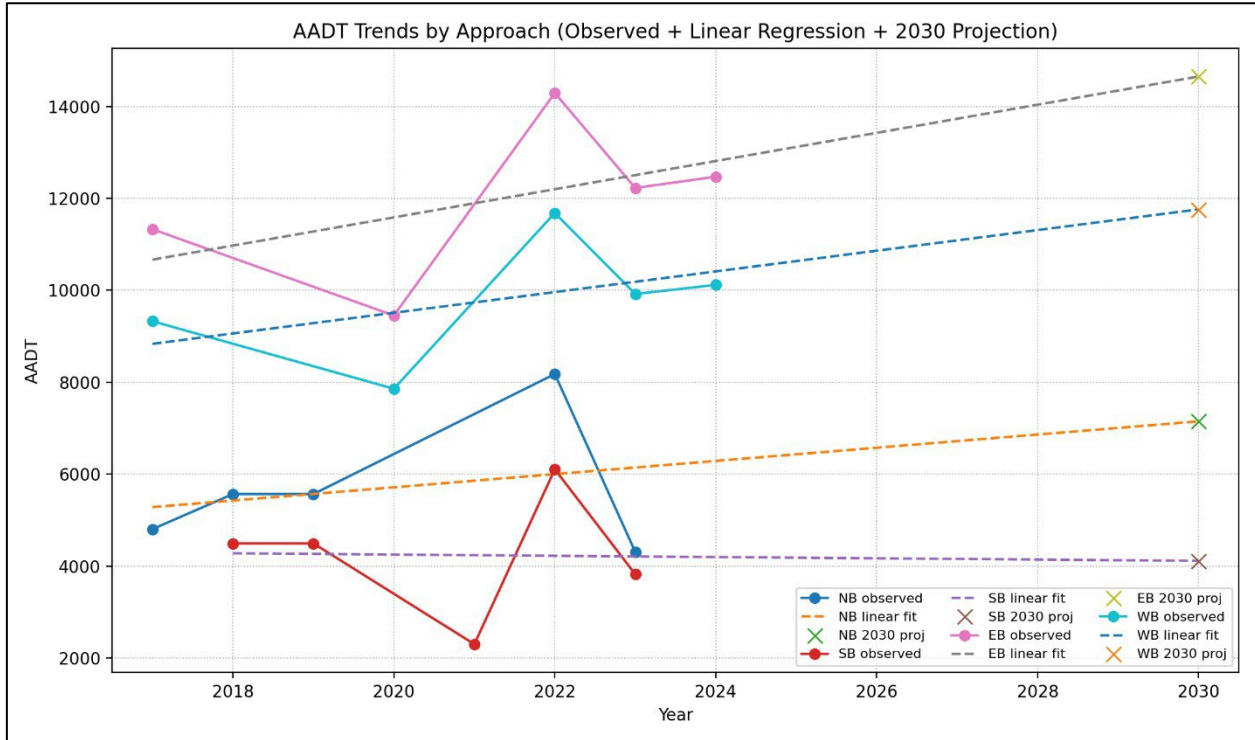


Figure 4. AADT plot and Linear Regression

3.3 EMISSIONS FACTORS

Emission factors used in the MOSERS analysis were developed using the EPA MOVES model (version 4.0.3) to remain consistent with the emissions modeling framework used for conformity in the El Paso region. MOVES was executed to generate pollutant- and process-specific emission rates representative of local conditions for the analysis year (2030). The resulting outputs were then post-processed and formatted as emission rate lookup tables (ERLTs) (see Appendix B) so they could be imported into MOSERS and applied directly within the tool. These lookup tables provide the emission factors needed to quantify changes in emissions associated with the project strategies, including running exhaust (used with VMT reductions) and start/trip-end emissions (used with reductions in vehicle trips), ensuring that MOSERS calculations are based on MOVES-derived rates aligned with regional conformity assumptions.

For the Bicycle and Pedestrian strategy, the running exhaust emission factors used in the calculations were obtained from *ERLT_Running*, while the auto trip-end (start) emission factors were obtained from *ERLT_Starts*. For the Roundabouts strategy, the idling emission factors were obtained from *ERLT_Idling*. To develop these ERLTs, MOVES emission-rate

runs were completed for both summer and winter seasonal conditions. To represent a conservative analysis, the ERLTs were populated using the maximum emission rate observed across the seasonal runs for each pollutant/process combination.

To retrieve the specific emission factors applied in the MOSERS workbooks (Appendix A), the ERLTs were filtered consistently to match the project context. For all ERLTs, records were filtered by Source Type Name = "Auto" and then limited to Road Type ID = 4, which represents Urban Restricted Access (urban freeway) conditions in MOVES. For *ERLT_Running* (used in the Bicycle and Pedestrian calculations), the table was further filtered by speed to select 30 mph, representing the approximate average operating speed between the assumed peak-hour and off-peak-hour speeds used in the analysis. This consistent filtering approach ensures the emission factors applied by MOSERS reflect the roadway and operating conditions assumed for the Montwood Dr. and Sunfire Blvd. project while maintaining alignment with regional MOVES-based conformity inputs

4. SUMMARY OF RESULTS

The emissions analysis results are summarized in Table 8, which presents the estimated daily emission reductions by pollutants for both the Bicycle and Pedestrian strategy and the Roundabouts strategy. These values were taken directly from the MOSERS outputs and reflect the methods described in Section 2, using the project-specific input data and assumptions documented in Section 3. The MOSERS calculation workbooks used to generate these results are included in Appendix A for reference. Overall, the results indicate that implementing the proposed improvements at Montwood Dr. and Sunfire Blvd. is expected to produce measurable air quality benefits across the pollutants evaluated.

Table 8. CMAQ Analysis Emissions Reductions

Pollutant	Bicycle and Pedestrian (Kg/day)	Bicycle and Pedestrian (lbs/day)	Roundabouts (Kg/day)	Roundabouts (lbs/day)
CO	5.550	12.236	0.929	2.048
CO ₂	729	1,606	2,107	4,645
NO _x	0.162	0.357	0.219	0.482
VOC	0.131	0.290	0.054	0.119
PM ₁₀	0.006	0.013	0.014	0.030

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APPENDIX A: MOSERS WORKBOOKS FOR BICYCLE AND PEDESTRIAN AND ROUNDABOUTS (ELECTRONIC ONLY)

APPENDIX B: EMISSIONS LOOKUP TABLES (ERLT) FOR MOSERS INPUT (ELECTRONIC ONLY)



Congestion Mitigation and Air Quality (CMAQ) Analysis-McRae Phase 3

Prepared for City of El Paso

February 2026

Texas A&M Transportation Institute



TECHNICAL REPORT

Technical Documentation

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1. TASK SUMMARY

The City of El Paso requested technical assistance from the Texas A&M Transportation Institute in developing a Congestion Mitigation and Air Quality (CMAQ) analysis for the McRae Phase 3 active transportation project along McRae Boulevard from Montwood Drive to I-10 (See Figure 1 for a spatial location). This analysis estimates emissions benefits associated with implementation of shared-use path and pedestrian-support improvements, including intersection pedestrian upgrades (ADA ramps and striping), illumination, signage, and supporting site amenities.

The primary objective of this effort is to support preparation of CMAQ documentation for submission to the El Paso Metropolitan Planning Organization and other relevant agencies by providing an updated, defensible estimate of air quality benefits. The analysis quantifies reductions in vehicle trips and vehicle miles traveled (VMT) expected to occur when travelers choose to walk or bicycle instead of driving due to improved bicycle and pedestrian facilities and connectivity along the corridor.

The emissions analysis presented in this report follows the Texas Department of Transportation MOSERS methodology using Strategy 3.2 Bicycle and Pedestrian Programs – Option 2 (Facility Needs Index–Based Estimation). Under this approach, the share of travelers attracted to bicycles or walks rather than drives are estimated using the facility needs to index together with service-zone population and employment, corridor and buffer characteristics, and trip parameters. The resulting reduction in vehicle trips and VMT is then converted to pollutant reductions using standard emissions equations and applicable emissions factors. Data sources and assumptions used in the analysis are

documented, the MOSERS equation and variables are summarized, and results are presented for the selected strategy.

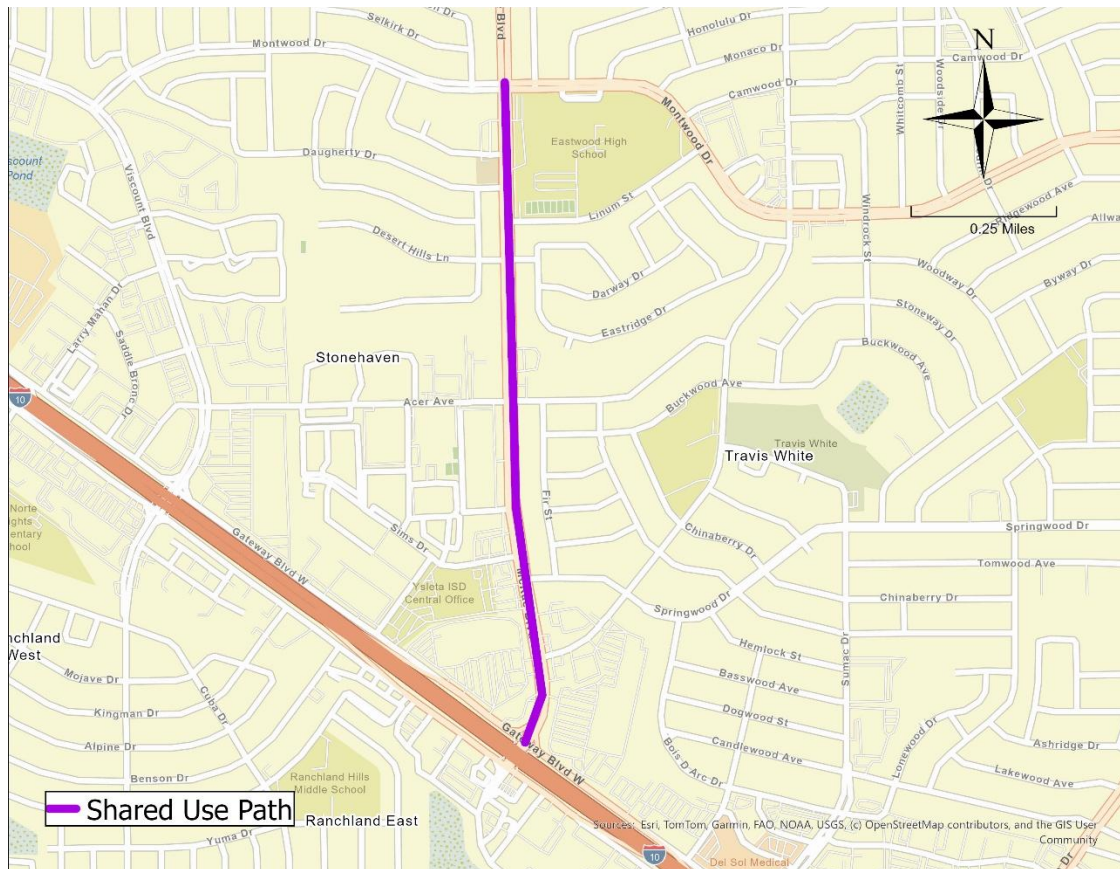


Figure 1. McRae Blvd. from Montwood Dr to I-10

2. STRATEGY AND METHODOLOGY

The Texas Guide to Accepted Mobile Source Emission Reduction Strategies (commonly known as the MOSERS Guide) is a set of reference documents and tools for Texas transportation practitioners undertaking air quality planning. The intent of MOSERS is to provide guidance and resources for transportation of air quality practitioners to understand and evaluate mobile-source emissions-reduction strategies. The MOSERS guide was originally developed by TTI in 2003 and updated subsequently in 2007, and 2020. After a thorough review by the research team, the strategy implemented in the McRae Phase 3 active transportation project is “Bicycle and Pedestrian” (strategy 3.2 option 2).

2.1 BICYCLE AND PEDESTRIAN (OPTION 2)

Bicycle and pedestrian programs reduce vehicle trips, vehicle miles traveled (VMT), and associated emissions by encouraging travelers to choose walking or bicycling in place of driving. For McRae Phase 3, the selected strategy is MOSERS Strategy 3.2 – Option 2, which quantifies emissions benefits based on how improved bicycle and pedestrian facilities within a defined service zone attract new walking/biking trips that would otherwise be made by automobile. The McRae Phase 3 project supports this mode shift by enhancing active transportation conditions along McRae Boulevard between Montwood Drive and I-10 through shared-use path and pedestrian-support improvements, including intersection pedestrian upgrades (ADA ramps and striping), illumination, signage, landscaping/irrigation, and related corridor amenities.

Option 2 is a facility-needs-index-based estimation approach. Rather than starting from households, it uses predicted Bicycle Needs Index (BNI) and Pedestrian Needs Index (PNI) values to estimate the percentage of people in the service zone who would be attracted to bicycle or walk after the facility is provided. Participants are estimated using population and employment in the service zone, together with facility lengths, buffer distances, trip characteristics, and auto occupancy. When participants shift trips to walking or bicycling, the associated vehicle trips and VMT are assumed eliminated, and emissions benefits are calculated from the reduced vehicle activity. This method is most applicable in populated areas with existing or planned bicycle/pedestrian connectivity that serves businesses or business centers, where improved facilities can plausibly replace short auto trips

Emissions Equations

$$\text{Daily Emission Reduction (grams/day)} = A + B$$

Reduction in auto trip-end (start) emissions from reduced trips

$$A = VT_R \times TEF_{AUTO}$$

Reduction in running exhaust emissions from reduced auto VMT

$$B = VMT_R \times EF_B$$

Where:

VT_R = reduction in number of daily auto vehicle trips (trips/day)

VMT_R = reduction in daily auto vehicle miles traveled (miles/day)

TEF_{AUTO} = auto trip-end emission factor (grams/trip) (pollutant-specific)

EF_B = speed-based running exhaust emission factor for average pre-program auto speed (grams/mile) (pollutant-specific)

Activity Methodology (Facility Needs Index–Based)

Option 2 estimates bicycle and pedestrian facility users in the service zone, then converts those users into reduced vehicle trips and VMT:

Bicycle facility users:

$$U_B = (N_P \cdot I_B + N_E \cdot I_B) \cdot L_B \cdot D_B$$

Pedestrian facility users:

$$U_P = (N_P \cdot I_P + N_E \cdot I_P) \cdot L_P \cdot D_P$$

Reduced daily auto trips:

$$VTR = \frac{(U_B + U_P) \cdot N}{O_A}$$

Reduced daily auto VMT:

$$VMTR = VTR \cdot L$$

The MOSERS calculator for Strategy 3.2, Option 2 estimates daily emissions benefits by linking expected travel behavior changes to reductions in automobile activity. The process begins by estimating how many people within the defined service zone would be attracted to walk or bicycle after the McRae Phase 3 improvements are implemented. That participation estimate is based on service-zone population and employment, the bicycle and pedestrian needs indices, the length of bicycle and pedestrian facilities available within the zone, assumed buffer distances that represent the area of influence of those facilities, basic trip characteristics, and average vehicle occupancy. Once the expected number of new walk and bike users is calculated, the methodology converts that participation into the number of daily vehicle trips avoided and the daily vehicle miles

traveled avoided. These reduced vehicle activities are then translated into pollutant reductions by applying appropriate trip-end and running exhaust emission factors. Table 1 summarizes the variables referenced throughout the activity and emissions calculations, including each variable's unit and definition, to ensure the analysis is transparent and reproducible. Figure 2 presents a Street View image of the McRae corridor, which documents existing site conditions and provides visual context for the corridor improvements and service-zone assumptions used in the analysis.

Table 1. Bicycle and Pedestrian Option 2 Variables and Definitions (McRae Phase 3)

Variable	Unit	Definition / Notes
Daily Emission Reduction	g/day	Total daily reduction in emissions from reduced auto activity (trip-end + running).
A	g/day	Reduction in auto trip-end emissions due to fewer auto trips.
B	g/day	Reduction in running exhaust emissions due to fewer auto miles traveled.
TEF_{auto}	g/trip	Auto trip-end emission factor (pollutant-specific: NO _x , VOC, PM, CO).
EF_{β}	g/mile	Speed-based running exhaust emission factor for the average pre-project auto speed (pollutant-specific: NO _x , VOC, PM, CO).
VTR	trips/day	Reduction in total daily auto vehicle trips.
VMTR	miles/day	Reduction in total daily auto vehicle miles traveled (VMT).
U_{β}	facility users	Bicycle facility users in the service zone.
U_p	facility users	Pedestrian facility users in the service zone.
N_p	persons	Estimated population in the service zone.
N_e	persons	Estimated total employment in the service zone.
I_{β}	index	Predicted Bicycle Needs Index (BNI) in the service zone.
I_p	index	Predicted Pedestrian Needs Index (PNI) in the service zone.

A (service zone area)	sq. mi.	Area of the service zone.
L_{β}	miles	Total length of bicycle facility in the service zone.
L_p	miles	Total length of pedestrian facility in the service zone.
D_{β}	miles	Bicycle facility buffer distance (default commonly used: 2.0 miles unless local basis provided).
D_p	miles	Pedestrian facility buffer distance (default commonly used: 0.5 miles unless local basis provided).
O_a	persons/vehicle	Auto occupancy (default commonly used: 1.13; may be set to 1.0 if assuming SOV only).
N	trips/person/day	Average number of trips per participant per day.
L	miles	Average trip length in the service zone.



Figure 2. McRae Phase 3, Google Streetview

3. INPUT DATA AND ASSUMPTIONS

To estimate emission reductions for the McRae Phase 3 bicycle and pedestrian improvements, the MOSERS tool requires a set of project-specific inputs for the selected strategy described in Section 2. This section summarizes the input data used to characterize the McRae corridor service zone and the proposed shared-use path and pedestrian-support facilities, and it documents the key assumptions applied in the Strategy 3.2 Bicycle and Pedestrian Programs – Option 2 (Facility Needs Index–Based Estimation) methodology.

3.1 BICYCLE AND PEDESTRIAN (OPTION 2)

The MOSERS inputs summarized in Table 2 were developed from project documentation for McRae Phase 3, MOSERS Strategy 3.2 Option 2 guidance, locally documented regional travel characteristics, and nationally recognized demographic sources, with engineering judgment applied where corridor-specific observations were not available for a sketch-planning CMAQ analysis. Inputs were selected to be conservative, transparent, and repeatable, consistent with the intent of Option 2, estimating how improved bicycle and pedestrian facilities within a defined service zone shift a portion of short auto trips to walking and bicycling, reducing vehicle trips, VMT, and associated emissions.

The analysis year and regional context were set to match the CMAQ application materials. The facility length assumptions reflect the project limits along McRae Boulevard from Montwood Drive to I-10, and the project scope (shared-use path and pedestrian-support improvements, including intersection ADA ramps/stripping, illumination, signage, and corridor amenities) supports application of the bicycle/pedestrian program methodology to this linear investment. The service zone was defined using a corridor catchment representing practical pedestrian access to improved facilities. A 0.5-mile pedestrian access distance is commonly used in planning applications as a walk shed; applying this buffer along an approximately 1.0-mile corridor yields a service-zone area of 1.8 square miles (Table 2).

Service-zone population was estimated using a planning-level density method: the service-zone area (1.8 square miles) was combined with representative City of El Paso population density from U.S. Census Bureau summary statistics to estimate 4,700 persons. Service-zone employment was estimated using a consistent planning-level employment-intensity assumption appropriate for an urban arterial corridor with nearby commercial

and employment-serving land uses, resulting in 2,400 employees within the same boundary.

Because corridor-specific BNI/PNI surfaces were not available, the analysis applied conservative, locally grounded proxy values based on El Paso regional journey-to-work mode shares reported from American Community Survey tabulations. A bicycle commute share of approximately 0.10% and a walk commute share of approximately 1.40% were converted to decimal proportions for the Option 2 inputs, yielding $I_b = 0.001$ and $I_p = 0.014$ (Table 2). This approach anchors participation to observed regional conditions and avoids overstating mode shift in the absence of a locally calibrated needs-index model.

Trip behavior inputs were selected to reflect short, utility-oriented travel most likely to shift with improved facilities. The average trip length was assumed to be 1.0 mile, consistent with corridor-scale walk/bike replacement trips, and national travel survey evidence that many active-mode trips are short. The average trips per participant per day were set to 2.0, representing an out-and-back utility pattern. The average auto trip speed used for speed-dependent running-exhaust factors was set to 35 mph, derived from the posted 40 mph speed limit reduced by 5 mph to reflect typical urban arterial operating conditions where signal control and intersection delay reduce average travel speed. Collectively, these assumptions provide an internally consistent set of MOSERS inputs for applying Strategy 3.2 Option 2 to McRae Phase 3, as summarized in Table 2.

Table 2. Bicycle and Pedestrian Strategy: MOSERS Inputs, Assumptions, and References

Input data Description	Data	Units	Assumption	Source
Metropolitan area	El Paso	—	Project is located within the El Paso metropolitan area as documented in project materials.	McRae Phase 3 project materials / ePRF
Analysis year	2029	year	Analysis year set to align with CMAQ application year identified for the project.	McRae Phase 3 project materials / ePRF
Road type	Urban–Freeway	—	McRae Boulevard is treated as an urban freeway corridor within the project limits for purposes of selecting representative operating conditions.	Project corridor context (McRae Blvd.) and standard functional classification practice
Estimated population in the service zone (N_p)	4,700	persons	Service-zone population estimated using a planning-level density method: service-zone area (1.8 sq mi) multiplied by representative City of El Paso population density, rounded for reporting.	U.S. Census Bureau population density summary (City of El Paso) + service-zone definition
Estimated total employment in the service zone (N_e)	2,400	persons	Service-zone employment estimated at planning level using an employment-intensity assumption appropriate for an urban arterial	U.S. Census Bureau LEHD/LODES workplace-employment framework (conceptual basis)

			corridor with commercial and employment-serving land uses; applied over the defined service-zone area.	
Bicycle Needs Index (BNI) (I_B)	0.001	—	Index set using a conservative, locally grounded proxy based on regional journey-to-work bicycle mode share. Bicycle commute share $\approx 0.10\%$ converted to a decimal proportion ($0.10 \div 100 = 0.001$).	El Paso MPO supporting documentation using American Community Survey commute-mode tabulations + MOSERS Option 2 index input structure
Pedestrian Needs Index (PNI) (I_P)	0.014	—	Index set using a conservative, locally grounded proxy based on regional journey-to-work walk mode share. Walk commute share $\approx 1.40\%$ converted to a decimal proportion ($1.40 \div 100 = 0.014$).	El Paso MPO supporting documentation using American Community Survey commute-mode tabulations + MOSERS Option 2 index input structure
Area of the service zone (A)	1.8	square miles	Service zone defined as a corridor catchment using a 0.5-mile pedestrian access buffer over an approximately 1.0-mile project length; area approximated using a corridor "capsule" geometry and rounded (≈ 1.8 sq mi).	Standard planning walk-shed convention (0.5-mile access) + project limits (Montwood to I-10, ~ 1 mile)
Total length of the bicycle facility in the service zone (L_B)	1	miles	Bicycle facility length set equal to the project corridor length between Montwood Drive and I-10, representing continuous bicycle-	Project limits (Montwood Drive to I-10) documented in project materials

			support exposure along the McRae Phase 3 limits.	
Total length of the pedestrian facility in the service zone (L_p)	1	miles	Pedestrian facility length is set equal to the project corridor length between Montwood Drive and I-10, representing continuous pedestrian-support exposure along the McRae Phase 3 limits.	Project limits (Montwood Drive to I-10) documented in project materials
Average number of trips per participant per day (N)	2	trips/person/day	Daily participation represented as an out-and-back utility trip pattern (two trips per participant per day), consistent with commute-oriented walk/bike participation assumptions in sketch-planning analyses.	MOSERS sketch-planning application conventions + engineering judgment (conservative utility-trip representation)
Average trip length in the service zone (L)	1	miles	Average replaced auto trip length assumed to be short and corridor-scale, consistent with typical walk/bike replacement trips and the linear extent of the project corridor.	National travel survey evidence that active-mode trips are frequently short + project corridor scale
Average trip speed in the service zone (pre-program auto speed) (v)	35	mph	Average operating speed assumed below posted speed due to signal control and intersection delay typical of urban arterials; set as posted 40 mph minus 5 mph (35 mph) to represent average corridor travel conditions.	Posted speed (field/Street View) + Highway Capacity Manual urban-street concept of average travel speed reflecting control delay

3.2 EMISSIONS FACTORS

Emission factors used in the MOSERS analysis were developed using the EPA MOVES model (version 4.0.3) to remain consistent with the emissions modeling framework used for conformity in the El Paso region. MOVES was executed to generate pollutant- and process-specific emission rates representative of local conditions for the analysis year (2029). The resulting outputs were then post-processed and formatted as emission rate lookup tables (ERLTs) (see Appendix B) so they could be imported into MOSERS and applied directly within the tool. These lookup tables provide the emission factors needed to quantify changes in emissions associated with the project strategies, including running exhaust (used with VMT reductions) and start/trip-end emissions (used with reductions in vehicle trips), ensuring that MOSERS calculations are based on MOVES-derived rates aligned with regional conformity assumptions.

For the Bicycle and Pedestrian strategy, the running exhaust emission factors used in the calculations were obtained from *ERLT_Running*, while the auto trip-end (start) emission factors were obtained from *ERLT_Starts*. To develop these ERLTs, MOVES emission-rate runs were completed for both summer and winter seasonal conditions. To represent a conservative analysis, the ERLTs were populated using the maximum emission rate observed across the seasonal runs for each pollutant/process combination.

To retrieve the specific emission factors applied in the MOSERS workbooks (Appendix A), the ERLTs were filtered consistently to match the project context. For all ERLTs, records were filtered by Source Type Name = "Auto" and then limited to Road Type ID = 4, which represents Urban Restricted Access (urban freeway) conditions in MOVES. For *ERLT_Running* (used in the Bicycle and Pedestrian calculations), the table was further filtered by speed to select 35 mph, representing the approximate average operating speed used in the analysis. This consistent filtering approach ensures the emission factors applied by MOSERS reflect the roadway and operating conditions assumed for the McRae Phase 3 project while maintaining alignment with regional MOVES-based conformity inputs

4. SUMMARY OF RESULTS

The emissions analysis results are summarized in Table 3, which presents the estimated daily emission reductions by pollutants for the Bicycle and Pedestrian strategy. These values were taken directly from the MOSERS outputs and reflect the method described in Section 2, using the project-specific input data and assumptions documented in Section 3. The MOSERS calculation workbook used to generate these results is included in Appendix A for reference. Overall, the results indicate that implementing the proposed improvements at McRae Phase 3 is expected to produce measurable air quality benefits across the pollutants evaluated.

Table 3. CMAQ Analysis Emissions Reductions

Pollutant	Bicycle and Pedestrian (Kg/day)	Bicycle and Pedestrian (lbs/day)
CO	0.246	0.543
CO ₂	21.860	48
NO _x	0.034	0.075
VOC	0.018	0.039
PM ₁₀	0.001	0.002

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APPENDIX A: MOSERS WORKBOOK FOR BICYCLE AND PEDESTRIAN OPTION 2 (ELECTRONIC ONLY)

APPENDIX B: EMISSIONS LOOKUP TABLES (ERLT) FOR MOSERS INPUT (ELECTRONIC ONLY)



Congestion Mitigation and Air Quality (CMAQ) Analysis-Paul Harvey Park Trail

Prepared for City of El Paso

February 2026

Texas A&M Transportation Institute



TECHNICAL REPORT

Technical Documentation

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1. TASK SUMMARY

The City of El Paso requested technical assistance from the Texas A&M Transportation Institute to develop a Congestion Mitigation and Air Quality Improvement Program (CMAQ) analysis for the Paul Harvey Park Trail project (see Figure 1 for the project location). The project consists of construction of a shared-use path connecting Paul Harvey Park to the Westside Natatorium, generally following an existing social trail behind the Bluff Canyon Circle / Bel Mar Avenue area and connecting toward Mesa Hills Drive, with project limits identified from De Leon Drive to Sunland Park.

The primary objective of this effort is to support preparation of CMAQ documentation for submittal to the appropriate MPO and other relevant agencies by providing an updated, defensible estimate of air quality benefits. The analysis quantifies reductions in vehicle trips and vehicle miles traveled (VMT) expected to occur when travelers choose to walk or bicycle instead of driving due to improved bicycle and pedestrian facilities and connectivity provided by the trail project.

The emissions analysis presented in this report follows the Texas Department of Transportation MOSERS methodology using Strategy 3.2 Bicycle and Pedestrian Programs – Option 2 (Facility Needs Index–Based Estimation). Under this approach, the share of travelers attracted to bicycle or walk rather than drive is estimated using the facility needs index together with service-zone population and employment, corridor and buffer characteristics, and trip parameters. The resulting reduction in vehicle trips and VMT is then converted to pollutant reductions using standard emissions equations and applicable emissions factors. Data sources and assumptions used in the analysis are

documented, MOSERS equations and variables are summarized, and results are presented for the selected strategy.

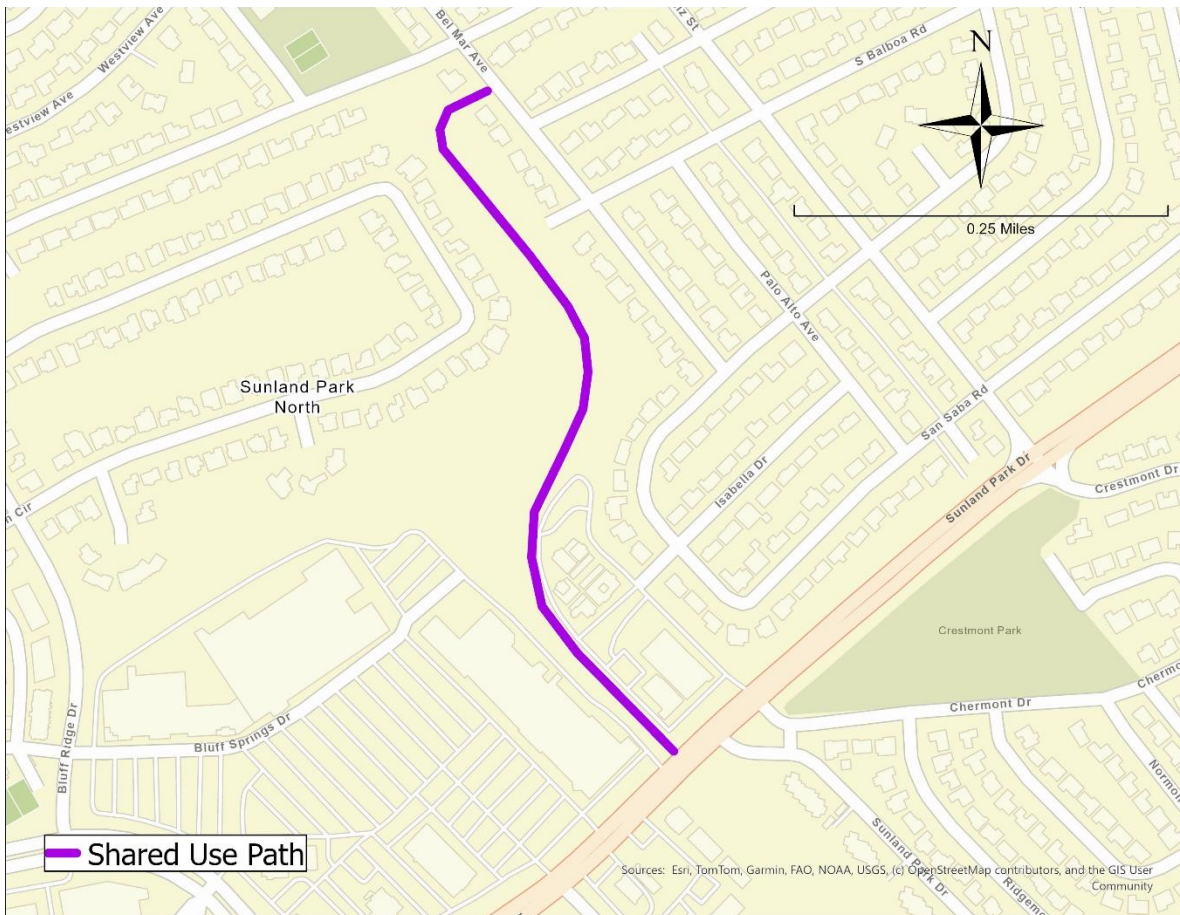


Figure 1. Paul Harvey Park Trail. from De Leon Dr to Sunland Park

2. STRATEGY AND METHODOLOGY

The Texas Guide to Accepted Mobile Source Emission Reduction Strategies (commonly known as the MOSERS Guide) is a set of reference documents and tools for Texas transportation practitioners undertaking air quality planning. The intent of MOSERS is to provide guidance and resources for transportation of air quality practitioners to understand and evaluate mobile-source emissions-reduction strategies. The MOSERS guide was originally developed by TTI in 2003 and updated subsequently in 2007, and 2020. After a thorough review by the research team, the strategy implemented in the Paul Harvey park trail project is “Bicycle and Pedestrian” (strategy 3.2 option 2).

2.1 BICYCLE AND PEDESTRIAN (OPTION 2)

Bicycle and pedestrian programs reduce vehicle trips, vehicle miles traveled (VMT), and associated emissions by encouraging travelers to choose walking or bicycling in place of driving, particularly for short, local trips that can reasonably shift modes when safe, comfortable facilities are available. For the Paul Harvey Park Trail project, the selected approach is MOSERS Strategy 3.2 – Option 2 (Facility Needs Index–Based Estimation), which quantifies emissions benefits based on how improved bicycle and pedestrian facilities within a defined service zone attract new walking and bicycling activity that would otherwise be made by automobile. The Paul Harvey Park Trail project supports this mode shift by providing a shared-use path connection between Paul Harvey Park and the Westside Natatorium, improving active transportation connectivity and user comfort by formalizing and enhancing a corridor that currently functions as an informal route.

Option 2 is a facility-needs-index–based estimation approach. Rather than starting from household counts, it uses predicted Bicycle Needs Index (BNI) and Pedestrian Needs Index (PNI) values to estimate the percentage of people in the service zone who would be attracted to bicycle or walk after the facility is provided. Participants are estimated using service-zone population and employment, together with facility lengths, buffer distances, trip characteristics, and auto occupancy. When trips shift to walking or bicycling, the associated vehicle trips and VMT are assumed to be eliminated, and emissions benefits are calculated from the reduced vehicle activity using the MOSERS equations and applicable emission factors. This method is most applicable in populated areas with existing or planned bicycle/pedestrian connectivity—such as park and community destinations—where improved facilities can plausibly replace short trips by providing a direct, continuous, and lower-stress route.

Emissions Equations

$$\text{Daily Emission Reduction (grams/day)} = A + B$$

Reduction in auto trip-end (start) emissions from reduced trips

$$A = VT_R \times TEF_{AUTO}$$

Reduction in running exhaust emissions from reduced auto VMT

$$B = VMT_R \times EF_B$$

Where:

VT_R = reduction in number of daily auto vehicle trips (trips/day)

VMT_R = reduction in daily auto vehicle miles traveled (miles/day)

TEF_{AUTO} = auto trip-end emission factor (grams/trip) (pollutant-specific)

EF_B = speed-based running exhaust emission factor for average pre-program auto speed (grams/mile) (pollutant-specific)

Activity Methodology (Facility Needs Index–Based)

Option 2 estimates bicycle and pedestrian facility users in the service zone, then converts those users into reduced vehicle trips and VMT:

Bicycle facility users:

$$U_B = (N_P \cdot I_B + N_E \cdot I_B) \cdot L_B \cdot D_B$$

Pedestrian facility users:

$$U_P = (N_P \cdot I_P + N_E \cdot I_P) \cdot L_P \cdot D_P$$

Reduced daily auto trips:

$$VTR = \frac{(U_B + U_P) \cdot N}{O_A}$$

Reduced daily auto VMT:

$$VMTR = VTR \cdot L$$

The MOSERS calculator for Strategy 3.2, Option 2 estimates daily emissions benefits by linking expected travel behavior changes to reductions in automobile activity. The process begins by estimating how many people within the defined service zone would be attracted to walk or bicycle after the Paul Harvey Park Trail improvements are

implemented. That participation estimate is based on service-zone population and employment, the bicycle and pedestrian needs indices, the length of bicycle and pedestrian facilities available within the zone, assumed buffer distances that represent the area of influence of those facilities, basic trip characteristics, and average vehicle occupancy. Once the expected number of new walk and bike users is calculated, the methodology converts that participation into the number of daily vehicle trips avoided and the daily vehicle miles traveled avoided. These reduced vehicle activities are then translated into pollutant reductions by applying appropriate trip-end and running exhaust emission factors. Table 1 summarizes the variables referenced throughout the activity and emissions calculations, including each variable's unit and definition, to ensure the analysis is transparent and reproducible. Figure 2 presents a Street View image of the Paul Harvey Park Trail corridor, which documents existing site conditions and provides visual context for the proposed trail improvements and service-zone assumptions used in the analysis.

Table 1. Bicycle and Pedestrian Option 2 Variables and Definitions (Paul Harvey Park Trail)

Variable	Unit	Definition / Notes
Daily Emission Reduction	g/day	Total daily reduction in emissions from reduced auto activity (trip-end + running).
A	g/day	Reduction in auto trip-end emissions due to fewer auto trips.
B	g/day	Reduction in running exhaust emissions due to fewer auto miles traveled.
TEF_{auto}	g/trip	Auto trip-end emission factor (pollutant-specific: NO _x , VOC, PM, CO).
EF_{β}	g/mile	Speed-based running exhaust emission factor for the average pre-project auto speed (pollutant-specific: NO _x , VOC, PM, CO).
VTR	trips/day	Reduction in total daily auto vehicle trips.
VMTR	miles/day	Reduction in total daily auto vehicle miles traveled (VMT).
U_{β}	facility users	Bicycle facility users in the service zone.

U_p	facility users	Pedestrian facility users in the service zone.
N_p	persons	Estimated population in the service zone.
N_e	persons	Estimated total employment in the service zone.
I_β	index	Predicted Bicycle Needs Index (BNI) in the service zone.
I_p	index	Predicted Pedestrian Needs Index (PNI) in the service zone.
A (service zone area)	sq. mi.	Area of the service zone.
L_β	miles	Total length of bicycle facility in the service zone.
L_p	miles	Total length of pedestrian facility in the service zone.
D_β	miles	Bicycle facility buffer distance (default commonly used: 2.0 miles unless local basis provided).
D_p	miles	Pedestrian facility buffer distance (default commonly used: 0.5 miles unless local basis provided).
O_a	persons/vehicle	Auto occupancy (default commonly used: 1.13; may be set to 1.0 if assuming SOV only).
N	trips/person/day	Average number of trips per participant per day.
L	miles	Average trip length in the service zone.



Figure 2. Paul Harvey Park Trail (Start-End), Google Streetview

3. INPUT DATA AND ASSUMPTIONS

To estimate emission reductions for the Paul Harvey Park Trail project, the MOSERS tool requires a set of project-specific inputs for the selected strategy described in Section 2. This section summarizes the input data used to characterize the trail service zone and the proposed shared-use path connection between Paul Harvey Park and the Westside Natatorium, and it documents the key assumptions applied in the Strategy 3.2 Bicycle and Pedestrian Programs – Option 2 (Facility Needs Index–Based Estimation) methodology.

3.1 BICYCLE AND PEDESTRIAN (OPTION 2)

The MOSERS inputs summarized in Table 2 were developed from Paul Harvey Park Trail project documentation, MOSERS Strategy 3.2 Option 2 guidance, locally documented regional travel characteristics, and nationally recognized demographic sources, with engineering judgment applied where corridor-specific observations were not available for a sketch-planning CMAQ analysis. Inputs were selected to be conservative, transparent, and repeatable, consistent with the intent of Option 2, estimating how improved bicycle and pedestrian facilities within a defined service zone shift a portion of short auto trips to walking and bicycling, reducing vehicle trips, VMT, and associated emissions.

The analysis year (2031) and regional context (El Paso metropolitan area) were set to align with the CMAQ application materials. Facility inputs reflect the shared-use path connection between Paul Harvey Park and the Westside Natatorium. The trail length used for the bicycle and pedestrian facility inputs was measured in Google Maps using the “Measure distance” tool along the trail alignment. The measured length is 2,421.92 feet, which converts to 0.459 miles (2,421.92 ÷ 5,280). This value is used for both facility-length inputs ($L_b = L_p = 0.46$ miles, rounded), and the measurement approach and endpoints are documented in Figure 3.

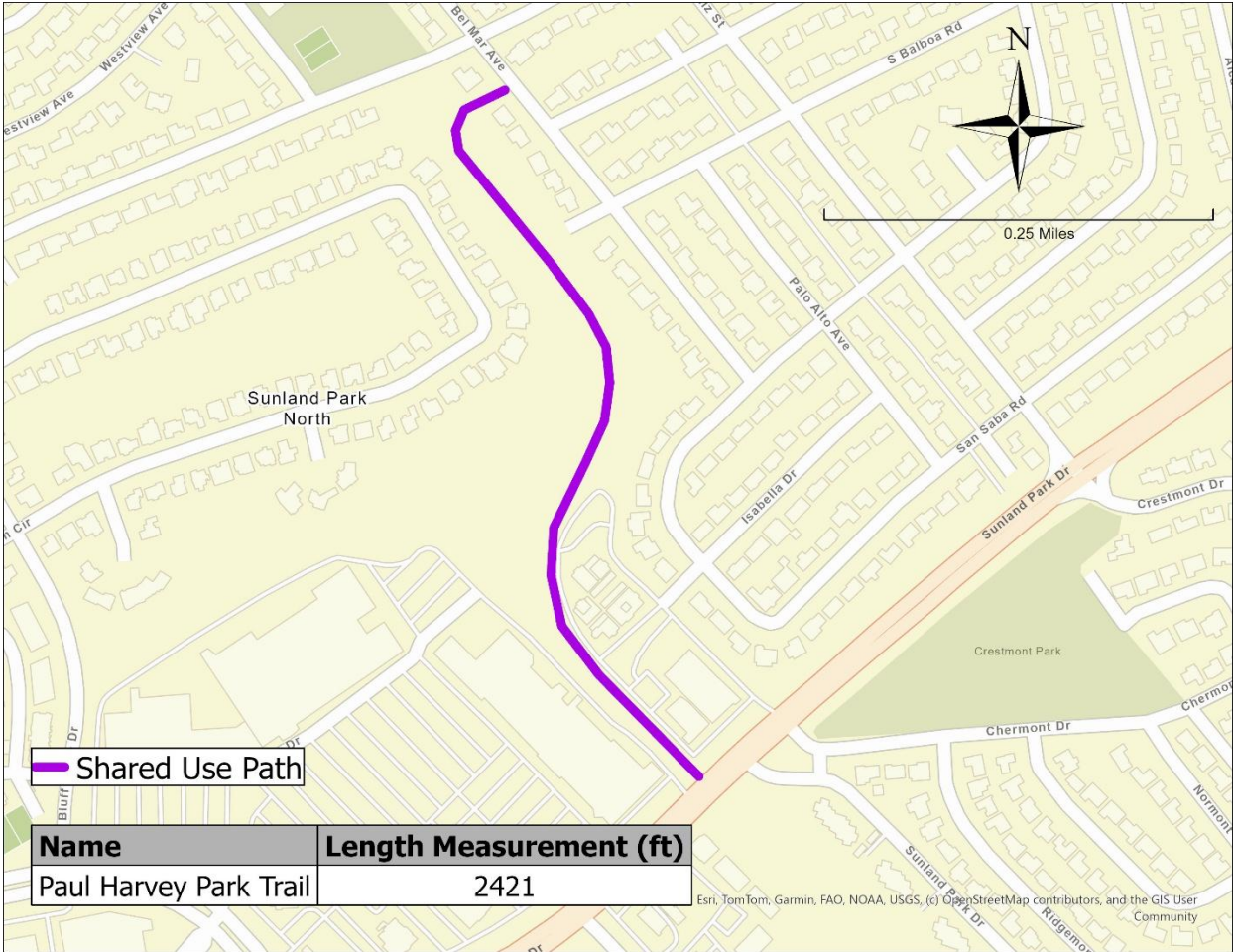


Figure 3. Paul Harvey Park Trail Length Measurement

The service zone was defined using a corridor catchment representing practical pedestrian access to the facility. A 0.5-mile pedestrian access distance is commonly used in planning applications as a walk shed and aligns with buffer-based concepts used in sketch methods for bicycle and pedestrian strategies. Service-zone area was approximated using a “capsule” geometry (a buffered corridor with semicircular ends), computed as $A = (2 \times r$

$\times L) + (\pi \times r^2)$. Using $r = 0.5$ miles and $L = 0.459$ miles, $A = (2 \times 0.5 \times 0.459) + (\pi \times 0.25) = 0.459 + 0.785 = 1.244$, reported as 1.24 square miles in Table 2.

Service-zone population ($N_p = 3,200$ persons) was estimated using a planning-level density method by applying representative City of El Paso population density from U.S. Census Bureau summary statistics to the calculated service-zone area and rounding for reporting. Service-zone employment ($N_e = 750$ persons) was estimated using a conservative planning-level employment intensity consistent with the residential/park context and localized commercial activity in the project vicinity, consistent with the conceptual basis of U.S. Census Bureau LEHD/LODES workplace-employment characterization.

Because corridor-specific BNI/PNI surfaces were not available, the analysis applied conservative proxy values based on El Paso regional journey-to-work mode shares reported from American Community Survey commute-mode tabulations and summarized in regional/MPO documentation. A bicycle commute share of approximately 0.10% and a walk commute share of approximately 1.40% were converted to decimal proportions for the Option 2 index inputs, yielding $I_b = 0.001$ and $I_p = 0.014$ (Table 2). Trip behavior inputs were selected to reflect short, utility-oriented travel: $N = 2.0$ trips/person/day represents a conservative out-and-back pattern, and $L = 0.7$ miles represents the measured pre-program driving distance between key endpoints served by the trail connection. The average auto trip speed ($v = 30$ mph) represents displaced auto travel on adjacent urban streets; it was derived from the posted 35 mph speed limit reduced by 5 mph to reflect typical urban operating conditions with intersection control and access friction, consistent with standard urban-street concepts of average travel speed inclusive of control delay.

Table 2. Bicycle and Pedestrian Strategy: MOSERS Inputs, Assumptions, and References

Input data Description	Data	Units	Assumption	Source
Metropolitan area	El Paso	—	Project is located within the El Paso metropolitan area as documented in project materials.	Paul Harvey Park Trail project materials / ePRF
Analysis year	2031	year	Analysis year set to align with CMAQ application year identified for the project.	Paul Harvey Park Trail project materials / ePRF
Road type	Urban-Freeway	—	Road type selected to represent the urban street network on which short local auto trips would occur in the absence of the trail connection.	MOSERS input category definitions + project area context
Estimated population in the service zone (N_p)	3,200	persons	Service-zone population estimated using a planning-level density method: service-zone area ($A \approx 1.24$ sq mi) multiplied by representative City of El Paso population density; rounded for reporting.	U.S. Census Bureau (City of El Paso population density) + service-zone geometry assumption
Estimated total employment in the service zone (N_e)	750	persons	Service-zone employment estimated using a conservative planning-level employment intensity consistent with a residential/park context with localized commercial nodes; applied over the defined service-zone area and rounded.	U.S. Census Bureau LEHD/LODES framework (method basis) + engineering judgment for land-use context shown in project vicinity

Bicycle Needs Index (BNI) (I_{β})	0.001	—	Index set using a locally grounded proxy based on regional journey-to-work bicycle mode share (~0.10%) converted to a decimal proportion for MOSERS Option 2 input (0.10 ÷ 100).	ACS commute-mode tabulations as summarized in El Paso regional/MPO documentation + MOSERS Option 2 index input structure
Pedestrian Needs Index (PNI) (I_p)	0.014	—	Index set using a locally grounded proxy based on regional journey-to-work walk mode share (~1.40%) converted to a decimal proportion for MOSERS Option 2 input (1.40 ÷ 100).	ACS commute-mode tabulations as summarized in El Paso regional/MPO documentation + MOSERS Option 2 index input structure
Area of the service zone (A)	1.24	square miles	Service zone defined as a corridor catchment using a 0.5-mile pedestrian access buffer over the measured trail length (2,421.92 ft = 0.459 mi); area approximated using a corridor "capsule" geometry and rounded.	Standard planning walkshed convention (0.5-mile access) + Google Maps distance measurement + geometric approximation
Total length of the bicycle facility in the service zone (L_{β})	0.46	miles	Bicycle facility length represented by the measured trail alignment length (2,421.92 ft converted to miles).	Google Maps "Measure distance" tool (trail alignment)
Total length of the pedestrian facility in the service zone (L_p)	0.46	miles	Pedestrian facility length represented by the measured trail alignment length (2,421.92 ft converted to miles).	Google Maps "Measure distance" tool (trail alignment)

Average number of trips per participant per day (N)	2	trips/person/day	Daily participation represented as an out-and-back utility trip pattern (two trips per participant per day), consistent with sketch-planning walk/bike participation assumptions.	MOSERS sketch-planning application convention + engineering judgment (conservative utility-trip representation)
Average trip length in the service zone (L)	0.7	miles	Average replaced auto trip length represented by the measured current driving distance between key activity endpoints served by the trail connection.	Google Maps driving distance measurement (project area)
Average trip speed in the service zone (pre-program auto speed) (v)	30	mph	Average operating speed assumed below posted speed due to signal control and intersection delay typical of urban streets; set as posted 35 mph minus 5 mph to represent average travel speed.	Posted speed (field/Street View) + HCM urban-street concept of average travel speed reflecting control delay

3.2 EMISSIONS FACTORS

Emission factors used in the MOSERS analysis were developed using the EPA MOVES model (version 4.0.3) to remain consistent with the emissions modeling framework used for conformity in the El Paso region. MOVES was executed to generate pollutant- and process-specific emission rates representative of local conditions for the analysis year (2031). The resulting outputs were then post-processed and formatted as emission rate lookup tables (ERLTs) (see Appendix B) so they could be imported into MOSERS and applied directly within the tool. These lookup tables provide the emission factors needed to quantify changes in emissions associated with the project strategies, including running exhaust (used with VMT reductions) and start/trip-end emissions (used with reductions in vehicle trips), ensuring that MOSERS calculations are based on MOVES-derived rates aligned with regional conformity assumptions.

For the Bicycle and Pedestrian strategy, the running exhaust emission factors used in the calculations were obtained from *ERLT_Running*, while the auto trip-end (start) emission factors were obtained from *ERLT_Starts*. To develop these ERLTs, MOVES emission-rate runs were completed for both summer and winter seasonal conditions. To represent a conservative analysis, the ERLTs were populated using the maximum emission rate observed across the seasonal runs for each pollutant/process combination.

To retrieve the specific emission factors applied in the MOSERS workbooks (Appendix A), the ERLTs were filtered consistently to match the project context. For all ERLTs, records were filtered by Source Type Name = "Auto" and then limited to Road Type ID = 4, which represents Urban Restricted Access (urban freeway) conditions in MOVES. For *ERLT_Running* (used in the Bicycle and Pedestrian calculations), the table was further filtered by speed to select 30 mph, representing the approximate average operating speed used in the analysis. This consistent filtering approach ensures the emission factors applied by MOSERS reflect the roadway and operating conditions assumed for the McRae Phase 3 project while maintaining alignment with regional MOVES-based conformity inputs

4. SUMMARY OF RESULTS

The emissions analysis results are summarized in Table 3, which presents the estimated daily emission reductions by pollutants for the Bicycle and Pedestrian strategy. These values were taken directly from the MOSERS outputs and reflect the method described in Section 2, using the project-specific input data and assumptions documented in Section 3. The MOSERS calculation workbook used to generate these results is included in Appendix A for reference. Overall, the results indicate that implementing the new Paul Harvey Park Trail is expected to produce measurable air quality benefits across the pollutants evaluated.

Table 3. CMAQ Analysis Emissions Reductions

Pollutant	Bicycle and Pedestrian (Kg/day)	Bicycle and Pedestrian (lbs/day)
CO	0.080	0.176
CO ₂	6.245	13.768
NO _x	0.012	0.027
VOC	0.006	0.013
PM ₁₀	0.00025	0.001

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APPENDIX A: MOSERS WORKBOOK FOR BICYCLE AND PEDESTRIAN OPTION 2 (ELECTRONIC ONLY)

APPENDIX B: EMISSIONS LOOKUP TABLES (ERLT) FOR MOSERS INPUT (ELECTRONIC ONLY)



Congestion Mitigation and Air Quality (CMAQ) Analysis-Horizon City TOD

Prepared for Horizon City

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Texas A&M Transportation Institute



TECHNICAL REPORT

Technical Documentation

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1. TASK SUMMARY

The Town of Horizon City requested technical assistance from the Texas A&M Transportation Institute (TTI) to develop Congestion Mitigation and Air Quality Improvement Program (CMAQ) analyses for a phased transit initiative supporting a planned Transit Oriented Development (TOD) and associated transit plaza in Horizon City. The Town has identified three implementation stages with anticipated completion in 2026 (local circulator service), 2027 (transit plaza/TOD hub), and 2028 (express transit connection between Horizon City and the University of Texas at El Paso [UTEP]). Consistent with this phased delivery, this report presents three separate CMAQ analyses, one for each stage, to quantify the distinct emissions benefits associated with each scope element and its expected effect on travel behavior and transit operations.

The primary objective of this effort is to support preparation of CMAQ documentation for submission to the appropriate Metropolitan Planning Organization (MPO) and other relevant agencies by providing defensible estimates of air quality benefits. The analyses focus on emissions reductions achieved when a portion of travel demand shifts from automobile travel to transit due to expanded service coverage, improved access to transit, and enhanced passenger facilities associated with the phased program. The transit concept is anchored by a planned plaza site within the TOD area near Rodman Street and Corky Park, co-located with the future City Hall, and includes implementation of two transit routes (an express connection to UTEP and a circulator connection serving local destinations).

The emissions analyses presented in this report follow the Texas Department of Transportation MOSERS methodology using Strategy 1.1 Transit System/Service Expansion and Replacement, applied here as Transit System / New Transit to represent new service introduction rather than a replacement scenario. Under this approach, net daily emissions benefits are estimated by (1) quantifying the reduction in automobile trips and vehicle miles traveled (VMT) associated with new transit ridership and (2) accounting for emissions generated by the added transit vehicle activity. Figures in this report provide spatial context for each stage: Figure 1 depicts the planned circulator service concept,

Figure 2 identifies the proposed transit plaza site location, and Figure 3 illustrates the planned express connection between Horizon City and UTEP.

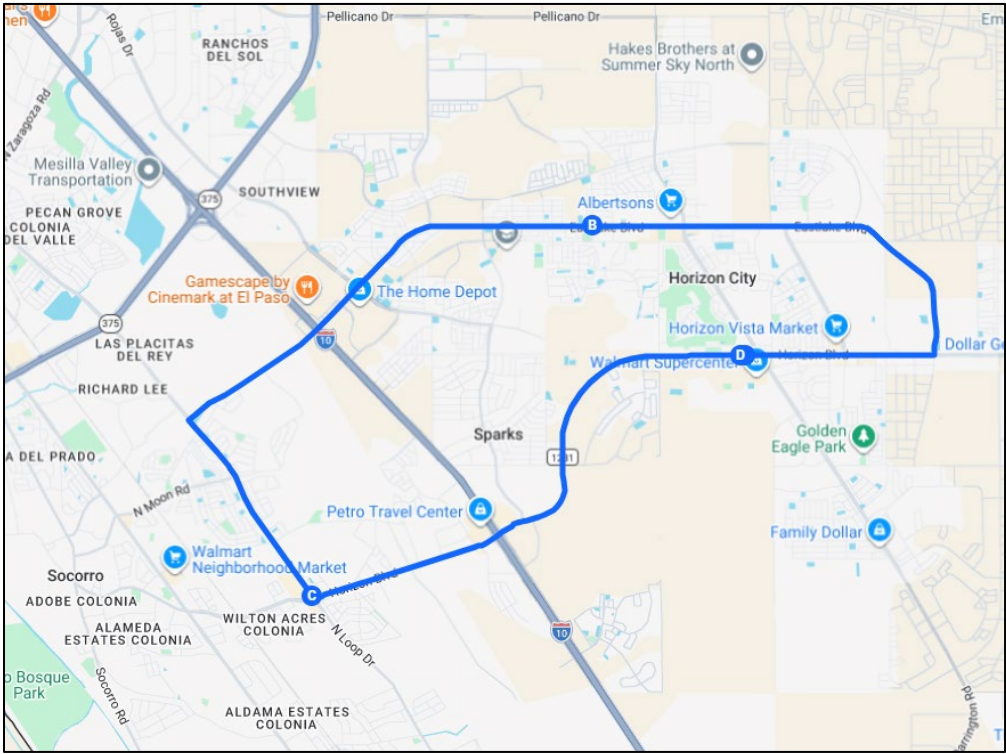


Figure 1. Horizon City to Socorro Circulator

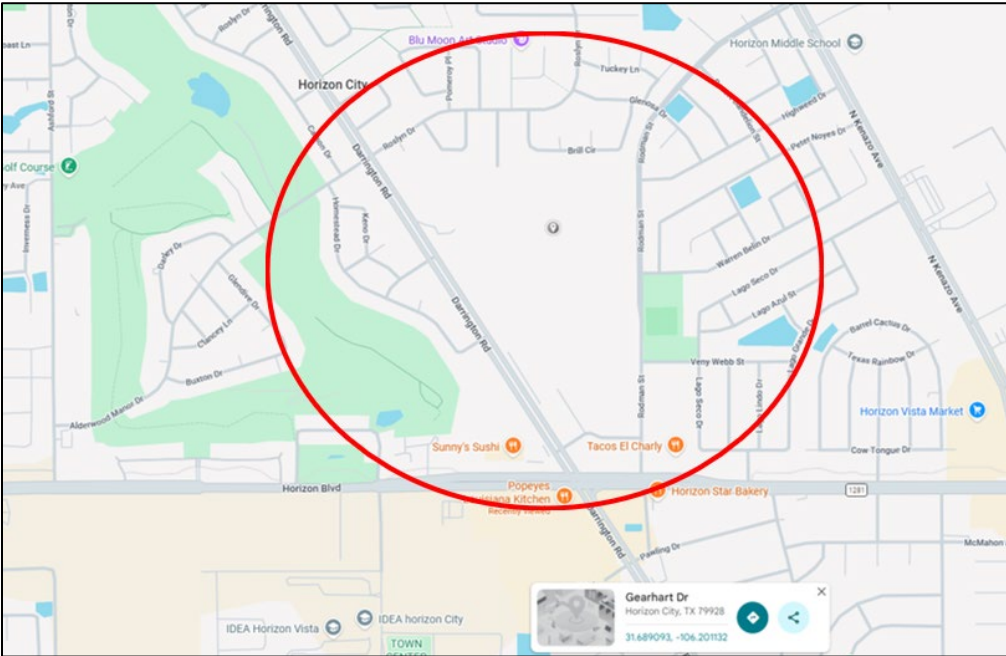


Figure 2. Horizon City transit plaza/TOD

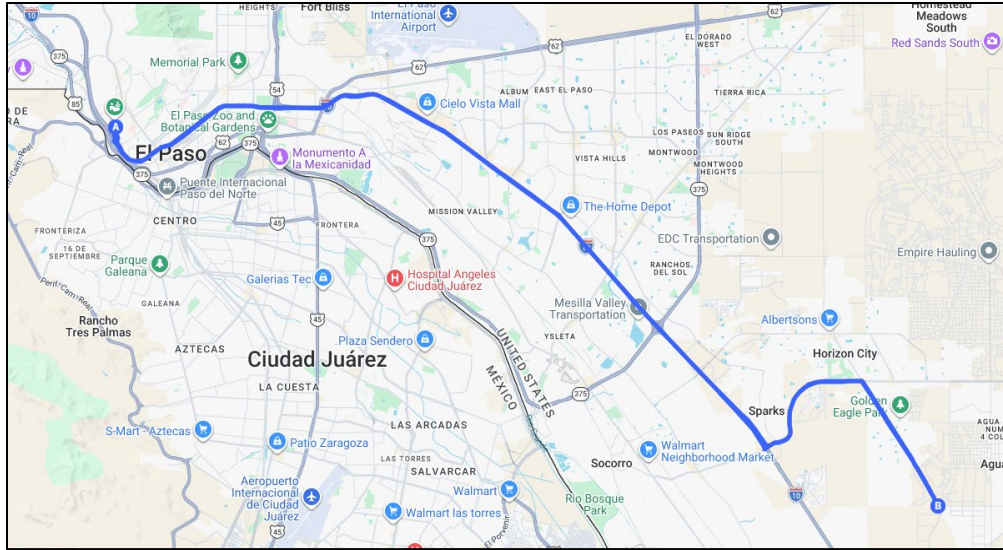


Figure 3. Representative transit service connection from Horizon City to UTEP

2. STRATEGY AND METHODOLOGY

The Texas Guide to Accepted Mobile Source Emission Reduction Strategies (MOSERS) is a set of reference guidance and sketch-planning tools used by Texas transportation and air quality practitioners to develop consistent, defensible estimates of emissions benefits from transportation control measures. MOSERS provides standardized methodologies, input definitions, and calculation procedures to evaluate how changes in travel activity (e.g., shifts in trips and vehicle miles traveled [VMT]) and vehicle operations translate into changes in criteria pollutants and greenhouse gas emissions.

For the Horizon City CMAQ analyses, the selected methodology is MOSERS Strategy 1.1, applied in this report as Transit System / New Transit to represent introduction of new transit service. Under this approach, net daily emissions benefits are quantified by estimating (1) reductions in automobile trips and VMT attributable to new transit ridership and (2) the emissions associated with the added transit vehicle activity required to provide the new service. Because the project is being modeled as new transit service, replacement-related terms and inputs in the MOSERS framework are treated as not applicable (i.e., the “before” service and fleet replacement components are not used), and the analysis focuses on the incremental change attributable to the proposed service.

2.1 TRANSIT SYSTEM/NEW TRANSIT

Transit System / New Transit reduces regional emissions by shifting a portion of person-trips from private automobiles to transit, thereby reducing automobile trips and vehicle miles traveled (VMT) within the affected travel market. For Horizon City, the project is intended to introduce enhanced transit connectivity anchored by a proposed transit plaza associated with the planned Transit Oriented Development (TOD). The phased program includes three implementation stages: completion of a local circulator in 2026, construction of the Horizon City transit plaza in 2027, and implementation of an express transit connection between Horizon City and the University of Texas at El Paso (UTEP) in 2028. Collectively, these improvements are intended to increase transit accessibility and attractiveness by improving service availability, connectivity, and passenger facilities, thereby increasing ridership and reducing automobile travel demand.

The methodology estimates emissions impacts by accounting for both the reduction in automobile activity and the increase in transit vehicle activity associated with providing new service. Transit vehicle trips and transit VMT are calculated from the proposed peak and off-peak headways, the service hours in each period, and the one-way corridor length. Daily ridership is then allocated between peak and off-peak periods using ridership factors, and the share of riders assumed to have otherwise traveled by automobile is used to estimate reductions in auto trips and auto VMT within the transit service area. Net emissions benefits are calculated by applying trip-end and running-exhaust emission factors to (1) reduced automobile trips/VMT and (2) added transit vehicle trips/VMT associated with the new service. This approach is most applicable where new transit services can reasonably attract riders from automobile travel, particularly when service connects residential areas to major employment, education, and activity centers and is supported by accessible, well-located passenger facilities such as a central transit plaza.

Emissions Equations

$$\text{Daily Emission Reduction} \left(\frac{\text{grams}}{\text{day}} \right) = A + B - C - D$$

Reduction in auto start emissions from trips reduced

$$B = VMT_{R,P} \times EF_{AUTO,P} + VMT_{R,OP} \times EF_{AUTO,OP}$$

Reduction in auto running exhaust emissions from VMT reductions

$$C = VT_{BUS} \times TEF_{BUS}$$

Increase in emissions from additional bus Starts

$$D = VMT_{BUS,P} \times EF_{BUS,P} + VMT_{BUS,OP} \times EF_{BUS,OP}$$

Increase in emissions from additional bus running exhaust emissions

Activity Methodologies

For transit trips and transit VMT

$$VT_{BUS} = VT_{BUS,P} + VT_{BUS,OP}$$

$$VT_{BUS,P} = \frac{1}{H_{BUS,P}} \times h_P$$

$$VT_{BUS,OP} = \frac{1}{H_{BUS,OP}} \times h_{OP}$$

$$VMT_{BUS,P} = VT_{BUS,P} \times L_{BUS}$$

$$VMT_{BUS,OP} = VT_{BUS,OP} \times L_{BUS}$$

For auto trips and auto VMT

$$VT_R = VT_{R,P} + VT_{R,OP}$$

$$VMT_R = VMT_{R,P} + VMT_{R,OP}$$

$$R = R_P + R_{OP}$$

$$R_P = R \times F_P \times h_P$$

$$R_{OP} = R \times F_{OP} \times h_{OP}$$

$$VT_{R,P} = \frac{R_P \times r_R \times (1 - P_C)}{O_A} + \frac{R_P \times r_R \times P_C}{O_C}$$

$$VT_{R,OP} = \frac{R_{OP} \times r_R \times (1 - P_C)}{O_A} + \frac{R_{OP} \times r_R \times P_C}{O_C}$$

$$VMT_{R,P} = VT_{R,P} \times L_A$$

$$VMT_{R,OP} = VT_{R,OP} \times L_A$$

The MOSERS calculator for Strategy 1.1 (Transit System / New Transit) estimates daily emissions benefits by linking changes in travel activity associated with new transit services to changes in both automobile and transit vehicle emissions. The procedure begins by characterizing the proposed transit service in terms of corridor length, service span, and peak and off-peak headways, which are used to estimate the number of transit vehicle trips and transit vehicle miles traveled (VMT) in the “once implemented”. Daily ridership is then allocated between peak and off-peak periods using standard ridership factors, and the share of transit riders who would have otherwise traveled by automobile is applied to estimate the reduction in automobile trips and automobile VMT within the service area.

Once the changes in auto activity and transit activity are quantified, the methodology applies trip-end and running-exhaust emission factors to compute net pollutant impacts. Specifically, emissions reductions from decreased automobile Starts and running exhaust are combined with the incremental emissions associated with new transit vehicle starts and transit running exhaust, yielding a net daily emissions benefit consistent with the MOSERS equations. Table 1, Table 2 and Table 3 summarize the project variables inputs used in these activity and emissions calculations

Table 1. Strategy 1.1 (Transit System / New Transit)-Variables and Definitions (Emissions Factors)

Variable	Unit	Definition / Notes
$EF_{\text{AUTO,P}}$	grams/mile	Speed-based running exhaust emission factor for affected roadway during peak hours (pollutant-specific: NO _x , VOC, PM, CO).
$EF_{\text{AUTO,OP}}$	grams/mile	Speed-based running exhaust emission factor for affected roadway during off-peak hours (pollutant-specific).
$EF_{\text{BUS,P}}$	grams/mile	Speed-based running exhaust emission factor for transit vehicle during peak hours (pollutant-specific).
$EF_{\text{BUS,OP}}$	grams/mile	Speed-based running exhaust emission factor for transit vehicle during off-peak hours (pollutant-specific).

TEF _{AUTO}	grams/trip	Auto trip-end emission factor (trip start / trip-end; pollutant-specific).
TEF _{BUS}	grams/trip	Bus (or other transit vehicle) trip-end emission factor (pollutant-specific).

Table 2. Strategy 1.1 (Transit System / New Transit)-Variables and Definitions (Service Inputs)

Variable	Unit	Definition / Notes
H _{BUS,P}	minutes/vehicle	Proposed average transit headway during peak hours
H _{BUS,OP}	minutes/vehicle	Proposed average transit headway during off-peak hours
L _{BUS}	mile	Transit corridor length (route length used for the service).
h _P	hour	Proposed service hours during peak hours.
h _{OP}	hour	Proposed service hours during off-peak hours.
R	riders/day	Estimated typical daily transit ridership (total daily riders used by MOSERS).
r _{R,A}	percent	Percent of transit riders who would have been auto drivers (mode-shift parameter).
L _A	mile	Average auto trip length within the buffer distance of the new transit service (used to estimate reduced auto VMT).
V _{B,P}	mph	Estimated transit speed along the corridor during peak hours.
V _{B,OP}	mph	Estimated transit speed along the corridor during off-peak hours.
V _{A,P}	mph	Current auto average speed along the corridor during peak hours.
V _{A,OP}	mph	Current auto average speed along the corridor during off-peak hours.
O _A	persons/vehicle	Average auto occupancy (MOSERS default: 1.13; local value may be used if available).

O_C	persons/vehicle	Carpool occupancy (MOSERS default: 2.31; local value may be used if available).
P_C	percent	Percent of riders who would have been auto drivers and were carpooled (MOSERS default: 50%).
F_P	—	Peak-hour ridership factor (allocates daily ridership to peak period).
F_{OP}	—	Off-peak ridership factor (allocates daily ridership to off-peak period).

Table 3. Strategy 1.1 (Transit System / New Transit Variables and Definitions (Derived Activity Outputs))

Variable	Unit	Definition / Notes
$VT_{BUS,P}$	trips	Transit vehicle trips during peak hours.
$VT_{BUS,OP}$	trips	Transit vehicle trips during off-peak hours.
VT_{BUS}	trips	Total transit vehicle trips (peak + off-peak).
$VMT_{BUS,P}$	miles	Transit vehicle VMT during peak hours.
$VMT_{BUS,OP}$	miles	Transit vehicle VMT during off-peak hours.
$VT_{R,P}$	trips	Reduction in automobile vehicle trips during peak hours.
$VT_{R,OP}$	trips	Reduction in automobile vehicle trips during off-peak hours.
$VMT_{R,P}$	miles	Reduction in automobile VMT during peak hours.
$VMT_{R,OP}$	miles	Reduction in automobile VMT during off-peak hours.

3. INPUT DATA AND ASSUMPTIONS

To estimate emissions impacts for the proposed Horizon City transit improvements, the MOSERS tool requires a set of project-specific inputs for the selected strategy described in Section 2. This section summarizes the input data used to define the proposed transit service characteristics (e.g., corridor length, headways, service span, ridership, and operating speeds), characterize baseline automobile travel conditions within the transit

service area, and document the key assumptions applied in the Strategy 1.1 Transit System/New Transit methodology.

3.1 TRANSIT SYSTEM/NEW TRANSIT INPUTS

To quantify emissions benefits for the three phased Horizon City transit elements, the MOSERS methodology requires a consistent set of project-specific inputs describing service characteristics, travel conditions, and ridership assumptions. Table 4 summarizes the input values used for each of the three Sub-CMAQ analyses corresponding to the 2026 circulator, 2027 transit plaza, and 2028 express service components. The sections that follow, document the basis for these inputs and describe the key assumptions applied for each phase.

Table 4. Transit System/New Transit: MOSERS Inputs for the three stages project

Input data description	Variable	Circulator	HC Plaza	Express (HC-Utep)	Units
Metropolitan area	—	El Paso	El Paso	El Paso	—
Analysis year	—	2026	2027	2028	year
Urban or rural with restricted or unrestricted access	—	Urban–Freeway	Urban–Freeway	Urban–Freeway	—
Type of new transit service	—	CNG Bus	CNG Bus	CNG Bus	—
Proposed average transit headway during peak hours	$H_{BUS,P}$	50	50	50	minute/vehicle
Proposed average transit headway during off-peak hours	$H_{BUS,OP}$	55	55	55	minute/vehicle
Proposed one-way transit corridor length	L_{BUS}	16.6	16.6	29	mile
Average one-way auto trip length within the buffer distance of new transit	L_A	16.6	16.6	29	mile

Proposed service hours during peak period of the day	h_P	4	4	6	hour
Proposed service hours during off-peak period of the day	h_{OP}	9	9	11	hour
Estimated increase in typical daily transit ridership	R	800	928	1114	riders/day
Percentage of transit riders who were auto drivers	r_R	56	56	56	percent
Estimated transit speed along the corridor during peak hours	$v_{B,P}$	25	25	45	mph
Current auto average speed along the corridor during peak hours	$v_{A,P}$	25	25	45	mph
Estimated transit speed along the corridor during off-peak hours	$v_{B,OP}$	30	30	60	mph
Current auto average speed along the corridor during off-peak hours	$v_{A,OP}$	30	30	60	mph

3.1.1 Circulator (2026) and Transit Plaza (2027): Input Basis and Assumptions

For the first two project stages—the 2026 circulator and the 2027 transit plaza—the MOSERS inputs are modeled using the same underlying service design assumptions, including corridor definition, vehicle type, headways, service hours, and operating speeds. This reflects that the plaza stage does not fundamentally change the planned circulator

service supply, but rather improves passenger access, amenities, and connectivity. Accordingly, the only input varied between the 2026 and 2027 analyses is the estimated typical daily transit ridership (R), which is assumed to increase in 2027 due to the added functionality and attractiveness of the completed transit plaza.

3.1.1.1 *Headway*

Proposed peak and off-peak headways (50 and 55 minutes per vehicle, respectively) were selected using the existing EPATS/LGC service patterns documented for Routes 30 and 31 as a planning-level benchmark. The published Route 30/31 weekday timetable provides an appropriate local reference for typical bus service spacing in the Horizon City service area, and the selected headways reflect a conservative, service-feasible range consistent with the route concepts described in the TOD materials.

3.1.1.2 *Transit corridor length and auto trip length within the service area*

L_{BUS} and L_A were set to 16.6 miles based on the proposed circulator alignment shown in Figure 1, which was provided in project materials shared by Town of Horizon City personnel. The circulator route length was measured in Google Maps along the same roadway path. For the circulator stage, L_A was assumed equal to L_{BUS} to represent the typical auto trip length within the travel market directly served by the new circulator.

3.1.1.3 *Proposed Service Hours*

They were set to 4 peak hours (h_P) and 9 off-peak hours (h_{OP}) based on the published weekday service span for EPATS/LGC Routes 30 and 31, which indicate approximately 13 total hours of operation. For MOSERS inputs, the service day was partitioned into a 4-hour peak period to represent the highest-demand commute window, with the remaining 9 hours assigned to off-peak service to preserve the observed total daily service span while reflecting typical time-of-day demand patterns.

3.1.1.4 *Ridership*

For the Circulator (2026) and Transit Plaza (2027) stages, the MOSERS ridership input (R) was developed using a transparent, planning-level method that ties the assumed service plan (headways and service hours) to the amount of transit service supplied and then applies a conservative loading assumption grounded in local fleet characteristics. First, the

number of bus trips provided per day was estimated from the assumed peak and off-peak headways and service hours. Using the 2026/2027 service plan (50-minute peak headway over 4 peak hours; 55-minute off-peak headway over 9 off-peak hours), the estimated service supply is approximately 4.8 one-way trips per direction during peak ($4 \times 60 / 50$) and 9.82 one-way trips per direction during off-peak ($9 \times 60 / 55$), for a total of 14.62 trips per direction per day. Accounting for both directions yields approximately 29.24 one-way bus trips per day across the full circulator alignment.

Ridership was then estimated by applying an average passenger load per one-way trip. For the 2026 Circulator stage, the planning-level average load was set using a 29-passenger minimum bus capacity documented in the local fleet reference. Applying a full-capacity load on each one-way trip would yield approximately $29.24 \times 29 \approx 848$ riders/day. Because MOSERS requires a single typical daily ridership input and to avoid overstating daily utilization at the sketch-planning level, the 2026 ridership input was rounded to a conservative, report-ready planning value of $R = 800$ riders/day, which remains consistent in magnitude with the capacity-based estimate while providing a simple, transparent input for the CMAQ documentation.

For the 2027 Transit Plaza stage, all operational inputs remain identical to the 2026 Circulator stage; the only change is the ridership input (R) to reflect the added attractiveness and usability created by a dedicated plaza/anchor facility (improved access, passenger amenities, and a stronger transfer focus). Rather than applying an arbitrary percentage increase, the plaza-stage ridership applies a locally grounded uplift factor derived from an observed plaza-anchored circulator analog in Sun Metro's system reporting (approximately 1.16, consistent with the prior benchmarking approach). Accordingly, the 2027 stage ridership input was set to $R = 800 \times 1.16 = 928$ riders/day (rounded to a whole number). This approach maintains consistency with the assumed service supply while ensuring the "plaza effect" is represented through a benchmark-based uplift rather than an unsubstantiated adjustment.

3.1.1.5 *Percentage of transit riders*

For the percentage of new transit riders who would otherwise be auto drivers ($r_r = 56\%$), the value was selected to represent a defensible, planning-level "auto substitution" share in the absence of local stated-preference or on-board survey data for the proposed Horizon City services. The assumption is grounded in national passenger travel survey evidence summarized by the U.S. Department of Transportation, Bureau of Transportation

Statistics (BTS), which reports how travelers substitute modes when a preferred mode is unavailable and highlights that a substantial portion of motorized person trips, particularly in auto oriented contexts, would be made by driving (or riding in a household vehicle) if transit were not an option. Using this BTS evidence as a benchmark, 56% was applied as a mid-range, conservative estimate of the share of riders who represent a true reduction in auto activity (i.e., those who would have driven a personal vehicle for the trip absent the new service), with the remaining riders assumed to come from non-driving alternatives (e.g., being a passenger, walking/biking, or not making the trip). This approach aligns with MOSERS intent for sketch-planning analyses by tying the key “mode diversion” parameter to a documented national dataset when locally collected diversion shares are not available.

3.1.1.6 Speeds

For the speed inputs, planning-level average corridor speeds were estimated using the project route geometry and travel times observed in Google Maps. Average speed was computed using the standard distance–time relationship:

$$\text{Speed (mph)} = \text{Distance (miles)} \div \text{Time (minutes)} \times 60$$

For automobile speeds, the proposed Horizon City circulator was traced in Google Maps consistent with the alignment shown in Figure 1 and the project route description, yielding an estimated one-way corridor length of 16.6 miles. A representative off-peak travel time of 35 minutes produced an average auto speed of $16.6 \div 35 \times 60 = 28.46$ mph, which was rounded to 30 mph for the MOSERS input ($v_{a,OP} = 30$ mph). A representative peak-period travel time of 45 minutes produced $16.6 \div 45 \times 60 = 22.13$ mph, which was carried forward as a planning-level estimate of 25 mph ($v_{a,P} = 25$ mph) to reflect typical peak delay along signalized urban arterials and access corridors.

For transit speeds, the analysis applies the same average corridor speeds used for automobiles for this circulator/plaza service. This is appropriate at the sketch-planning level because the proposed transit service operates on the same roadway network as general traffic and would be subject to the same corridor-level congestion and intersection delay patterns. Accordingly, the MOSERS inputs assume $v_{b,P} = v_{a,P} = 25$ mph for peak conditions and $v_{b,OP} = v_{a,OP} = 30$ mph for off-peak conditions. Using a single, corridor-based speed set for both modes provides a transparent and repeatable basis for

selecting speed-dependent emission factors in MOSERS, grounded directly in the mapped corridor geometry and observed Google Maps travel times for the project alignment.

3.1.2 Express Transit Route (HC-UTEP)

This subsection documents the MOSERS input assumptions for the 2028 express-route stage, which differs from the circulator and plaza stages primarily in corridor length, service span, and operating speeds due to the longer, regional connection between Horizon City and UTEP (as depicted in Figure 3). While the analysis continues to apply the same Transit System/New Transit methodology, the express-route inputs reflect higher expected line-haul speeds and a longer one-way travel market, with all assumptions developed from project documentation, mapped corridor characteristics, and defensible planning-level service parameters.

3.1.2.1 *Headway*

For the express-route stage (2028), the proposed headways are carried forward unchanged from the circulator/plaza assumptions (50 minutes during peak hours and 55 minutes during off-peak hours). This maintains a consistent, documented service-frequency basis across all three Horizon City stages, allowing differences in emissions benefits to be driven by the express route's distinct corridor length, service hours, and operating speeds rather than by changes in assumed frequency.

3.1.2.2 *Transit corridor length and auto trip length within the service area*

The proposed one-way transit corridor length (L_{BUS}) was set to 29.0 miles based on the project alignment provided by Town of Horizon City personnel and mapped in Google Maps (Figure 3). The same value (29.0 miles) was used for the average one-way auto trip length within the transit service area (L_A) to reflect that the express service is intended to substitute for the same origin–destination travel market (Horizon City to UTEP corridor) that would otherwise be made by automobile along the primary I-10 travel path.

3.1.2.3 *Proposed Service Hours*

Proposed service hours for the express service were developed using operating-span and peak-period guidance documented in Sun Metro's system materials. As shown in Figure

4, express bus service is characterized as operating from approximately 4:00 AM to 9:00 PM, representing a total daily span of 17 hours. Consistent with the same reference, “peak” service is described as occurring during the morning and afternoon commuter windows (6:00–9:00 AM and 3:00–6:00 PM), yielding 6 total peak hours per weekday. The remaining portion of the 17-hour service day was therefore classified as off-peak, resulting in 11 off-peak hours (17 – 6 = 11). Accordingly, the MOSERS Strategy 1.1 inputs were set to $h_p = 6$ hours and $h_{op} = 11$ hours for express corridor analysis.¹

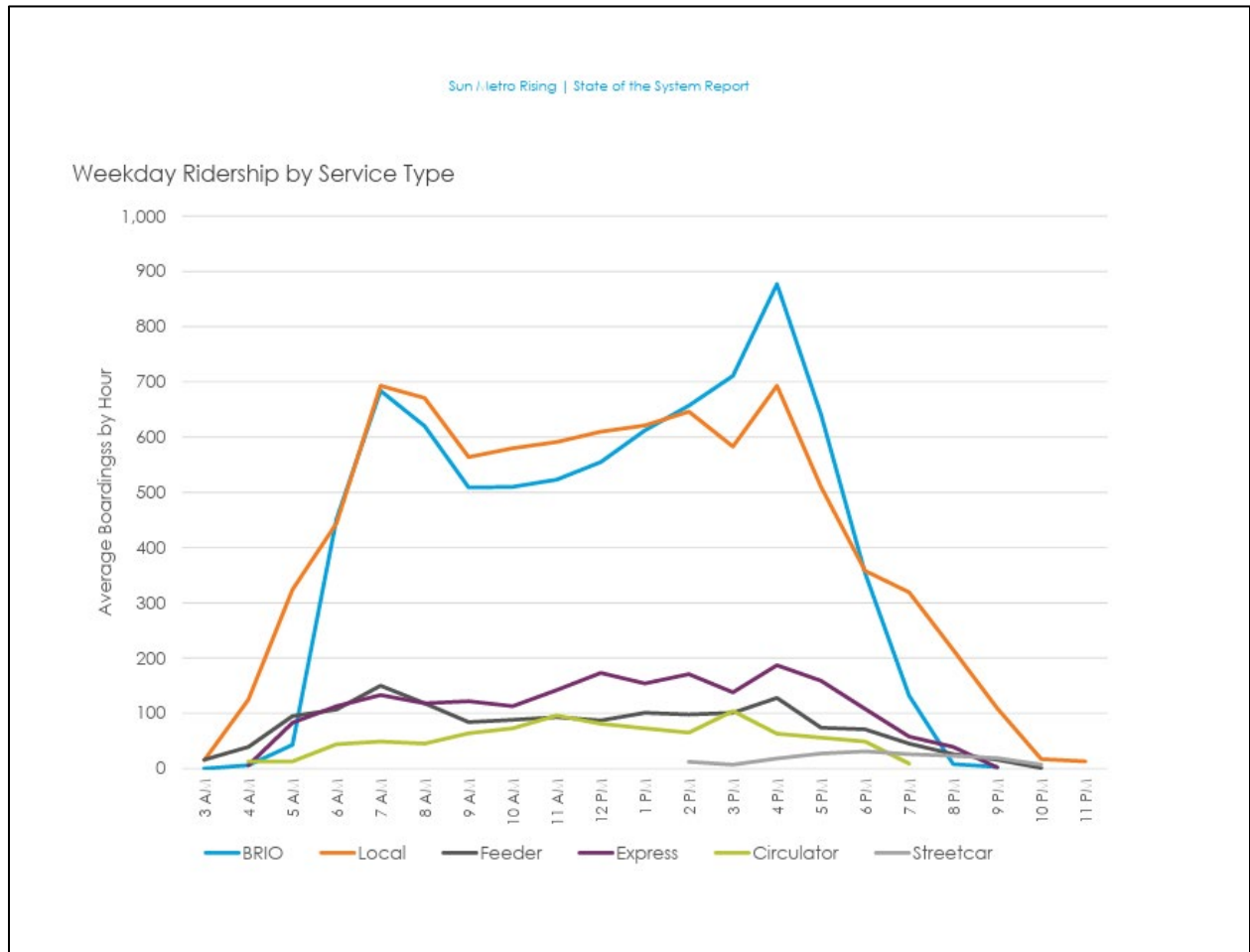


Figure 4. Express service span and peak-period operating characteristics

3.1.2.4 Ridership

For the express service (Stage 3), daily ridership was estimated using the same MOSERS-consistent, service-based calculation framework applied to the earlier stages but updated

¹ City of El Paso | Sun Metro State of the System Report (July 2022), p. 60

to reflect the longer daily service span and the higher-demand nature of a direct Horizon City–UTEP express connection. First, the analysis computed the number of daily one-way bus trips from the assumed headways and service hours. With a 50-minute peak headway over 6 peak hours, the service provides 7.2 one-way trips per direction during peak ($6 \times 60 / 50$). With a 55-minute off-peak headway over 11 off-peak hours, the service provides 12.0 one-way trips per direction during off-peak ($11 \times 60 / 55$). Summing, these yields 19.2 one-way trips per direction per day, and accounting for both directions yields 38.4 total one-way bus trips per day.

Ridership was then estimated by applying two bounding passenger-load assumptions to this daily service supply: (1) a conservative planning load consistent with the earlier approach, defined as one-half of the minimum seated capacity of a standard Sun Metro bus ($29/2 = 14.5$ riders per one-way trip), and (2) a “full-capacity” upper bound assuming each one-way trip carries the minimum seated capacity of 29 riders per trip, as documented in the *City of El Paso | Sun Metro State of the System Report (July 2022)*. Under the conservative load case, estimated daily ridership is $38.4 \times 14.5 = 557$ riders/day. Under the full-capacity case, estimated daily ridership is $38.4 \times 29 = 1,114$ riders/day. To express the closest model to the high demand that the express route might face due to the population in the area plus students needed to commute, the daily ridership was selected as the full capacity of 1,114 riders/day

3.1.2.5 *Percentage of transit riders*

For the express service, the percentage of transit riders who would otherwise be auto drivers (56%) was held consistent with the circulator and plaza analyses. This maintains methodological consistency across the three staged CMAQ evaluations and reflects the use of the same planning-level default drawn from national passenger survey evidence in the absence of locally collected stated-preference or on-board survey data for the proposed Horizon City services.

3.1.2.6 *Speeds*

Because the 2028 service is an express connection that operates primarily on the I-10 corridor with limited stops, the analysis assumed equal average operating speeds for transit and autos for both peak and off-peak periods. This assumption is appropriate at a sketch-planning level for an express service where buses and general traffic share the same primary roadway and are expected to experience similar corridor travel conditions.

Average speeds were estimated using a travel-time approach based on the project route mapped in Google Maps using the alignment provided by Horizon City. The corridor length is approximately 29 miles one-way. For the off-peak scenario, the mapped travel time was approximately 30 minutes, yielding an average speed of:

$$v \approx \frac{29 \text{ miles}}{30 \text{ min}} \times 60 \approx 58 \text{ mph} \approx 60 \text{ mph}$$

For the peak scenario, the mapped travel time was approximately 40 minutes, yielding:

$$v \approx \frac{29 \text{ miles}}{40 \text{ min}} \times 60 \approx 39 \text{ mph} \approx 45 \text{ mph}$$

Accordingly, the analysis used 45 mph for peak hours and 60 mph for off-peak hours as representative average corridor speeds for both the express transit service and parallel auto travel.

3.2 EMISSIONS FACTORS

Emission factors used in the MOSERS analysis were developed using the EPA MOVES model (version 4.0.3) to remain consistent with the emissions modeling framework used for conformity in the El Paso region. MOVES was executed to generate pollutant- and process-specific emission rates representative of local conditions for each analysis year associated with the phased Horizon City project. The resulting MOVES outputs were then post-processed and formatted as emission rate lookup tables (ERLTs) (see Appendix B) so they could be imported into MOSERS and applied directly within the tool. These lookup tables provide the emission factors needed to quantify changes in emissions associated with Transit System / New Transit, including running exhaust emission factors (applied to changes in VMT) and trip-end/start emission factors (applied to changes in vehicle trips), ensuring MOSERS calculations are based on MOVES-derived rates aligned with regional conformity assumptions.

Because the Horizon City CMAQ evaluation is structured as three staged analyses, separate ERLTs were prepared for each analysis year (2026, 2027, and 2028). For each stage, the MOSERS workbook was populated using the ERLTs corresponding to the matching year to maintain consistency between the activity assumptions and the year-specific MOVES emission rates. As in prior El Paso CMAQ applications, MOVES emission-

rate runs were completed for both summer and winter seasonal conditions, and ERLT values were populated using the maximum emission rate across the seasonal runs for each pollutant/process combination to provide a conservative representation.

To retrieve the specific emission factors applied in the MOSERS workbooks (Appendix A), the ERLTs were filtered consistently to match the project context and to distinguish between automobile and transit bus emission factors. For automobile-related factors, ERLTs were filtered by Source Type Name = "Auto". For transit service factors, ERLTs were filtered by Source Type Name = "TBus", consistent with the MOSERS transit vehicle category used for Strategy 1.1 calculations. For all ERLTs, records were filtered to Road Type ID = 4 (Urban Restricted Access / urban freeway) to reflect the primary corridor operating context assumed for the Horizon City–UTEP travel market and regional freeway facilities.

Running exhaust emission factors were selected from *ERLT_Running* and trip-end/start emission factors were selected from *ERLT_Starts*. For running factors, the ERLTs were further filtered by speed to match the peak and off-peak operating speeds assumed in the staged analyses. Specifically, auto running emission factors were selected using the peak and off-peak auto speeds for each stage, and transit running emission factors were selected using the corresponding peak and off-peak transit speeds (which are identical to auto speeds for the express stage, and distinct from auto speeds for the circulator/plaza stages). This approach ensures that the emission factors applied in MOSERS are internally consistent with the operating conditions and vehicle types assumed in the activity calculations, while maintaining alignment with MOVES-based, regionally consistent conformity inputs.

4. SUMMARY OF RESULTS

The emissions analysis results are summarized in Table 5, which presents the estimated daily emission reductions by pollutants for each of the three staged Horizon City analyses (2026 circulator, 2027 transit plaza, and 2028 express service). The reported values were taken directly from the MOSERS outputs and reflect the calculation framework described in Section 2, using the project-specific input data and assumptions documented in Section 3. For transparency and reproducibility, the MOSERS calculation workbooks used to generate the staged results are provided in Appendix A, and the corresponding year-specific emission rate lookup tables (ERLTs) are provided in Appendix B. Overall, the results

indicate that implementation of the staged transit program is expected to produce measurable air quality benefits, with the magnitude of benefits varying by stage as service characteristics and ridership levels change over time.

Table 5. Transit System/New Transit CMAQ Analysis Emissions Reductions

Pollutant	Circulator (2026) (Kg/day)	Circulator (2026) (lbs/day)	HC Plaza (2027) (Kg/day)	HC Plaza (2027) (lbs/day)	Express Transit (2028) (Kg/day)	Express Transit (2028) (lbs/day)
CO	6.823	15.042	7.768	17.125	6.617	14.558
CO ₂	925.015	2039	1126.159	2483	1894.246	4176
NO _x	0.133	0.294	0.157	0.346	0.332	0.731
VOC	0.017	0.037	0.039	0.086	0.082	0.182
PM ₁₀	0.009	0.02	0.010	0.022	0.018	0.040

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<https://maps.app.goo.gl/761FYszDNqvziSks8>

APPENDIX A: MOSERS WORKBOOK FOR TRANSIT SYSTEM/NEW TRANSIT (ELECTRONIC ONLY)

APPENDIX B: EMISSIONS LOOKUP TABLES (ERLT) FOR MOSERS INPUT (ELECTRONIC ONLY)

Congestion Mitigation and Air Quality (CMAQ) Analysis-Playa Drain Shared use Path

Prepared for City of El Paso

April 2026

Texas A&M Transportation Institute



TECHNICAL REPORT

Technical Documentation

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1. TASK SUMMARY

The City of El Paso requested technical assistance from the Texas A&M Transportation Institute (TTI) to develop a Congestion Mitigation and Air Quality (CMAQ) analysis for the Playa Drain Shared Use Path (Knights to Midway) project (see Figure 1 for project location and limits). The project consists of constructing approximately 1.75 miles of shared-use path along the Playa Drain corridor from Knights Drive to Midway Drive, including supporting improvements such as signage, sidewalks, landscaping, furnishings, and illumination to enhance safety and connectivity for pedestrians and bicyclists.

The primary objective of this effort is to support preparation of CMAQ documentation for submission to the El Paso Metropolitan Planning Organization (MPO) and other relevant agencies by providing an updated, defensible estimate of air quality benefits. The analysis quantifies reductions in vehicle trips and vehicle miles traveled (VMT) expected to occur when travelers choose to walk or bicycle instead of driving due to improved bicycle and pedestrian facilities and connectivity provided by the shared-use path.

The emissions analysis presented in this report follows the Texas Department of Transportation MOSERS methodology using Strategy 3.2 Bicycle and Pedestrian Programs – Option 2 (Facility Needs Index–Based Estimation). Under this approach, the share of travelers attracted to bicycle or walk rather than drive is estimated using the facility needs index together with service-zone population and employment, corridor and buffer characteristics, and trip parameters. The resulting reduction in vehicle trips and VMT is then converted to pollutant reductions using standard emissions equations and applicable emission factors. Data sources and assumptions used in the analysis are

2020. After a thorough review by the research team, the strategy implemented in the Playa Drain shared use path project is “Bicycle and Pedestrian” (strategy 3.2 option 2).

2.1 BICYCLE AND PEDESTRIAN (OPTION 2)

Bicycle and pedestrian programs reduce vehicle trips, vehicle miles traveled (VMT), and associated emissions by encouraging travelers to choose walking or bicycling in place of driving, particularly for short, local trips that can feasibly shift modes when safe and continuous facilities are available. For the Playa Drain Shared Use Path (Knights to Midway) project, the selected approach is MOSERS Strategy 3.2 – Option 2 (Facility Needs Index–Based Estimation), which quantifies emissions benefits based on how improved bicycle and pedestrian facilities within a defined service zone attract new walking and bicycling trips that would otherwise be made by automobile. The Playa Drain project supports this mode shift by constructing approximately 1.75 miles of shared-use path along the Playa Drain corridor and adding supporting improvements such as signage, sidewalks, landscaping, furnishings, and illumination, which together improve comfort, safety, and connectivity for non-motorized travel.

Option 2 is a facility-needs-index–based estimation approach. Rather than starting from household counts, it uses predicted Bicycle Needs Index (BNI) and Pedestrian Needs Index (PNI) values to estimate the percentage of people in the service zone who would be attracted to bicycle or walk after the facility is provided. Participants are estimated using service-zone population and employment, together with facility lengths, buffer distances, trip characteristics, and auto occupancy. When trips shift to walking or bicycling, the associated vehicle trips and VMT are assumed eliminated, and emissions benefits are calculated from the reduced vehicle activity using the MOSERS equations and applicable emission factors. This method is most applicable in populated areas where improved bicycle and pedestrian connectivity can plausibly replace short auto trips and provide practical access between neighborhoods, schools, parks, and nearby activity centers.

Emissions Equations

$$\text{Daily Emission Reduction (grams/day)} = A + B$$

Reduction in auto trip-end (start) emissions from reduced trips

$$A = VT_R \times TEF_{AUTO}$$

Reduction in running exhaust emissions from reduced auto VMT

$$B = VMT_R \times EF_B$$

Where:

VT_R = reduction in number of daily auto vehicle trips (trips/day)

VMT_R = reduction in daily auto vehicle miles traveled (miles/day)

TEF_{AUTO} = auto trip-end emission factor (grams/trip) (pollutant-specific)

EF_B = speed-based running exhaust emission factor for average pre-program auto speed (grams/mile) (pollutant-specific)

Activity Methodology (Facility Needs Index–Based)

Option 2 estimates bicycle and pedestrian facility users in the service zone, then converts those users into reduced vehicle trips and VMT:

Bicycle facility users:

$$U_B = (N_P \cdot I_B + N_E \cdot I_B) \cdot L_B \cdot D_B$$

Pedestrian facility users:

$$U_P = (N_P \cdot I_P + N_E \cdot I_P) \cdot L_P \cdot D_P$$

Reduced daily auto trips:

$$VTR = \frac{(U_B + U_P) \cdot N}{O_A}$$

Reduced daily auto VMT:

$$VMTR = VTR \cdot L$$

The MOSERS calculator for Strategy 3.2, Option 2 estimates daily emissions benefits by linking expected travel behavior changes to reductions in automobile activity. The process begins by estimating how many people within the defined service zone would be attracted to walk or bicycle after the Playa Drain Shared Use Path (Knights to Midway)

improvements are implemented. That participation estimate is based on service-zone population and employment, the bicycle and pedestrian needs indices, the length of bicycle and pedestrian facilities available within the zone, assumed buffer distances that represent the area of influence of those facilities, basic trip characteristics, and average vehicle occupancy. Once the expected number of new walk and bike users is calculated, the methodology converts that participation into the number of daily vehicle trips avoided and the daily vehicle miles traveled avoided. These reduced vehicle activities are then translated into pollutant reductions by applying appropriate trip-end and running exhaust emission factors. Table 1 summarizes the variables referenced throughout the activity and emissions calculations, including each variable's unit and definition, to ensure the analysis is transparent and reproducible. Figure 2 presents a Street View image of Knights Drive, documenting existing site conditions along the primary portion of the project corridor and providing visual context for the shared-use path improvements and service-zone assumptions used in the analysis.

Table 1. Bicycle and Pedestrian Option 2 Variables and Definitions (Playa Dr Path)

Variable	Unit	Definition / Notes
Daily Emission Reduction	g/day	Total daily reduction in emissions from reduced auto activity (trip-end + running).
A	g/day	Reduction in auto trip-end emissions due to fewer auto trips.
B	g/day	Reduction in running exhaust emissions due to fewer auto miles traveled.
TEF_{auto}	g/trip	Auto trip-end emission factor (pollutant-specific: NO _x , VOC, PM, CO).
EF_{β}	g/mile	Speed-based running exhaust emission factor for the average pre-project auto speed (pollutant-specific: NO _x , VOC, PM, CO).
VTR	trips/day	Reduction in total daily auto vehicle trips.
VMTR	miles/day	Reduction in total daily auto vehicle miles traveled (VMT).
U_{β}	facility users	Bicycle facility users in the service zone.
U_p	facility users	Pedestrian facility users in the service zone.

N_p	persons	Estimated population in the service zone.
N_e	persons	Estimated total employment in the service zone.
I_β	index	Predicted Bicycle Needs Index (BNI) in the service zone.
I_p	index	Predicted Pedestrian Needs Index (PNI) in the service zone.
A (service zone area)	sq. mi.	Area of the service zone.
L_β	miles	Total length of bicycle facility in the service zone.
L_p	miles	Total length of pedestrian facility in the service zone.
D_β	miles	Bicycle facility buffer distance (default commonly used: 2.0 miles unless local basis provided).
D_p	miles	Pedestrian facility buffer distance (default commonly used: 0.5 miles unless local basis provided).
O_a	persons/vehicle	Auto occupancy (default commonly used: 1.13; may be set to 1.0 if assuming SOV only).
N	trips/person/day	Average number of trips per participant per day.
L	miles	Average trip length in the service zone.



Figure 2. Playa Dr Path (Knights Dr and Bernandine Av), Google Streetview

3. INPUT DATA AND ASSUMPTIONS

To estimate emission reductions for the Playa Drain Shared Use Path (Knights to Midway) project, the MOSERS tool requires a set of project-specific inputs for the selected strategy described in Section 2. This section summarizes the input data used to characterize the project service zone and the proposed shared-use path and supporting pedestrian/bicycle improvements, and it documents the key assumptions applied in Strategy 3.2 Bicycle and Pedestrian Programs – Option 2 (Facility Needs Index–Based Estimation).

3.1 BICYCLE AND PEDESTRIAN (OPTION 2)

The MOSERS inputs summarized in Table 2 were developed from Playa Drain Shared Use Path project documentation, MOSERS Strategy 3.2 Option 2 guidance, locally documented regional travel characteristics, and nationally recognized demographic sources, with engineering judgment applied where corridor-specific observations were

not available for a sketch-planning CMAQ analysis. Inputs were selected to be conservative, transparent, and repeatable, consistent with the intent of Option 2, estimating how improved bicycle and pedestrian facilities within a defined service zone can shift a portion of short auto trips to walking and bicycling, thereby reducing vehicle trips, VMT, and associated emissions.

The analysis year (2028) and regional context (El Paso metropolitan area) were set to align with the CMAQ evaluation timeframe for the project. The facility-length inputs reflect the project scope to construct approximately 1.75 miles of shared-use path along the Playa Drain corridor from Knights Drive to Midway Drive, with supporting improvements such as signage, sidewalks, landscaping, furnishings, and illumination. These project elements are consistent with the type of corridor-scale bicycle and pedestrian investment evaluated under Strategy 3.2 Option 2 and provide the basis for estimating mode shift attributable to improved connectivity, comfort, and safety.

The service zone was defined using a corridor catchment representing practical pedestrian access to the facility. A 0.5-mile pedestrian access distance is commonly used in planning applications as a walk shed and is consistent with the buffer-distance concepts embedded in sketch-planning methods for bicycle and pedestrian strategies. Service-zone area was approximated using a “capsule” geometry (a buffered corridor with semicircular ends), computed as $A = (2 \times r \times L) + (\pi \times r^2)$. Using $r = 0.5$ miles and a facility length $L = 1.75$ miles, the area is $A = (2 \times 0.5 \times 1.75) + (\pi \times 0.25) = 1.75 + 0.785 = 2.535$, reported as 2.54 square miles.

Service-zone population (N_p) was computed using localized demographic conditions rather than a citywide average. The analysis used the American Community Survey (ACS) 5-year profile for ZIP 79915 to obtain a representative population density for the project vicinity and multiplied that density by the calculated service-zone area. Using a density of approximately 3,845 persons per square mile and a service-zone area of 2.54 square miles, the estimated service-zone population is about 9,766 persons, rounded to 9,800 persons. Service-zone employment (N_e) was estimated using a similarly transparent ACS-based proxy. In the absence of a GIS-based workplace-jobs extraction for the exact corridor buffer, the employed population within ZIP 79915 was used to derive an employed-person density (employed persons divided by ZIP land area), which was then scaled to the service-zone area. This produced an estimate of approximately 3,759 employed persons, rounded to 3,800, providing a reproducible, data-driven representation of the activity

base within the corridor influence area appropriate for sketch-planning application of Option 2.

Because corridor-specific Bicycle Needs Index (BNI) and Pedestrian Needs Index (PNI) surfaces were not available for the defined service zone, the analysis applied conservative, locally grounded proxy values based on regional journey-to-work mode shares reported from ACS commute-mode tabulations. A bicycle commute share of approximately 0.10% and a walk commute share of approximately 1.40% were converted to decimal proportions for the Option 2 index inputs, yielding $I_b = 0.001$ and $I_p = 0.014$. This approach anchors participation to observed regional travel behavior and avoids overstating mode shift in the absence of a locally calibrated needs-index surface.

Trip behavior inputs were selected to reflect short, utility-oriented travel most likely to shift modes when a continuous shared-use path is provided. The average number of trips per participant per day ($N = 2.0$) represents a conservative out-and-back utility pattern. The average replaced auto trip length ($L = 1.2$ miles) was selected to reflect a short-trip market while recognizing that the project is explicitly designed to support bicycling as well as walking; this value remains conservative relative to the full corridor length while better representing typical bicycle-access trips than a purely walk-based assumption. Finally, the average auto operating speed ($v = 28$ mph) was developed from the posted speed environment along the primary streets defining the project area (Knights Drive approximately 30 mph and Midway Drive approximately 35 mph). A representative corridor posted speed (~ 32.5 mph) was reduced by 5 mph to reflect typical urban operating conditions where intersection control and access friction reduce average travel speed below posted speed, resulting in an assumed 27.5 mph, rounded to 28 mph. Collectively, these assumptions provide an internally consistent and defensible set of MOSERS inputs for applying Strategy 3.2 Option 2 to the Playa Drain Shared Use Path project, as summarized in Table 2.

Table 2. Bicycle and Pedestrian Strategy: MOSERS Inputs, Assumptions, and References

Input data Description	Data	Units	Assumption	Source
Metropolitan area	El Paso	—	Project is located within the El Paso metropolitan area as documented in project materials.	Playa Drain Shared Use Path project materials (SOW / limits).
Analysis year	2028	year	Analysis year set to align with the CMAQ analysis year for this project stage.	CMAQ project context / analysis setup
Road type	Urban-Freeway	—	Road type represented as Urban Restricted Access (Road Type ID = 4 in MOVES/MOSERS filtering) consistent with the established CMAQ/MOVES ERLT filtering convention used in prior El Paso CMAQ applications.	MOVES/MOSERS roadway type convention (Road Type ID = 4)

<p>Estimated population in the service zone (N_p)</p>	<p>9,800</p>	<p>persons</p>	<p>Service-zone population computed using ACS 5-year population density for ZIP 79915 and the service-zone area (A). ZIP 79915 density = 3,845.1 persons/sq mi; $A = 2.54$ sq mi $\Rightarrow N_p \approx 3,845.1 \times 2.54 = 9,766$, rounded to 9,800.</p>	<p>ACS 2024 5-year ZIP profile (population density for 79915). (Census Reporter) + service-zone geometry assumption (see A)</p>
<p>Estimated total employment in the service zone (N_e)</p>	<p>3,800</p>	<p>persons</p>	<p>In absence of a GIS-based LODES workplace extraction for the exact corridor buffer, service-zone employment was estimated using an ACS-based employed-population proxy for ZIP 79915, scaled to the service-zone area. ZIP 79915 employed persons = 13,175 across 8.9 sq mi $\Rightarrow 1,480$ employed/sq mi; $A = 2.54$ sq mi $\Rightarrow N_e \approx 1,480 \times 2.54 = 3,759$, rounded to 3,800.</p>	<p>ACS/ZIP profile employment-status summary for 79915 (employed count). (ZIP-Codes.com) + service-zone area (A)</p>
<p>Bicycle Needs Index (BNI) (I_B)</p>	<p>0.001</p>	<p>—</p>	<p>Index set using a conservative proxy based on regional journey-to-work bicycle mode share (~0.10%) converted to a decimal proportion ($0.10 \div 100$).</p>	<p>ACS commute-mode tabulations (regional) + MOSERS Option 2 index input structure</p>

Pedestrian Needs Index (PNI) (I_p)	0.014	—	Index set using a conservative proxy based on regional journey-to-work walk mode share (~1.40%) converted to a decimal proportion ($1.40 \div 100$).	ACS commute-mode tabulations (regional) + MOSERS Option 2 index input structure
Area of the service zone (A)	2.54	square miles	Service zone defined using a 0.5-mile pedestrian access buffer over a 1.75-mile facility length; area approximated using corridor “capsule” geometry: $A = (2 \times r \times L) + (\pi \times r^2)$ with $r=0.5$ mi and $L=1.75$ mi $\Rightarrow A = (2 \times 0.5 \times 1.75) + (\pi \times 0.25) = 1.75 + 0.785 = 2.535 \approx 2.54$ sq mi.	Standard planning walk-shed convention (0.5-mile access) + project length from project materials.
Total length of the bicycle facility in the service zone (L_β)	1.75	miles	Bicycle facility length set equal to the shared-use path project length along the Playa Drain corridor.	Project scope and limits (SOW / limits).
Total length of the pedestrian facility in the service zone (L_p)	1.75	miles	Pedestrian facility length set equal to the shared-use path project length along the Playa Drain corridor.	Project scope and limits (SOW / limits).

Average number of trips per participant per day (N)	2	trips/person/day	Daily participation represented as an out-and-back utility pattern (two trips per participant per day), consistent with conservative sketch-planning applications for walk/bike facilities.	MOSERS sketch-planning convention + engineering judgment
Average trip length in the service zone (L)	1.2	miles	Average replaced auto trip length set to 1.2 miles to reflect bicycle-support emphasis and a slightly longer typical substituted trip than a purely walk-based assumption, while remaining within a short-trip, neighborhood-scale range appropriate for mode shift.	National travel survey evidence that many walk/bike trips are short + project context emphasizing bicycling (engineering judgment)
Average trip speed in the service zone (pre-program auto speed) (v)	28	mph	Representative operating speed derived from posted speeds on Knights (30 mph) and Midway (35 mph), reduced to reflect intersection delay/access friction. Corridor average posted speed \approx 32.5 mph; minus 5 mph \approx 27.5 mph; rounded to 28 mph.	Posted-speed corridor context (Knights/Midway) + HCM concept of average travel speed inclusive of control delay

3.2 EMISSIONS FACTORS

Emission factors used in the MOSERS analysis were developed using the EPA MOVES model (version 4.0.3) to remain consistent with the emissions modeling framework used for conformity in the El Paso region. MOVES was executed to generate pollutant- and process-specific emission rates representative of local conditions for the analysis year (2029). The resulting outputs were then post-processed and formatted as emission rate lookup tables (ERLTs) (see Appendix B) so they could be imported into MOSERS and applied directly within the tool. These lookup tables provide the emission factors needed to quantify changes in emissions associated with the project strategies, including running exhaust (used with VMT reductions) and start/trip-end emissions (used with reductions in vehicle trips), ensuring that MOSERS calculations are based on MOVES-derived rates aligned with regional conformity assumptions.

For the Bicycle and Pedestrian strategy, the running exhaust emission factors used in the calculations were obtained from *ERLT_Running*, while the auto trip-end (start) emission factors were obtained from *ERLT_Starts*. To develop these ERLTs, MOVES emission-rate runs were completed for both summer and winter seasonal conditions. To represent a conservative analysis, the ERLTs were populated using the maximum emission rate observed across the seasonal runs for each pollutant/process combination.

To retrieve the specific emission factors applied in the MOSERS workbooks (Appendix A), the ERLTs were filtered consistently to match the project context. For all ERLTs, records were filtered by Source Type Name = "Auto" and then limited to Road Type ID = 4, which represents Urban Restricted Access (urban freeway) conditions in MOVES. For *ERLT_Running* (used in the Bicycle and Pedestrian calculations), the table was further filtered by speed to select 28 mph, representing the approximate average operating speed used in the analysis. This consistent filtering approach ensures the emission factors applied by MOSERS reflect the roadway and operating conditions assumed for the Playa drain shared use path project while maintaining alignment with regional MOVES-based conformity inputs

4. SUMMARY OF RESULTS

The emissions analysis results are summarized in Table 3, which presents the estimated daily emission reductions by pollutants for the Bicycle and Pedestrian strategy. These values were taken directly from the MOSERS outputs and reflect the method described in Section 2, using the project-specific input data and assumptions documented in Section 3. The MOSERS calculation workbook used to generate these results is included in Appendix A for reference. Overall, the results indicate that implementing the proposed improvements at Playa drain shared path is expected to produce measurable air quality benefits across the pollutants evaluated.

Table 3. CMAQ Analysis Emissions Reductions

Pollutant	Bicycle and Pedestrian (Kg/day)	Bicycle and Pedestrian (lbs/day)
CO	0.746	1.645
CO ₂	65.020	143
NO _x	0.083	0.184
VOC	0.045	0.099
PM ₁₀	0.002	0.004

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APPENDIX A: MOSERS WORKBOOK FOR BICYCLE AND PEDESTRIAN OPTION 2 (ELECTRONIC ONLY)

APPENDIX B: EMISSIONS LOOKUP TABLES (ERLT) FOR MOSERS INPUT (ELECTRONIC ONLY)

Congestion Mitigation and Air Quality (CMAQ) Analysis- Solar Panel Equipped Carports

Prepared for Project Amistad

February 2026

Technical Report

DATE: February 23, 2026

TO: Celia R. Garcia
Project Amistad

FROM: Claudia E Valles Sosa PhD
El Paso Metropolitan Planning Organization

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1. TASK SUMMARY
2. PROJECT DESCRIPTION
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1. TASK SUMMARY

Project Amistad requested technical assistance from the El Paso Metropolitan Planning Organization (EPMPO) to develop a Congestion Mitigation and Air Quality (CMAQ) analysis for its Solar Panel-Equipped Carports Project at the transportation parking facility located at 3210 Dyer (See Figure 1 for location).

The proposed project consists of installing solar panel-equipped carports over 40 existing parking spaces, as shows on the Figure 1.

The primary objective of this analysis is to support Project Amistad in preparing a CMAQ report for submission to the MPO and other relevant agencies. This report includes emissions estimates and a summary of the project's anticipated benefits to support the CMAQ funding application.

The project involves the design and installation of solar panel-equipped carports and intended to:

- Provide shaded parking for vehicles
- Generate renewable solar energy for on-site use or grid-tied power
- Reduce facility operating costs and greenhouse gas emissions carbon
- Support state and local climate and energy goals

For CMAQ eligibility purposes, it is assumed that the solar installation project will support the EV fleet. The key assumption for the emissions analysis is as follows:

- Solar-generated electricity will displace the electricity grid at 100 percent; therefore, no additional emissions will be attributed to grid power generation.

The emissions analysis for the project is presented below. The strategy name and a brief project description are provided, along with the data sources and assumptions used in the analysis. The methodology includes the equations applied to calculate emission reductions.

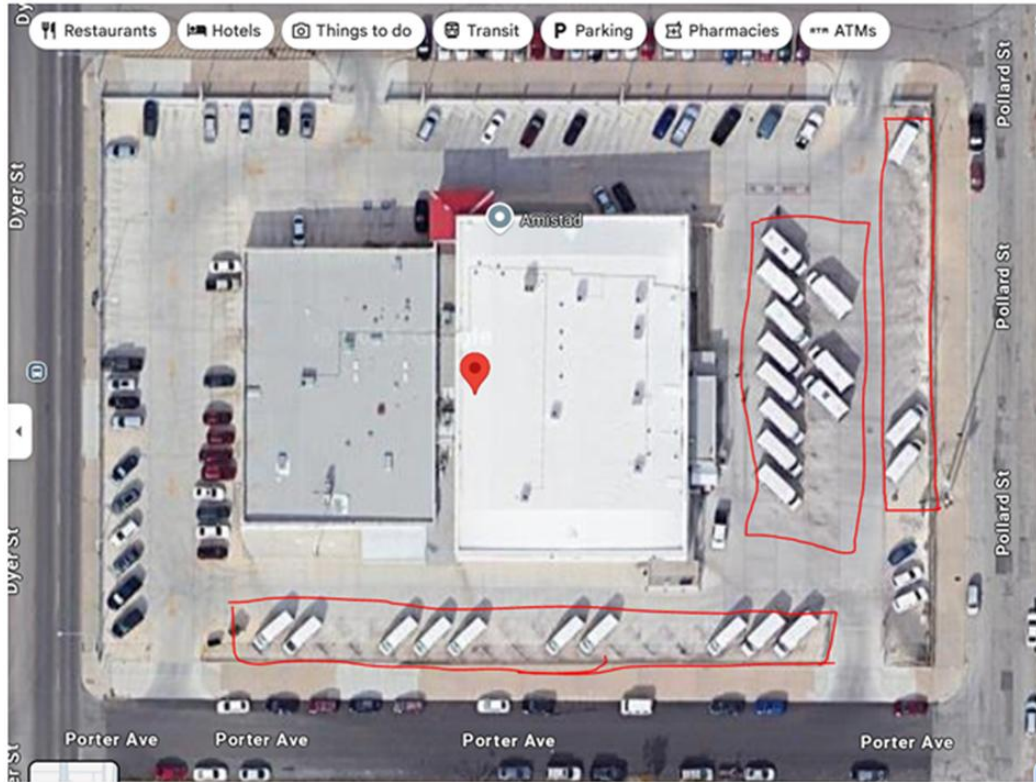


Figure 1. Transportation Parking area (3210 Dyer)

2. PROJECT DESCRIPTION

This project involves the design and installation of solar carports on Project Amistad's property. The initiative supports environmental, economic, and community-centered goals through the following:

- Provide shaded, weather-protected parking for the transportation fleet
- Generate renewable solar energy to offset facility electricity use and/or support grid-tied power
- Reduce the commercial demand charges on the electric bill
- Lower long-term utility costs, allowing more budget allocation toward mission-driven programs
- Reduce the organization's carbon footprint, contributing to a healthier local environment

- Support city and state sustainability targets, including El Paso’s climate and clean energy goals
- Demonstrate environmental leadership as a nonprofit, inspiring others to adopt clean technologies
- Improve energy resiliency, helping maintain operations during grid disruptions or peak pricing
- Maximize underutilized land (parking lot) for clean energy generation without impacting building space
- The system is designed to produce 246,000 kilowatt hours annually
- This project will help relieve the costs associated with continuously rising electric rates putting more money back into Project Amistad.

3. STRATEGIES AND METHODOLOGY

For this analysis two parts of the potential CMAQ-related emission benefits will be calculated:

- Estimate the annual electricity demand from charging that should be offset by the solar part.
- Estimate the facility's potential to promote the vehicle replacement from gasoline vehicles to EVs.

Step 1 — Assume Charging Use Scenario

Conservative planning assumption for Level 2 workplace charging:

- 25 kWh per vehicle per day
- 200 charging days per year
- 40 spaces

$$25 \times 200 \times 40 = 200,000 \text{ kWh/year}$$

That aligns closely with the solar system production (~246,000 kWh/year), which is convenient structurally.

Step 2 — Assume Vehicle Replacement

If the 40 EV spaces help promote the replacement of gasoline vehicles, assume the structure will promote 40 new EVs.

Typical gasoline vehicle on the road:

- ~0.10 g/mile NO_x (MOVES4-based urban estimate, close to passenger/bus mixed average)

If each EV drives 15,000 miles/year:

40 vehicles × gasoline NO_x ≈ 0.066 tons NO_x/year avoided on the road

Annual NO_x Reduction: 0.066 tons/year

Project Life (20 years)

$$0.066 \times 20 = 1.3 \text{ tons}$$

Total Lifetime NO_x Reduction: 1.3 tons

Cost Effectiveness (20 years) based on NO_x

$$497,818 \div 1.3 = 382,936 \text{ per ton NO}_x$$

Daily reductions

Pollutant	Reduction (kg/day)
VOC	0
CO	0
NO_x	0.165
PM₁₀	0