Appendix A

Air Quality Benefits Assessment

Air Quality Benefits Assessment

Analysis Methodology

The air quality benefits from achieving the goals of the Angleton Livable Center Study are estimated based on measurable impacts to mode shift, reduced single-occupant vehicle (SOV) trips, shorter trips and internal trip capture.

Catchment Area

The Angleton Study Area is considered the catchment area for number of trips to potentially be affected by the recommended improvements and development. The area is defined as the traffic area zones (TAZs) inclusive of the study area from the H-GAC travel demand model (shown in **Figure 1**), the census tracts of the study area (approximate), or the H-GAC defined hex grids overlapping the study area from their commuter data web portal, depending on data source (Accessed 2021).

Trips Generated

The following trip generation rates, based on data from the Institute of Transportation Engineers (ITE) and H-GAC for households and jobs, respectively, were used to estimate the average daily trips produced in the catchment area (2045):

- **9.4 trips per household** (national average/ITE Trip gen)
- **3.4 trips per job** (H-GAC, Angleton subarea 2018*)

Demand

Based on the normative goals of the plan, an assumed 10% of the household and employment trips generated in the catchment area would either switch from single-occupant vehicle (SOV) trips to non-SOV trips or be reduced through internal trip capture. The trip length of an estimated 20% of the trips generated by households in the catchment area were additionally assumed to be reduced by 40%, resulting from the increased activities and opportunities to work, live, and play in and nearer to Angleton.

VMT Reduction

The total vehicle miles traveled (VMT) is based on average trip lengths for Angleton from the H-GAC commuting-patterns web-app (average 12.5 miles/trip for trips to and from Downtown Angleton), as compared to the average trip length from the National Household Travel Survey (9.7 miles/trip). Averages are combined with computed demand by the probable mode, per goal.

Air Quality Benefits

The MOSERS 11.1 methodology is used to estimate emissions reduction. Estimates for emissions per mile for the following air quality factors are:

- Nitrogen Oxides (NOx): 0.239 grams per mile
- Volatile Organic Compounds (VOC): 0.315 grams per mile
- Carbon Monoxide (CO): 3.732 grams per mile

Total emissions were annualized to determine the reduction in annual kilograms (kg) resulting from achieving the Angleton Livable Center goals that may result in a shift in mode share from SOV to non-SOV trips (carpooling, telecommuting, bike, pedestrian, internal trip capture, and transit trips), found in **Table 2**, and from trip length reductions, found in **Table 3**.

** Angleton study area-based trips of the H-GAC TDM (2018- and 2045-Year data for Jobs in TAZ #3086, and number of Households in the study area, specifically) were adjusted downward, to reflect the market analysis completed as part of the Angleton Livable Centers Study, and site development plans in development by Brazoria County, to provide a more conservative basis for projected air quality benefits.*

Growth in Benefit

Total emissions can be expected to grow as the area grows and as policies are gradually implemented. Given planned improvements and anticipated demographic growth, benefits resulting from the increased activities and opportunities to work, live, and play within central Angleton, managed parking program, transit services, and infrastructure improvements detailed in the study would gradually accrue over time. Total estimated air quality benefits are expressed as a range, with the upper end reflecting demographic growth projected in the H-GAC model for the study area by 2045. A summary is provided in **Table 1** (rounded).

Figure 1. *H-GAC Travel Demand Model TAZs*

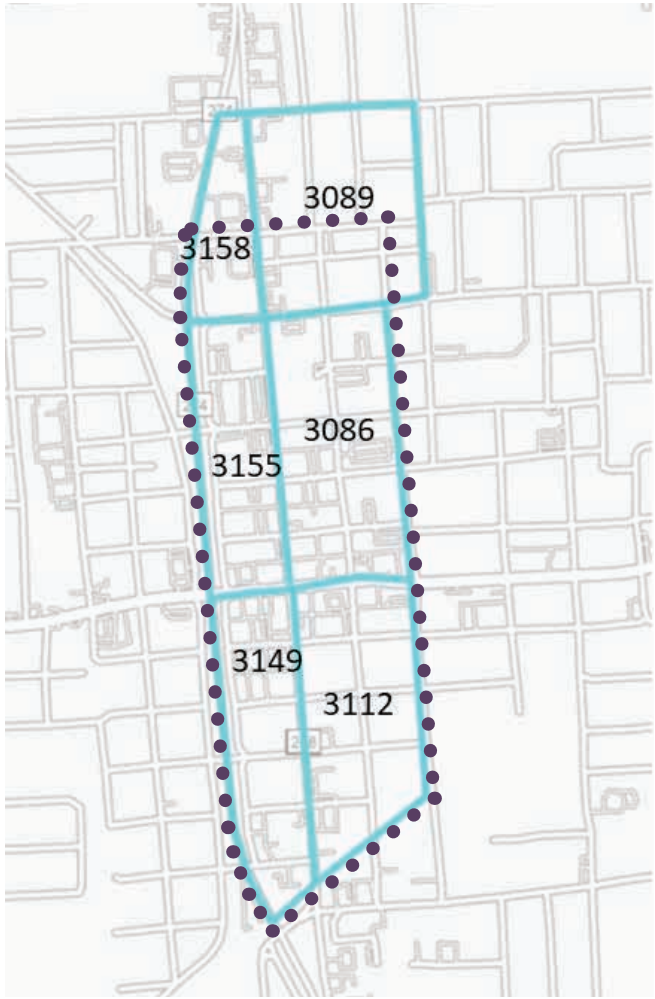

Table 1. *Air Quality Benefit Summary*

SUMMARY			
TOTAL ANNUAL EMISSIONS REDUCTION	NOx	800 - 1,400	kg/year
	VOC	1,100 - 1,900	kg/year
	CO	12,300 - 20,900	kg/year

Table 2. *Mode Shift and Internal Trip Capture (to Non-SOV)*

CALCULATION STEP	EQUATION	VARIABLE	QUANTITY	UNITS
DOWNTOWN ANGLETON TRIP GENERATORS	a	Households	200	homes
	b	Employment	2000	jobs
TRIP RATES	c	Households	9.4	trips/day/job
	d	Employment	3.4	trips/day/home
TOTAL TRIPS	e=(a*c)+(b*d)		8,680	trips/day
MODE SHIFT RATE	**f**		**10%**	**percent trips**
TRIPS REPLACED	**g=e*f**		**868**	**trips**
MILES PER TRIP REPLACED	h		12.5	miles/trip
VEHICLE MILES TRAVEL REPLACED	**j=g*h**		**10,850**	**miles**
EMISSIONS FACTORS	k	NOx	0.24	gm/mile
	l	VOC	0.32	gm/mile
	m	CO	3.73	gm/mile
TOTAL EMISSIONS REDUCED	**n=j*k**	**NOx**	**2,604**	**gm**
	o=j*l	**VOC**	**3,472**	**gm**
	p=j*m	**CO**	**40,471**	**gm**
ASSUMED ANNUAL DAYS	q		260	days/year
METRIC CONVERSION FACTOR	r		1,000	gm/kg
ANNUAL EMISSIONS REDUCTION	**s=(n*q)/r**	**NOx**	**677**	**kg/year**
	t=(o*q)/r	**VOC**	**902**	**kg/year**
	u=(p*q)/r	**CO**	**10,522**	**kg/year**

Table 3. *Trip Length Reduction*

CALCULATION STEP	EQUATION	VARIABLE	QUANTITY	UNITS
DOWNTOWN ANGLETON TRIP GENERATOR	a	Households	200	homes
TRIP RATES	c	Households	9.4	trips/day/job
TOTAL TRIPS	e=(a*c)		1,880	trips/day
MODE SHIFT RATE	**f**		**20%**	**percent trips**
REDUCED DIST. TRIPS	**g=e*f**		**376**	**trips**
MILES PER TRIP REDUCED	h		5	miles/trip
VEHICLE MILES TRAVEL REPLACED	**j=g*h**		**1,800**	**trips**
EMISSIONS FACTORS	k	NOx	0.24	gm/mile
	l	VOC	0.32	gm/mile
	m	CO	3.73	gm/mile
TOTAL EMISSIONS REDUCED	**n=j*k**	**NOx**	**451**	**gm**
	o=j*l	**VOC**	**602**	**gm**
	p=j*m	**CO**	**7,012**	**gm**
ASSUMED ANNUAL DAYS	q		260	days/year
METRIC CONVERSION FACTOR	r		1,000	gm/kg
ANNUAL EMISSIONS REDUCTION	**s=(n*q)/r**	**NOx**	**117**	**kg/year**
	t=(o*q)/r	**VOC**	**156**	**kg/year**
	u=(p*q)/r	**CO**	**1,823**	**kg/year**

TOTALS	
2018 AVERAGE TRIP LENGTH (ACS 2018 VIA H-GAC COMMUTING-PATTERN DATA)	12.5
PERCENT REDUCTION OF TRIP LENGTH BY 2045	60%

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