



Walk.Bike.Ohio

# Estimated Economic Benefits of Bicycling & Walking

2020



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## INTRODUCTION

This technical memorandum contains an economic impact analysis of the state of Ohio's bicycling and walking activity. Specifically, this analysis looks at the estimated number of bicycling and walking trips by Ohio residents each year, the estimated number of motor vehicle trips reduced by bicycling and walking trips, and the resulting transportation and environmental benefits. These estimates are intended to demonstrate how investments in Ohio's bicycling and walking network can contribute directly and indirectly to the state economy and improve residents' quality of life. Where appropriate, the estimated benefits are expressed in monetary terms so that the various impact areas associated with bicycling and walking in Ohio can be more easily compared to one another.

### Limitations

Even with extensive primary and secondary research incorporated into this analysis, it is not possible to accurately forecast the exact impacts of various bicycling- and walking-related factors. Accordingly, all estimated benefits are rounded and should be considered rough order of magnitude estimates instead of precise amounts. All monetary estimates are presented in undiscounted 2019 inflation-adjusted dollars.

### Summary

Existing bicycle and walk trips in Ohio are estimated to help residents save \$12.7 billion in transportation and environmental costs over the next 20 years. If Ohio's bicycle and walk rate increased to that of the 1st ranked state (Alaska), an additional \$24.6 billion in cost savings might be realized. If Ohio's bicycle and walk rate

increased to that of the 10th ranked state (Maine), an additional \$7.0 billion in cost savings might be realized. If Ohio's bicycle and walk rate increased to that of the 20th ranked state (Illinois), an additional \$5.0 billion in cost savings might be realized.

## VEHICLE TRIP REDUCTION ESTIMATES

Using bicycle and walk commute mode share as a proxy for historic bicycle and pedestrian counts requires extrapolating from a general estimate of how many people are bicycling and walking to work on a typical day in Ohio to get to an estimate of how many bicycle and walk trips take place for any purpose on a typical day in Ohio.

### Commuter Trip Estimates

The first step in the extrapolation process is estimating the number of annual bicycle and walk commute trips. This analysis assumes that the rolling daily bicycle and walk commute estimates from ACS represent a typical weekday in Ohio and accounts for seasonal changes. The daily bicycle and walk commute trip estimates are then multiplied by a factor of 260 weekdays to arrive at an annual estimate.



### All Trip Purpose Estimates

According to the 2017 National Household Travel Survey (NHTS), commute trips only represent a fraction of all bicycle and walk trips. Table 1 shows that for every bicycle commute trip in the United States, approximately 7.5 other bicycle trips take place. Similarly, Table 2 shows that for every walk commute trip, there’s approximately 11.6 other walk trips in the United States. Applying these factors to the estimated number of annual bicycle and walk commute trips gives an estimate of the total number of bicycle and walk trips per year in Ohio.

Table 4 shows the existing bicycle and walk commute rates in Ohio. Currently, Ohio is ranked 35th in the country for combined bicycling and walking commute rates. To become the top ranked state in the country would require increasing its combined rate to 8.9%, to be 10th would require a combined rate of 4.4%, and to be 20th would require a combined rate of 3.7% (see Table 3).

**Table 1: Bicycle Trip Purpose Multipliers\***

TRIP PURPOSE	BIKE TRIP RATIO
Utilitarian Trips to Commute Trips	5.33 trips : 1 trip
School Trips to Commute Trips	0.46 trips : 1 trip
Social/Recreational Trips to Commute Trips	1.68 trips : 1 trip
<b>Total</b>	<b>7.47 trips : 1 trip</b>

\*Source: National Household Travel Survey (2017)

**Table 2: Walk Trip Purpose Multipliers\***

TRIP PURPOSE	BIKE TRIP RATIO
Utilitarian Trips to Commute Trips	8.77 trips : 1 trip
School Trips to Commute Trips	0.68 trips : 1 trip
Social/Recreational Trips to Commute Trips	2.18 trips : 1 trip
<b>Total</b>	<b>11.63 trips : 1 trip</b>

\*Source: National Household Travel Survey (2017)

**Table 3: State Commute Mode Share Rankings\***

STATE	BIKE COMMUTE MODE SHARE	WALK COMMUTE MODE SHARE	COMBINED MODE SHARE
1st (Alaska)	0.93%	7.96%	8.89%
10th (Maine)	0.44%	3.92%	4.36%
20th (Illinois)	0.63%	3.04%	3.67%
35th (Ohio)	0.30%	2.24%	2.53%

\*Source: American Community Survey (2013-2017)



**Table 4: Commute Mode Share Estimates**

YEAR	BICYCLE COMMUTE MODE SHARE* (ESTIMATED DAILY BICYCLE COMMUTE TRIPS) - RANKINGS BELOW FROM COMBINED MODE SHARE				WALK COMMUTE MODE SHARE* (ESTIMATED DAILY WALK COMMUTE TRIPS) - RANKINGS BELOW FROM COMBINED MODE SHARE			
	EXISTING **	1ST RANK†	10TH RANK†	20TH RANK†	EXISTING **	1ST RANK†	10TH RANK†	20TH RANK†
2019	0.30% (32,000)	0.30% (32,000)	0.30% (32,000)	0.30% (32,000)	2.24% (241,000)	2.24% (241,000)	2.24% (241,000)	2.24% (241,000)
2020	0.30% (32,000)	0.33% (35,000)	0.30% (33,000)	0.31% (34,000)	2.24% (241,000)	2.52% (272,000)	2.32% (250,000)	2.28% (245,000)
2021	0.30% (32,000)	0.36% (39,000)	0.31% (33,000)	0.33% (36,000)	2.24% (241,000)	2.81% (303,000)	2.40% (259,000)	2.32% (250,000)
2022	0.30% (32,000)	0.39% (42,000)	0.32% (34,000)	0.35% (37,000)	2.24% (241,000)	3.09% (334,000)	2.49% (269,000)	2.36% (254,000)
2023	0.30% (32,000)	0.42% (46,000)	0.32% (35,000)	0.36% (39,000)	2.24% (241,000)	3.38% (365,000)	2.57% (278,000)	2.40% (259,000)
2024	0.30% (32,000)	0.45% (49,000)	0.33% (36,000)	0.38% (41,000)	2.24% (242,000)	3.67% (396,000)	2.66% (287,000)	2.44% (263,000)
2025	0.30% (32,000)	0.49% (53,000)	0.34% (37,000)	0.40% (43,000)	2.24% (242,000)	3.95% (427,000)	2.74% (296,000)	2.48% (268,000)
2026	0.30% (32,000)	0.52% (56,000)	0.35% (37,000)	0.41% (45,000)	2.24% (242,000)	4.24% (459,000)	2.83% (306,000)	2.52% (272,000)
2027	0.30% (32,000)	0.55% (60,000)	0.35% (38,000)	0.43% (47,000)	2.24% (242,000)	4.53% (490,000)	2.91% (315,000)	2.56% (277,000)
2028	0.30% (32,000)	0.58% (63,000)	0.36% (39,000)	0.45% (49,000)	2.24% (242,000)	4.81% (521,000)	3.00% (324,000)	2.60% (281,000)
2029	0.30% (32,000)	0.61% (66,000)	0.37% (40,000)	0.47% (50,000)	2.24% (242,000)	5.10% (552,000)	3.08% (334,000)	2.64% (286,000)
2030	0.30% (32,000)	0.65% (70,000)	0.37% (40,000)	0.48% (52,000)	2.24% (242,000)	5.38% (584,000)	3.16% (343,000)	2.68% (290,000)
2031	0.30% (32,000)	0.68% (73,000)	0.38% (41,000)	0.50% (54,000)	2.24% (243,000)	5.67% (615,000)	3.25% (352,000)	2.72% (295,000)
2032	0.30% (32,000)	0.71% (77,000)	0.39% (42,000)	0.52% (56,000)	2.24% (243,000)	5.96% (646,000)	3.33% (362,000)	2.76% (299,000)



YEAR	BICYCLE COMMUTE MODE SHARE* (ESTIMATED DAILY BICYCLE COMMUTE TRIPS) - RANKINGS BELOW FROM COMBINED MODE SHARE				WALK COMMUTE MODE SHARE* (ESTIMATED DAILY WALK COMMUTE TRIPS) - RANKINGS BELOW FROM COMBINED MODE SHARE			
	EXISTING **	1ST RANK†	10TH RANK†	20TH RANK†	EXISTING **	1ST RANK†	10TH RANK†	20TH RANK†
2033	0.30% (32,000)	0.74% (80,000)	0.39% (43,000)	0.53% (58,000)	2.24% (243,000)	6.24% (678,000)	3.42% (371,000)	2.80% (304,000)
2034	0.30% (32,000)	0.77% (84,000)	0.40% (44,000)	0.55% (60,000)	2.24% (243,000)	6.53% (709,000)	3.50% (380,000)	2.84% (308,000)
2035	0.30% (32,000)	0.80% (87,000)	0.41% (44,000)	0.57% (62,000)	2.24% (243,000)	6.82% (741,000)	3.59% (390,000)	2.88% (313,000)
2036	0.30% (32,000)	0.84% (91,000)	0.41% (45,000)	0.58% (63,000)	2.24% (243,000)	7.10% (772,000)	3.67% (399,000)	2.92% (317,000)
2037	0.30% (32,000)	0.87% (94,000)	0.42% (46,000)	0.60% (65,000)	2.24% (243,000)	7.39% (804,000)	3.75% (409,000)	2.96% (322,000)
2038	0.30% (32,000)	0.90% (98,000)	0.43% (47,000)	0.62% (67,000)	2.24% (243,000)	7.67% (835,000)	3.84% (418,000)	3.00% (326,000)
2039	0.30% (32,000)	0.93% (101,000)	0.44% (47,000)	0.63% (69,000)	2.24% (244,000)	7.96% (867,000)	3.92% (427,000)	3.04% (331,000)

\* Source of estimated population change: Ohio Development Services Agency, Office of Research, Population Projections, 2018

\*\* Source existing commute mode share data: American Community Survey, 2013-2017 five-year estimates

† Assumes linear increase from existing commute mode share to 1st, 10th, and 20th ranked COMBINED commute mode share shown in Table 2 and Table 3 over 20-year period.



**Table 5: Annual Walk and Bicycle Trip Estimates**

Table 5 shows the estimated number of bicycle and walk trips that take place in Ohio for any trip purpose based on the commute trips shown in Table 4 and the commute to all trip multipliers in Table 1 and Table 2.

YEAR	ESTIMATED ANNUAL BICYCLE TRIPS FOR ALL TRIP PURPOSES				ESTIMATED ANNUAL WALK TRIPS FOR ALL TRIP PURPOSES			
	EXISTING *	1ST RANK	10TH RANK	20TH RANK	EXISTING *	1ST RANK	10TH RANK	20TH RANK
2019	85,959,000	85,959,000	85,959,000	85,959,000	967,935,000	967,935,000	967,935,000	967,935,000
2020	85,725,000	98,610,000	88,556,000	92,582,000	966,612,000	1,085,857,000	1,001,752,000	983,282,000
2021	85,491,000	111,274,000	91,156,000	99,211,000	965,287,000	1,203,906,000	1,035,606,000	998,644,000
2022	85,256,000	123,951,000	93,758,000	105,848,000	963,960,000	1,322,080,000	1,069,495,000	1,014,023,000
2023	85,021,000	136,642,000	96,363,000	112,492,000	962,631,000	962,631,000	1,103,420,000	1,029,418,000
2024	84,786,000	149,347,000	98,971,000	119,142,000	961,300,000	1,558,807,000	1,137,381,000	1,044,828,000
2025	84,551,000	162,065,000	101,581,000	125,800,000	959,967,000	1,677,359,000	1,171,377,000	1,060,255,000
2026	84,315,000	174,797,000	104,195,000	132,465,000	958,632,000	1,796,037,000	1,205,409,000	1,075,697,000
2027	84,079,000	187,542,000	106,811,000	139,137,000	957,296,000	1,914,841,000	1,239,477,000	1,091,155,000
2028	83,842,000	200,300,000	109,429,000	145,816,000	955,957,000	2,033,770,000	1,273,580,000	1,106,629,000
2029	83,605,000	213,073,000	112,051,000	152,502,000	954,616,000	2,152,826,000	1,307,719,000	1,122,119,000
2030	83,368,000	225,858,000	114,675,000	159,195,000	953,273,000	2,272,008,000	1,341,894,000	1,137,625,000
2031	83,131,000	238,657,000	117,302,000	165,895,000	951,929,000	2,391,315,000	1,376,105,000	1,153,147,000
2032	82,893,000	251,470,000	119,932,000	172,602,000	950,582,000	2,510,749,000	1,410,351,000	1,168,685,000
2033	82,655,000	264,296,000	122,564,000	179,316,000	949,233,000	2,630,308,000	1,444,633,000	1,184,238,000
2034	82,417,000	277,136,000	125,199,000	186,038,000	947,883,000	2,749,993,000	1,478,951,000	1,199,808,000
2035	82,179,000	289,989,000	127,837,000	192,766,000	946,530,000	2,869,805,000	1,513,304,000	1,215,393,000
2036	81,940,000	302,856,000	130,478,000	199,501,000	945,175,000	2,989,742,000	1,547,693,000	1,230,995,000
2037	81,701,000	315,737,000	133,121,000	206,244,000	943,819,000	3,109,805,000	1,582,118,000	1,246,612,000
2038	81,461,000	328,630,000	135,767,000	212,993,000	942,460,000	3,229,993,000	1,616,579,000	1,262,245,000
2039	81,221,000	341,538,000	138,416,000	219,750,000	941,100,000	3,350,308,000	1,651,075,000	1,277,894,000
<b>SUM.</b>	<b>1,669,637,000</b>	<b>4,393,768,000</b>	<b>2,268,162,000</b>	<b>3,119,295,000</b>	<b>19,078,242,000</b>	<b>44,289,889,000</b>	<b>26,507,919,000</b>	<b>22,602,692,000</b>
<b>DIFF.</b>	<b>-</b>	<b>2,724,131,000</b>	<b>598,525,000</b>	<b>1,449,658,000</b>	<b>-</b>	<b>25,211,647,000</b>	<b>7,429,677,000</b>	<b>3,524,450,000</b>

\* This analysis assumes that some non-commute bicycle and pedestrian trips will shift to public transit following recent investments in public transit by the Ohio General Assembly. Source: LaFleur, R. "Ohio is ready to double public transit investment, but is it enough for struggling Cincinnati Metro?" WCPO Cincinnati. April 9, 2019. <<https://www.wcpo.com/news/transportation-development/move-up-cincinnati/ohio-is-ready-to-double-public-transit-investment-but-is-it-enough-for-struggling-cincinnati-metro>>



## Reduced Motor Vehicle Trip Estimates

After estimating the number of annual bicycle and walk trips in Ohio, the next step in the analysis is estimating how many of those bicycle and walk trips replace motor vehicle trips. Using a comparison of local and national mode share data, Table 6 and Table 7 show motor vehicle trip replacement factors for commute, utilitarian, college, K-12 school, and social/recreational trips. For example, if bicycling was not an option for Ohio commuters, an estimated 54.2% of commuters who currently bicycle to work might drive. The rest might walk, take transit, telecommute, or use another mode of transportation. Table 8 shows the estimated annual vehicle trip reduced from bicycling and walking trips.

**Table 6: Annual Walk and Bicycle Trip Estimates**

TRIP PURPOSE	MOTOR VEHICLE TRIPS REPLACED BY BICYCLE TRIPS <sup>1</sup>	BICYCLE TRIP DISTANCE
Commute Trips	54.2%	2.47 miles
Utilitarian Trips	87.1%	2.28 miles
College Trips	77.9%	1.31 miles
K-12 School Trips	53.2%	1.36 miles
Social/ Recreational Trips	15.5%	2.73 miles

## Reduced Vehicle-Miles Traveled Estimates

The 2017 National Household Travel Survey found that the distance traveled for bicycle and walk trips varied by the trip purpose. Table 6 and Table 7 show the average walk and bicycle trip distances by trip purpose. Table 9 shows the estimated annual number of vehicle-miles traveled (VMT) reduced from bicycling and walking trips.

**Table 7: Trip Reduction Multipliers for Walking**

TRIP PURPOSE	MOTOR VEHICLE TRIPS REPLACED BY BICYCLE TRIPS <sup>1</sup>	BICYCLE TRIP DISTANCE
Commute Trips	54.9%	0.72 miles
Utilitarian Trips	88.8%	0.83 miles
College Trips	85.0%	0.43 miles
K-12 School Trips	54.6%	0.69 miles
Social/ Recreational Trips	15.5%	1.12 miles

<sup>1</sup> Motor vehicle replacement factors were estimated through a comparison of local commute mode share data from the American Community Survey (2013-2017) and national mode share data for all trip purposes from the 2017 National Household Travel Survey.





**Table 8: Vehicle Trip Reduction Estimates**

YEAR	ESTIMATED ANNUAL VEHICLE TRIP REDUCTIONS FROM BICYCLING				ESTIMATED ANNUAL VEHICLE TRIP REDUCTIONS FROM WALKING			
	EXISTING *	1ST RANK	10TH RANK	20TH RANK	EXISTING *	1ST RANK	10TH RANK	20TH RANK
2019	63,968,000	63,968,000	63,968,000	63,968,000	762,649,000	762,649,000	762,649,000	762,649,000
2020	63,890,000	73,784,000	66,064,000	69,155,000	761,680,000	902,896,000	803,295,000	781,421,000
2021	63,811,000	83,610,000	68,161,000	74,347,000	760,710,000	1,043,293,000	843,985,000	800,214,000
2022	63,732,000	93,446,000	70,260,000	79,544,000	759,738,000	1,183,840,000	884,718,000	819,025,000
2023	63,653,000	103,293,000	72,362,000	84,747,000	758,765,000	1,324,536,000	925,494,000	837,857,000
2024	63,573,000	113,150,000	74,466,000	89,956,000	757,791,000	1,465,383,000	966,313,000	856,708,000
2025	63,494,000	123,018,000	76,572,000	95,170,000	756,814,000	1,606,380,000	1,007,175,000	875,579,000
2026	63,415,000	132,896,000	78,680,000	100,389,000	755,837,000	1,747,527,000	1,048,080,000	894,470,000
2027	63,335,000	142,785,000	80,791,000	105,614,000	754,858,000	1,888,823,000	1,089,029,000	913,380,000
2028	63,255,000	152,684,000	82,904,00	110,845,000	753,877,000	2,030,270,000	1,130,020,000	932,310,000
2029	63,175,000	162,594,000	85,019,000	116,081,000	752,895,000	2,171,866,000	1,171,055,000	951,260,000
2030	63,095,000	172,514,000	87,136,000	121,323,000	751,912,000	2,313,613,000	1,212,133,000	970,229,000
2031	63,015,000	182,444,000	89,255,000	126,570,000	750,927,000	2,455,510,000	1,253,254,000	989,218,000
2032	62,935,000	192,386,000	91,377,000	131,823,000	749,940,000	2,597,556,000	1,294,418,000	1,008,227,000
2033	62,855,000	202,337,000	93,501,000	137,081,000	748,952,000	2,739,752,000	1,335,626,000	1,027,255,000
2034	62,774,000	212,299,000	95,627,000	142,345,000	747,963,000	2,882,099,000	1,376,876,000	1,046,303,000
2035	62,694,000	222,272,000	97,755,000	147,614,000	746,972,000	3,024,595,000	1,418,170,000	1,065,371,000
2036	62,613,000	232,255,000	99,885,000	152,889,000	745,980,000	3,167,242,000	1,459,507,000	1,084,459,000
2037	62,532,000	242,249,000	102,018,000	158,169,000	744,986,000	3,310,038,000	1,500,887,000	1,103,566,000
2038	62,451,000	252,253,000	104,153,000	163,455,000	743,990,000	3,452,984,000	1,542,310,000	1,122,693,000
2039	62,370,000	262,268,000	106,290,000	168,746,000	742,993,000	3,596,080,000	1,583,776,000	1,141,840,000
<b>SUM.</b>	<b>1,262,667,000</b>	<b>3,354,537,000</b>	<b>1,722,276,000</b>	<b>2,375,863,000</b>	<b>15,047,580,000</b>	<b>44,904,283,000</b>	<b>23,846,121,000</b>	<b>19,221,385,000</b>
<b>DIFF.</b>	<b>-</b>	<b>2,091,870,000</b>	<b>459,609,000</b>	<b>1,113,196,000</b>	<b>-</b>	<b>29,856,703,000</b>	<b>8,798,541,000</b>	<b>4,173,805,000</b>

\* This analysis assumes that some non-commute bicycle and pedestrian trips will shift to public transit following recent investments in public transit by the Ohio General Assembly. Source: LaFleur, R. "Ohio is ready to double public transit investment, but is it enough for struggling Cincinnati Metro?" WCPO Cincinnati. April 9, 2019. <<https://www.wcpo.com/news/transportation-development/move-up-cincinnati/ohio-is-ready-to-double-public-transit-investment-but-is-it-enough-for-struggling-cincinnati-metro>>



**Table 9: Vehicle-Miles Traveled Reduction Estimates**

YEAR	ESTIMATED ANNUAL VEHICLE TRIP REDUCTIONS FROM BICYCLING				ESTIMATED ANNUAL VEHICLE TRIP REDUCTIONS FROM WALKING			
	EXISTING	1ST RANK	10TH RANK	20TH RANK	EXISTING	1ST RANK	10TH RANK	20TH RANK
2019	145,966,000	145,966,000	145,966,000	145,966,000	625,833,000	625,833,000	625,833,000	625,833,000
2020	145,894,000	168,814,000	150,930,000	158,091,000	625,488,000	743,099,000	660,147,000	641,929,000
2021	145,821,000	191,686,000	155,898,000	170,228,000	625,142,000	860,490,000	694,498,000	658,043,000
2022	145,748,000	214,583,000	160,872,000	182,379,000	624,796,000	978,007,000	728,885,000	674,173,000
2023	145,675,000	237,504,000	165,851,000	194,542,000	624,449,000	1,095,649,000	763,308,000	690,320,000
2024	145,602,000	260,449,000	170,835,000	206,718,000	624,102,000	1,213,417,000	797,768,000	706,485,000
2025	145,529,000	283,419,000	175,825,000	218,908,000	623,753,000	1,331,310,000	832,265,000	722,666,000
2026	145,455,000	306,413,000	180,820,000	231,110,000	623,404,000	1,449,328,000	866,797,000	738,864,000
2027	145,382,000	329,432,000	185,820,000	243,325,000	623,054,000	1,567,472,000	901,367,000	755,079,000
2028	145,308,000	352,475,000	190,825,000	255,553,000	622,703,000	1,685,741,000	935,972,000	771,310,000
2029	145,234,000	375,543,000	195,835,000	267,793,000	622,352,000	1,804,135,000	970,615,000	787,559,000
2030	145,159,000	398,635,000	200,851,000	280,047,000	622,000,000	1,922,655,000	1,005,293,000	803,825,000
2031	145,085,000	421,751,000	205,872,000	292,314,000	621,647,000	2,041,301,000	1,040,008,000	820,107,000
2032	145,011,000	444,892,000	210,898,000	304,593,000	621,294,000	2,160,072,000	1,074,760,000	836,407,000
2033	144,936,000	468,057,000	215,930,000	316,886,000	620,939,000	2,278,968,000	1,109,548,000	852,723,000
2034	144,861,000	491,246,000	220,966,000	329,191,000	620,584,000	2,397,989,000	1,144,372,000	869,056,000
2035	144,786,000	514,460,000	226,008,000	341,510,000	620,229,000	2,517,136,000	1,179,233,000	885,406,000
2036	144,711,000	537,699,000	231,055,000	353,841,000	619,872,000	2,636,408,000	1,214,130,000	901,773,000
2037	144,636,000	560,962,000	236,108,000	366,185,000	619,515,000	2,755,806,000	1,249,064,000	918,157,000
2038	144,560,000	584,249,000	241,165,000	378,542,000	619,157,000	2,875,329,000	1,284,034,000	934,558,000
2039	144,485,000	607,561,000	246,228,000	390,912,000	618,799,000	2,994,978,000	1,319,040,000	950,976,000
<b>SUM.</b>	<b>2,903,878,000</b>	<b>7,749,830,000</b>	<b>3,968,592,000</b>	<b>5,482,668,000</b>	<b>12,443,279,000</b>	<b>37,309,290,000</b>	<b>19,771,104,000</b>	<b>15,919,416,000</b>
<b>DIFF.</b>	<b>-</b>	<b>4,845,952,000</b>	<b>1,064,714,000</b>	<b>2,578,790,000</b>	<b>-</b>	<b>24,866,011,000</b>	<b>7,327,825,000</b>	<b>3,476,137,000</b>



## TRANSPORTATION BENEFITS

Replacing motor vehicle trips with bicycle and walk trips can help reduce household transportation costs, traffic congestion costs, roadway maintenance costs, and safety costs. Table 10 shows that for every vehicle-mile reduced from increased bicycling and walking, Ohio can expect to generate \$0.81 in transportation benefits.

**Table 10: Transportation Benefit Multipliers**

TRANSPORTATION BENEFIT MULTIPLIER	VALUE
Household Transportation Cost Savings	\$0.40 per VMT Reduced
Traffic Congestion Cost Savings	\$0.09 per VMT Reduced
Roadway Maintenance Cost Savings	\$0.15 per VMT Reduced
Collision Cost Savings	\$0.17 per VMT Reduced
Total Transportation Cost Savings	\$0.81 per VMT Reduced

Applied to the vehicle-miles traveled reduction estimates in Table 9, existing bicycle and walk trips in Ohio can help residents save \$12.3 billion in transportation costs over a 20-year period, as shown in Table 11. If Ohio's bicycle and walk rate increased to that of the 1st ranked state, an additional \$23.7 billion in transportation cost savings might be realized over a 20-year period. If Ohio's bicycle and walk rate increased to that of the 10th ranked state, an additional \$6.7 billion in transportation cost savings might be realized over a 20-year period. If Ohio's bicycle and walk rate increased to that of the 20th ranked state, an additional \$4.8 billion in transportation cost savings might be realized over a 20-year period.



**Table 11: Estimated Transportation Benefits**

YEAR	ESTIMATED ANNUAL TRANSPORTATION COST SAVINGS			
	EXISTING	1ST RANK	10TH RANK	20TH RANK
2019	\$0	\$0	\$0	\$0
2020	\$616,250,000	\$728,519,000	\$647,962,000	\$639,129,000
2021	\$615,916,000	\$840,574,000	\$679,373,000	\$661,698,000
2022	\$615,581,000	\$952,749,000	\$710,818,000	\$684,291,000
2023	\$615,245,000	\$1,065,043,000	\$742,297,000	\$706,908,000
2024	\$614,909,000	\$1,177,458,000	\$773,808,000	\$729,549,000
2025	\$614,572,000	\$1,289,992,000	\$805,353,000	\$752,214,000
2026	\$614,234,000	\$1,402,645,000	\$836,931,000	\$774,903,000
2027	\$613,896,000	\$1,515,419,000	\$868,543,000	\$797,615,000
2028	\$613,557,000	\$1,628,312,000	\$900,188,000	\$820,351,000
2029	\$613,217,000	\$1,741,324,000	\$931,866,000	\$843,111,000
2030	\$612,876,000	\$1,854,457,000	\$963,577,000	\$865,895,000
2031	\$612,535,000	\$1,967,709,000	\$995,322,000	\$888,703,000
2032	\$612,193,000	\$2,081,081,000	\$1,027,100,000	\$911,534,000
2033	\$611,851,000	\$2,194,572,000	\$1,058,911,000	\$934,389,000
2034	\$611,507,000	\$2,308,183,000	\$1,090,756,000	\$957,268,000
2035	\$611,163,000	\$2,421,914,000	\$1,122,634,000	\$980,171,000
2036	\$610,818,000	\$2,535,764,000	\$1,154,545,000	\$1,003,098,000
2037	\$610,473,000	\$2,649,735,000	\$1,186,489,000	\$1,026,049,000
2038	\$610,127,000	\$2,763,825,000	\$1,218,467,000	\$1,049,023,000
2039	\$609,780,000	\$2,878,034,000	\$1,250,478,000	\$1,072,021,000
<b>SUM.</b>	<b>\$12,260,700,000</b>	<b>\$35,997,309,000</b>	<b>\$18,965,418,000</b>	<b>\$17,097,920,000</b>
<b>DIFF.</b>	<b>-</b>	<b>\$23,736,609,000</b>	<b>\$6,704,718,000</b>	<b>\$4,837,220,000</b>



## ENVIRONMENTAL BENEFITS

Reductions in vehicle-miles traveled can also have an impact on air quality. Table 12 shows the estimated particulate matter, nitrous oxide, sulfur oxide, volatile organic compounds, and carbon dioxide that a typical motor vehicle emits for every mile driven.

Applying these emission estimates to the estimated vehicle-miles traveled reductions in Table 9, existing bicycle and walk trips in Ohio can help prevent 6.8 million metric tons of greenhouse gas and criteria pollutant emissions from entering the atmosphere over a 20-year period (equivalent to a \$453.9 million in mitigation cost savings), as shown in Table 13.

If Ohio's bicycle and walk rate increased to that of the 1st ranked state, an additional 12.5 million metric tons of emissions could be prevented from entering the atmosphere over a 20-year period (equivalent to an additional \$878.8 million in mitigation cost savings). If Ohio's bicycle and walk rate increased to that of the 10th ranked state, an additional 3.5 million metric tons of emissions could be prevented from entering the atmosphere over a 20-year period (equivalent to an additional \$248.2 million in mitigation cost savings). If Ohio's bicycle and walk rate increased to that of the 20th ranked state, an additional 2.6 million metric tons of emissions could be prevented from entering the atmosphere over a 20-year period (equivalent to an additional \$179.1 million in mitigation cost savings).

**Table 12: Estimated Emissions Multipliers**

GREENHOUSE GAS/ CRITERIA POLLUTANT	EMISSIONS PER VEHICLE-MILE TRAVELED (METRIC TONS)	ASSOCIATED MITIGATION/ CLEAN-UP COST PER VEHICLE- MILE TRAVELED
Particulate Matter (PM)	0.00000005	\$0.0167
Nitrous Oxides (NOx)	0.00000069	\$0.0052
Sulfur Oxides (SOx)	0.00000001	\$0.0003
Volatile Organic Compounds (VOC)	0.00000103	\$0.0020
Carbon Dioxide (CO2)	0.00042047	\$0.0052



**Table 13: Estimated Environmental Benefits**

YEAR	ESTIMATED ANNUAL GREENHOUSE GAS & CRITERIA POLLUTANT EMISSION REDUCTIONS (METRIC TONS)				ESTIMATED ANNUAL EMISSION MITIGATION COST SAVINGS			
	EXISTING	1ST RANK	10TH RANK	20TH RANK	EXISTING	1ST RANK	10TH RANK	20TH RANK
2019	326,000	326,000	326,000	326,000	\$0	\$0	\$0	\$0
2020	326,000	385,000	342,000	338,000	\$22,815,000	\$26,972,000	\$23,989,000	\$23,662,000
2021	326,000	444,000	359,000	350,000	\$22,803,000	\$31,121,000	\$25,152,000	\$24,498,000
2022	325,000	504,000	376,000	362,000	\$22,791,000	\$35,274,000	\$26,317,000	\$25,334,000
2023	325,000	563,000	392,000	374,000	\$22,778,000	\$39,431,000	\$27,482,000	\$26,172,000
2024	325,000	622,000	409,000	386,000	\$22,766,000	\$43,593,000	\$28,649,000	\$27,010,000
2025	325,000	682,000	426,000	398,000	\$22,753,000	\$47,759,000	\$29,817,000	\$27,849,000
2026	325,000	741,000	442,000	410,000	\$22,741,000	\$51,930,000	\$30,986,000	\$28,689,000
2027	324,000	801,000	459,000	422,000	\$22,728,000	\$56,105,000	\$32,156,000	\$29,530,000
2028	324,000	861,000	476,000	434,000	\$22,716,000	\$60,285,000	\$33,328,000	\$30,372,000
2029	324,000	920,000	493,000	446,000	\$22,703,000	\$64,469,000	\$34,500,000	\$31,214,000
2030	324,000	980,000	509,000	458,000	\$22,690,000	\$68,657,000	\$35,674,000	\$32,058,000
2031	324,000	1,040,000	526,000	470,000	\$22,678,000	\$72,850,000	\$36,850,000	\$32,902,000
2032	324,000	1,100,000	543,000	482,000	\$22,665,000	\$77,048,000	\$38,026,000	\$33,748,000
2033	323,000	1,160,000	560,000	494,000	\$22,653,000	\$81,250,000	\$39,204,000	\$34,594,000
2034	323,000	1,220,000	577,000	506,000	\$22,640,000	\$85,456,000	\$40,383,000	\$35,441,000
2035	323,000	1,280,000	593,000	518,000	\$22,627,000	\$89,666,000	\$41,563,000	\$36,289,000
2036	323,000	1,340,000	610,000	530,000	\$22,614,000	\$93,881,000	\$42,745,000	\$37,138,000
2037	323,000	1,400,000	627,000	542,000	\$22,602,000	\$98,101,000	\$43,927,000	\$37,987,000
2038	322,000	1,461,000	644,000	554,000	\$22,589,000	\$102,325,000	\$45,111,000	\$38,838,000
2039	322,000	1,521,000	661,000	567,000	\$22,576,000	\$106,553,000	\$46,296,000	\$39,689,000
<b>SUM.</b>	<b>6,806,000</b>	<b>19,351,000</b>	<b>10,350,000</b>	<b>9,367,000</b>	<b>\$453,928,000</b>	<b>\$1,332,726,000</b>	<b>\$702,155,000</b>	<b>\$633,014,000</b>
<b>DIFF.</b>	<b>-</b>	<b>12,545,000</b>	<b>3,544,000</b>	<b>2,561,000</b>	<b>-</b>	<b>\$878,798,000</b>	<b>\$248,227,000</b>	<b>\$179,086,000</b>



