Telecommuting in the 3C Models

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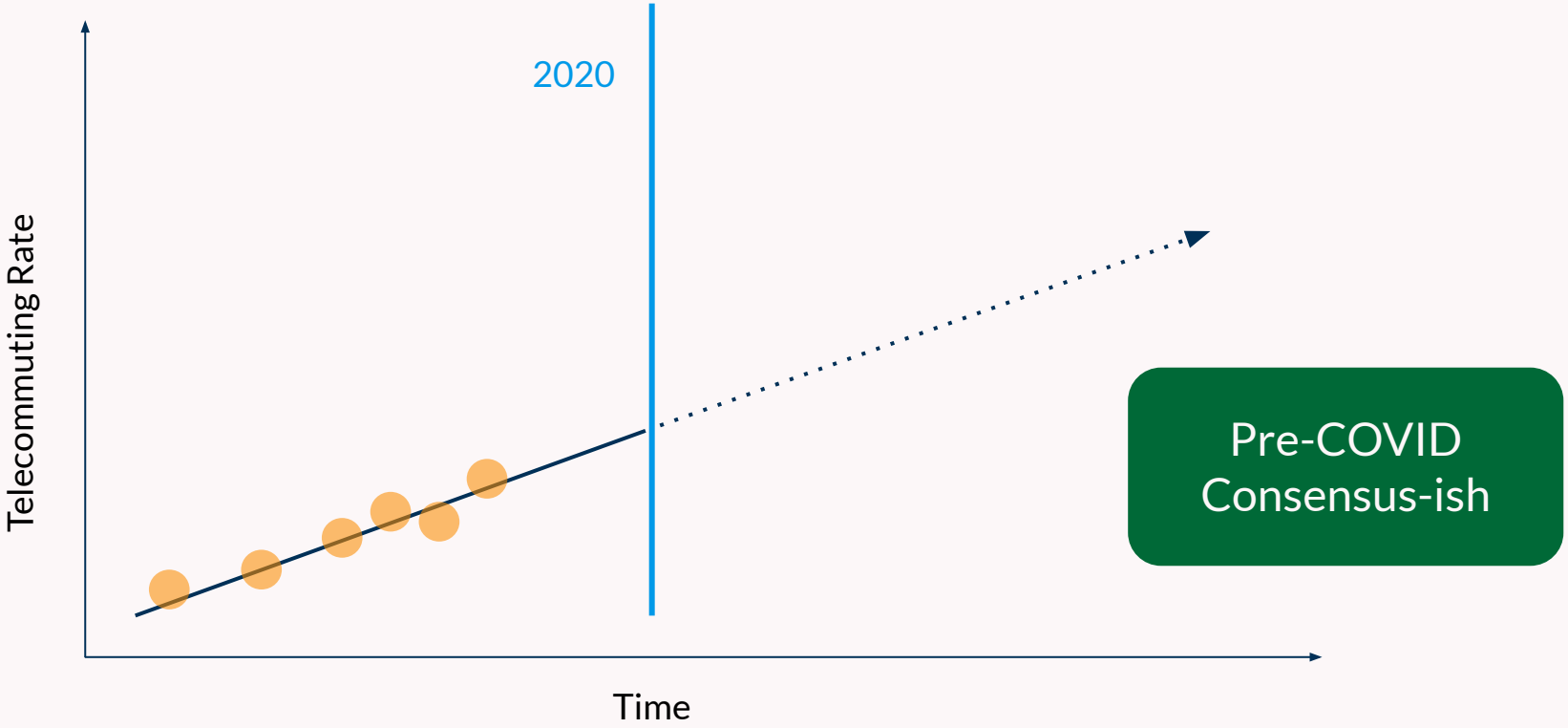
Ohio Travel Demand Model Users Group Meeting
December 3, 2021

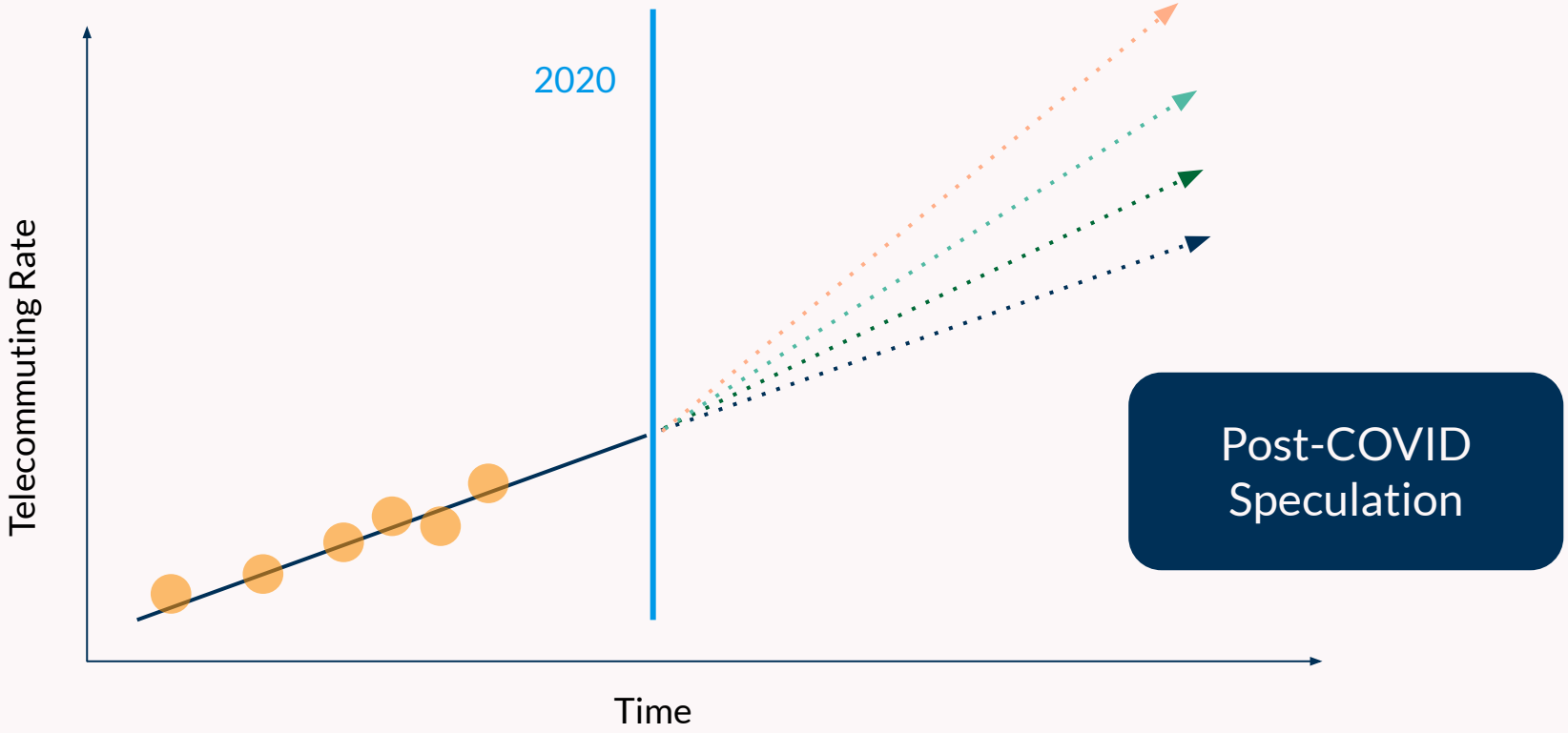
Agenda

1. Big Idea (5 mins)
2. Model Features (15 mins)
3. Sensitivity Test (10 mins)
4. Potential Next Steps (5 mins)

1. Big Idea



Before Times



After Times

Desirable Telecommuting Features

- Who
- What
- When
- Where
- Why

What Should the Model Do?

Desirable Telecommuting Features

- **Who**. Telecommuters should be explicitly identified in the simulation.
- **What**. Time spent working at home should be identified as such, i.e., a work activity.
- **When**. Time spent telecommuting at home should be explicit, i.e., scheduled.
- **Where**. Telecommuters should have a usual work location, i.e., we know where they are *not* traveling to.
- **Why**. Telecommuters' occupations and industries should align with ability of those types of jobs to telecommute; commute impedance should influence telecommuting choice.

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Anything We Missed?

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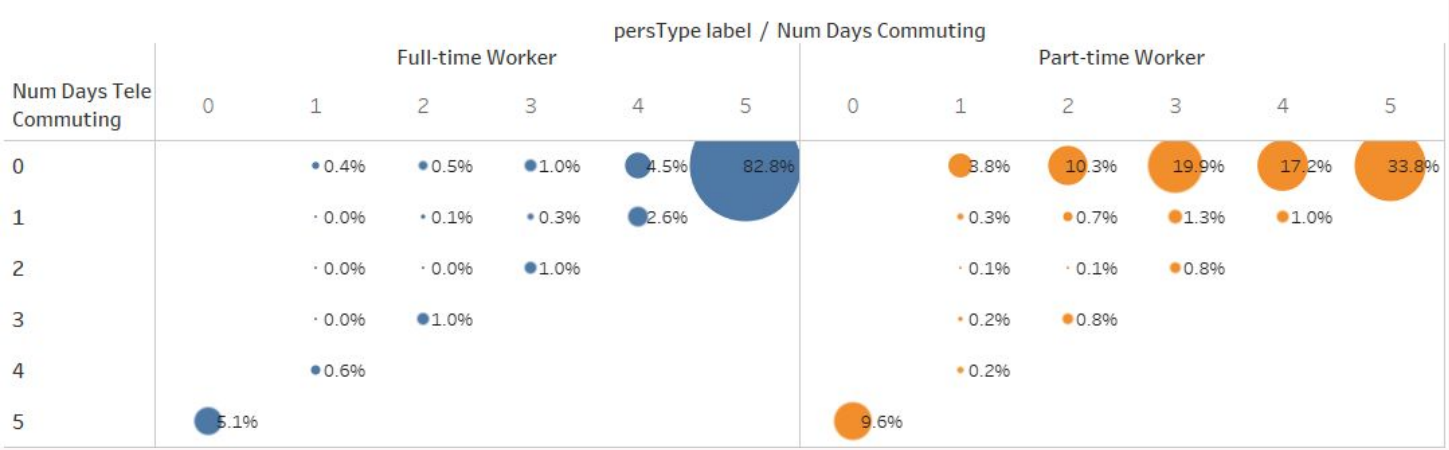
What Should the Model Do?

2. Model Features

Model Changes

Changes to Modules in the 3C Advanced Activity-Based Model due to Telecommuting

Commute Frequency Model



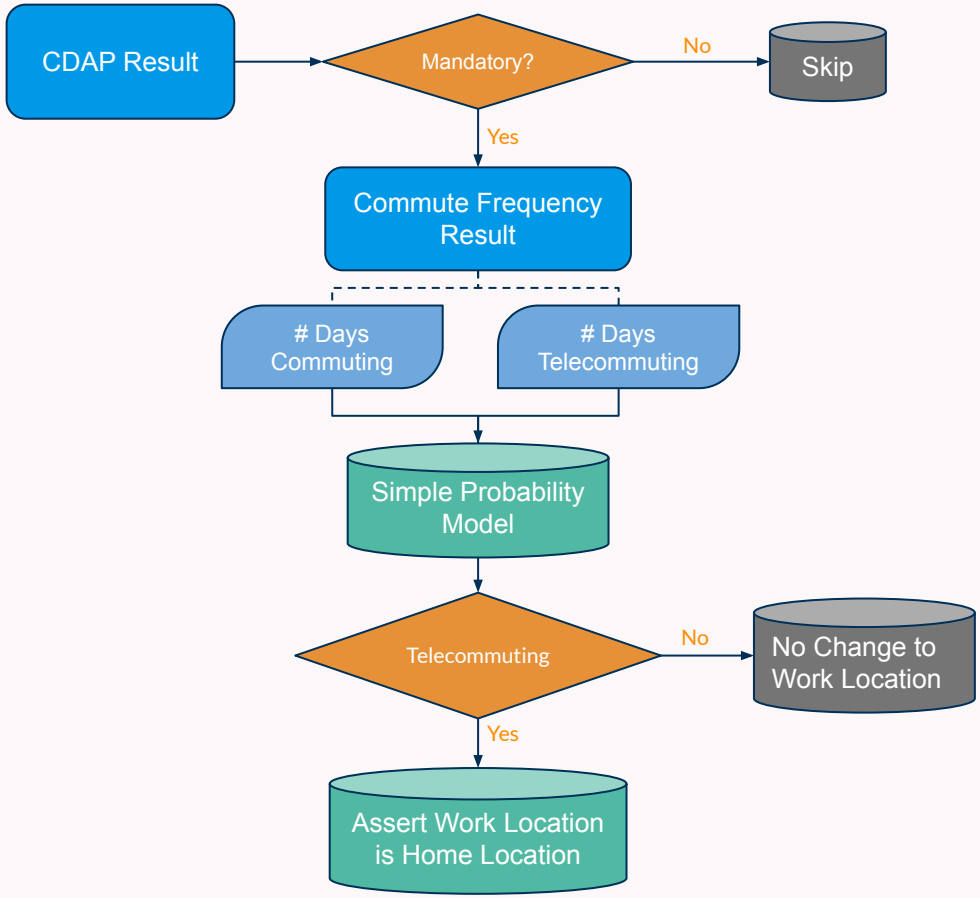
Expand the Dimension of Alternatives to include # Days Telecommuting

Coordinated Daily Activity Pattern Model (CDAP)

Alternatives	**Mandatory (M)** **Non-mandatory (NM)** **At-home (AH)**
Old Specification	Based-at-home workers AND telecommuters are NM or AH **Telecommuters have same behaviors as workers not working, as if they are taking the day off. Telecommuters are not constrained by work activity or work schedule.**
New Specification	Based-at-home workers AND telecommuters are M **Telecommuters are constrained by work activity and work schedule, actually working.**

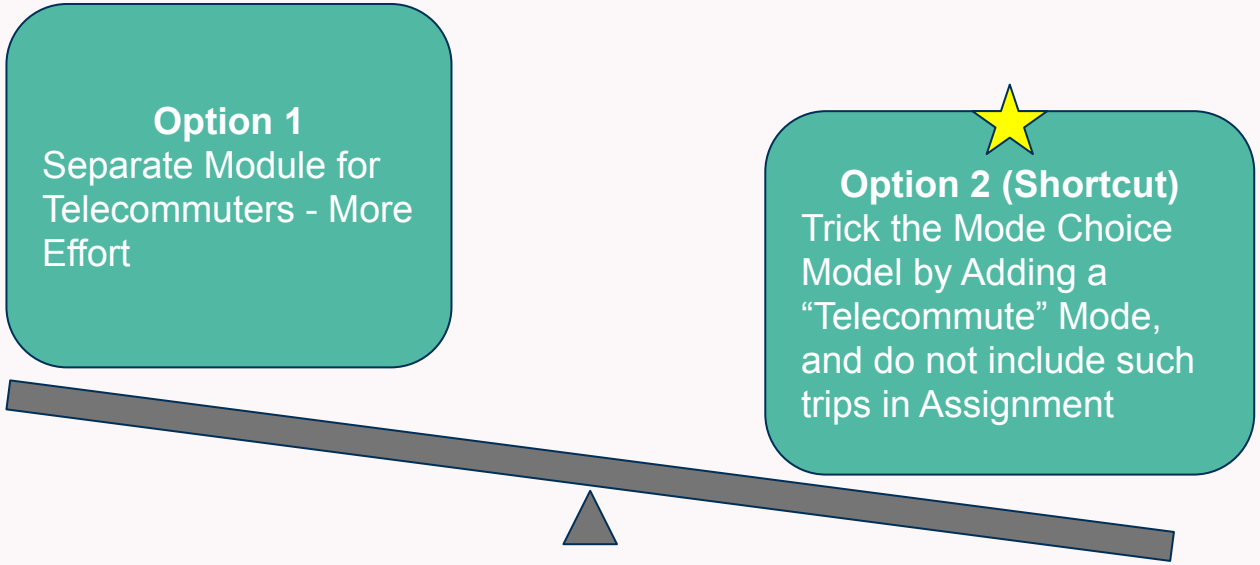
Differentiate workers working from home vs workers taking the day off

Explicit Telecommute Model



Is Telecommuting on the Simulation Day?

Mode Choice Model



Create “Telecommute” Mode

Model Stats

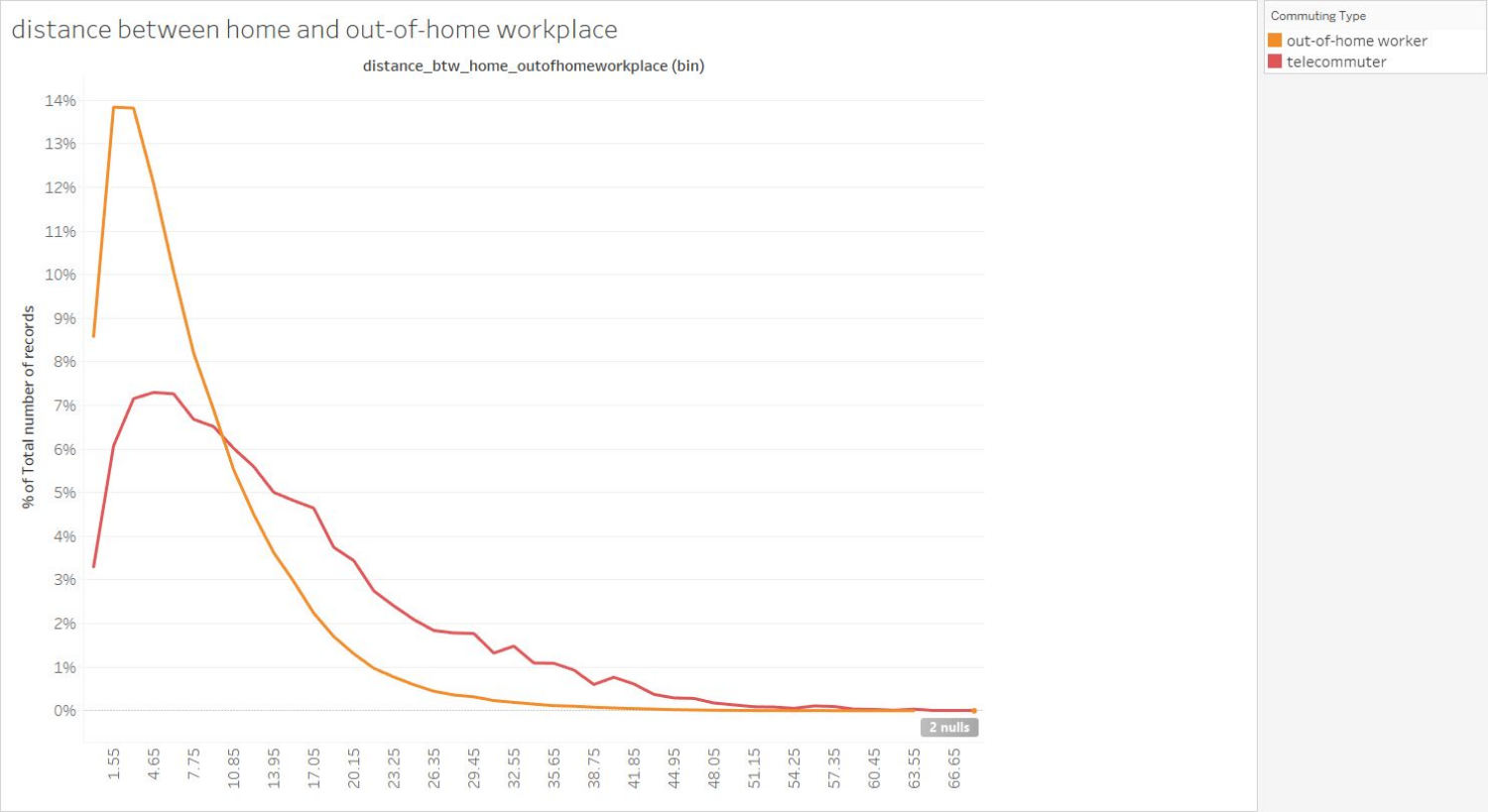
Telecommuting Related Model Stats in Columbus Base Year Implementation

Commuting Type	base telecommute
at-home worker	45,902
not working	118,311
out-of-home worker	697,058
telecommuter	16,247
Grand Total	877,518

Define: Telecommute Rate = telecommuter / (telecommuter + out-of-home worker)

Commuting Type	base telecommute
out-of-home worker	97.7%
telecommuter	2.3%

Number of Workers segmented by Commuting Type - Explicit Telecommuters



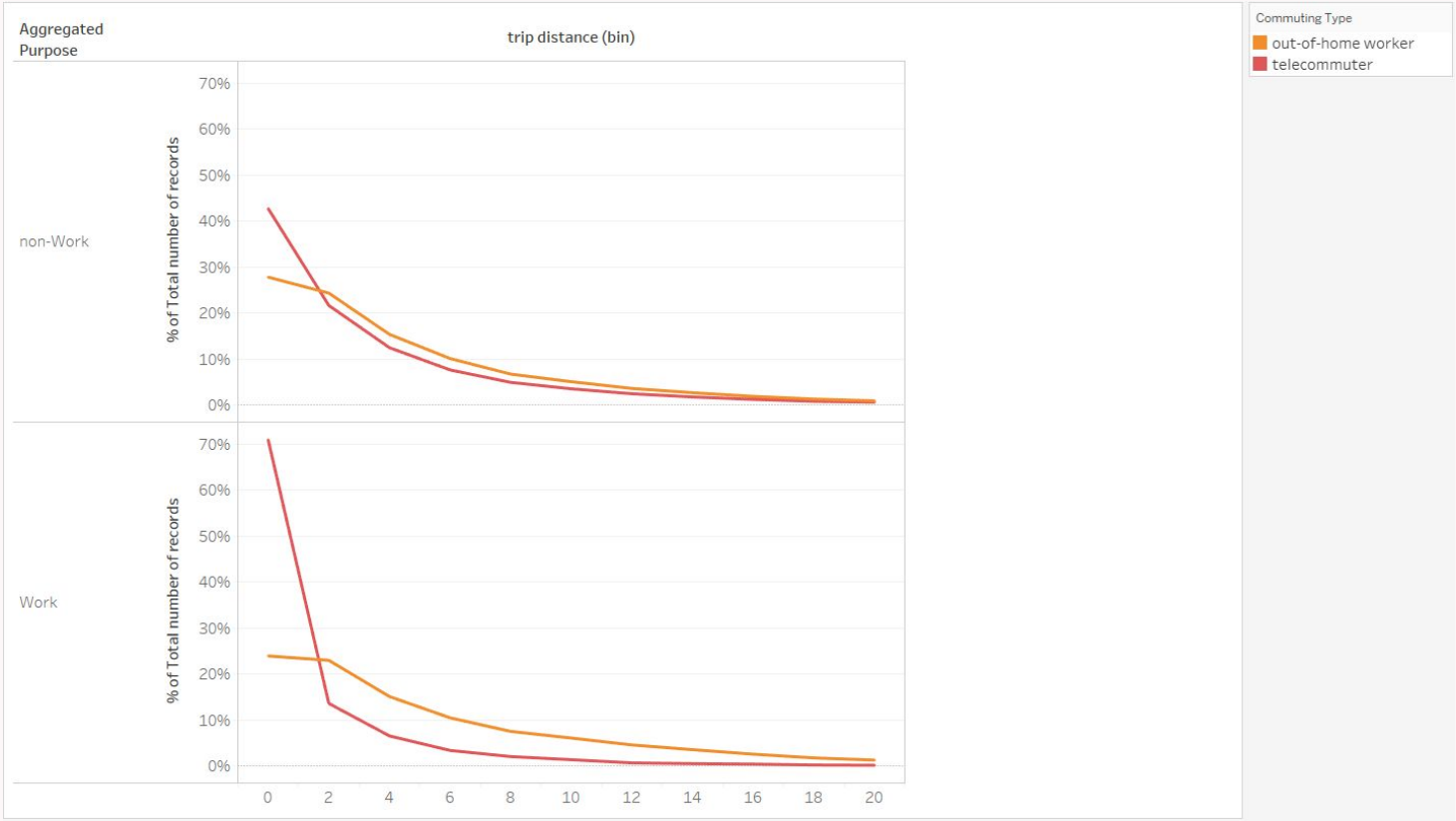
Distance btw Home and Out-of-home Workplace - Commute impedance should affect telecommute choice

Scenario	persType label	Commuting Type	Daily Trip VMT per person	number of persons
base telecommute	Full-time Worker	out-of-home worker	30.1	588,613
		not working	20.3	74,372
		at-home worker	14.9	32,932
		telecommuter	17.7	13,542
	Part-time Worker	out-of-home worker	25.7	108,445
		not working	14.1	43,939
		at-home worker	13.6	12,970
		telecommuter	16.9	2,705
	University Student	not a worker	14.5	96,347
	Non-worker	not a worker	16.3	251,853
	Retiree	not a worker	10.2	162,738
	Driving-age School Child	not a worker	7.5	61,919
	Pre-driving-age School Child	not a worker	0.2	245,041
	Pre-school Child	not a worker	0.5	129,017
Grand Total			17.2	1,824,433

Average Daily VMT by person type and commuting type - Savings from Telecommuting

Scenario	Commuting Type	number of persons	work activities per person	non-work activities per person	out-of-home work trips per person	out-of-home non-work trips per person
base telecommute	not a worker	946,915	0.0	2.7	0.0	2.7
	out-of-home worker	697,058	1.3	2.6	1.3	2.6
	not working	118,311	0.0	2.7	0.0	2.7
	at-home worker	45,902	1.4	2.7	0.6	2.7
	telecommuter	16,247	1.4	2.7	0.6	2.6
Grand Total		1,824,433	0.6	2.6	0.5	2.6

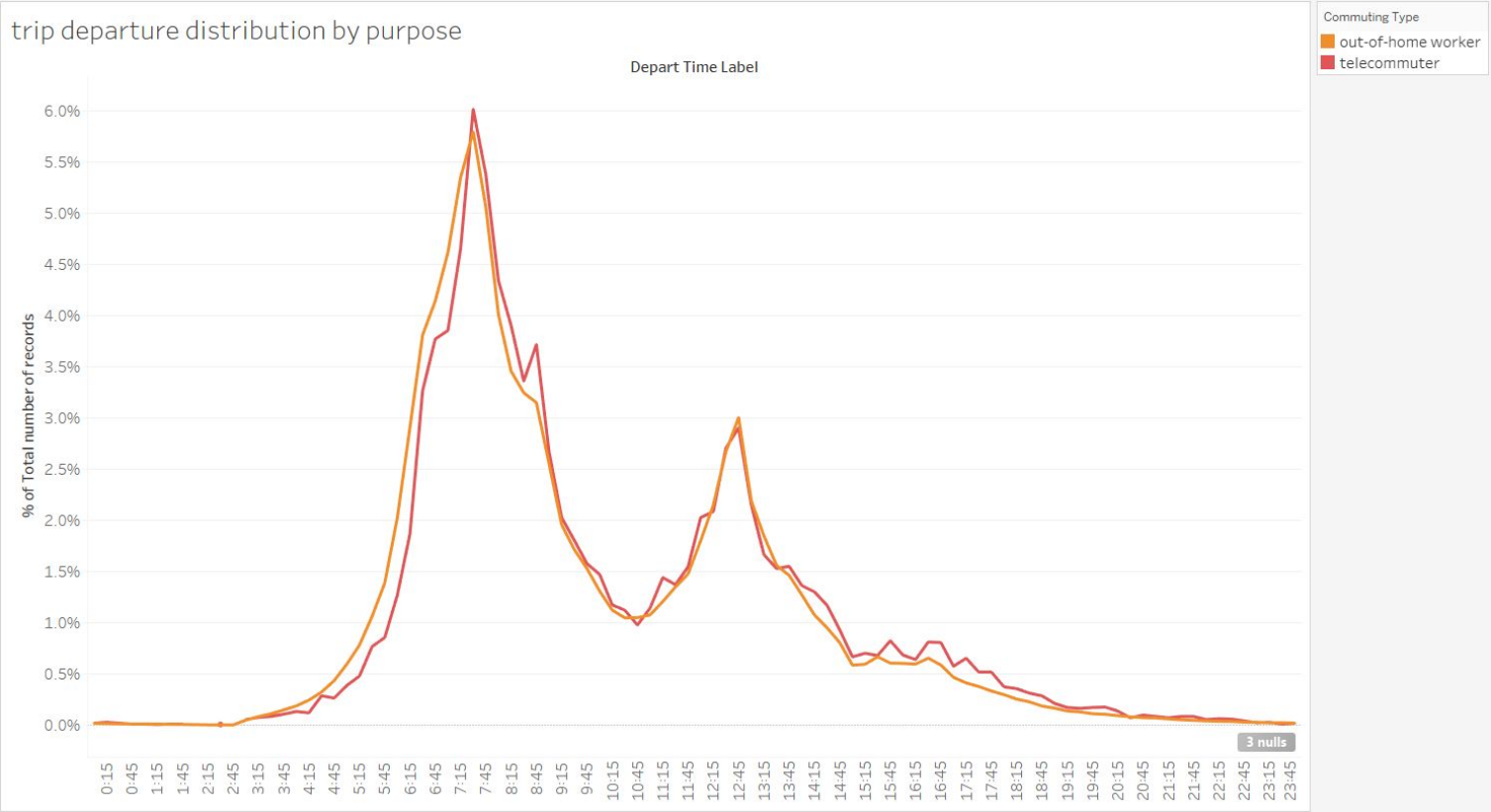
Activity Rate & Out-of-home Trip Rate (exclude trips going home) - Telecommuters have work activities, but not out-of-home work trips



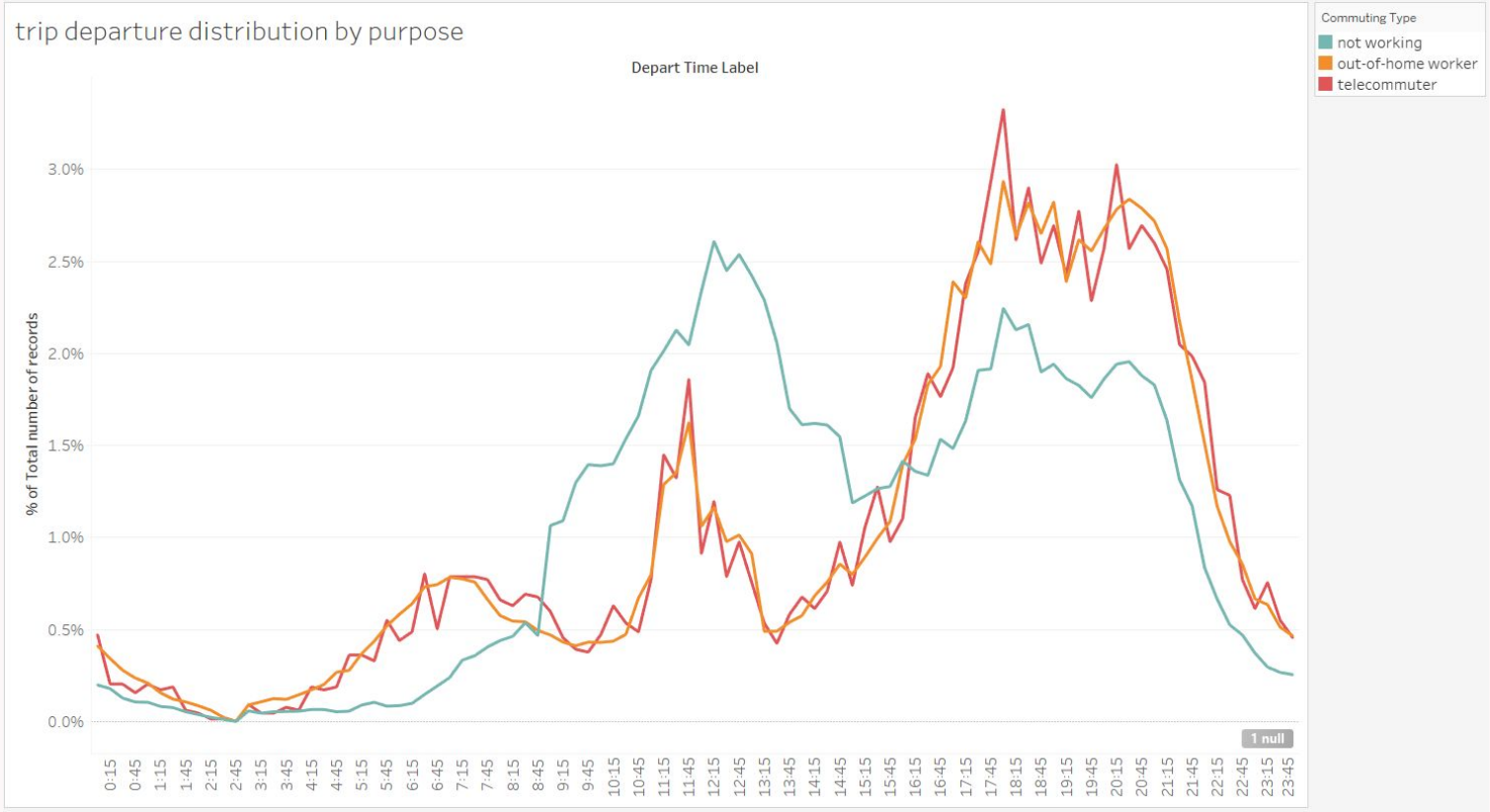
Trip Length Distribution - Telecommuters have shorter trips

Scenario	Commuting Type	number of persons	work activity duration per person	non-work activity duration per person
base telecommute	not a worker	946,915	2	216
	out-of-home worker	697,058	453	122
	not working	118,311	0	135
	at-home worker	45,902	445	119
	telecommuter	16,247	459	121
Grand Total		1,824,433	190	171

Activity Duration (in minutes) - Telecommuters are similar as Out-of-home Workers



Work Trip Departure Time - Telecommuters should still follow work schedule



Shopping Trip Departure Time - Not like workers taking a day off, Telecommuters' other activities should still be constrained by their work schedule

3. Sensitivity Test

Commuting Type	Scenario: base telecommute	Scenario: higher telecommute
out-of-home worker	97.7%	85.0%
telecommuter	2.3%	15.0%
Grand Total	100.0%	100.0%

Two Scenarios in Columbus: base (2%) vs higher (15%) Telecommuting

Industry Label	base telecommute telecommuter	higher telecommute telecommuter
Professional, Scientific and Technical Services	3.8%	42.6%
Management of Companies and Enterprises	3.7%	42.4%
Finance and Insurance	3.5%	39.7%
Information	3.3%	35.0%
Education Services	1.7%	32.6%
Wholesale Trade	2.9%	17.9%
Real Estate and Rental and Leasing	3.7%	14.6%
Administrative and Support and Waste Manag..	4.2%	10.9%
Mining	2.8%	7.1%
Public Administration	1.4%	6.4%
Other Services (except Public Administration)	2.1%	5.7%
Utilities	1.4%	5.7%
Health Care and Social Assistance	2.0%	4.6%
Manufacturing	2.0%	4.1%
Agriculture, Forestry, Fishing and Hunting	3.0%	4.0%
Arts, Entertainment and Recreation	1.0%	2.7%
Transportation and Warehousing	1.3%	2.5%
Construction	1.3%	2.5%
Retail Trade	1.5%	2.4%
Accommodation and Food Services	1.2%	1.3%
Grand Total	2.3%	15.0%

Telecommute Rate by Industry - Telecommuting is not for all industries

	work trips per person			non-work trips per person		
persType label	base telecommute	higher telecommute	% Difference	base telecommute	higher telecommute	% Difference
Full-time Worker	1.14	1.06	-7.0%	2.56	2.56	0.1%
Part-time Worker	0.82	0.79	-3.6%	2.87	2.87	0.2%
University Student	0.07	0.07	-0.1%	2.66	2.66	-0.2%
Non-worker	0.00	0.00	0.0%	3.21	3.20	-0.6%
Retiree	0.00	0.00	0.0%	2.45	2.45	-0.1%
Driving-age School Child	0.04	0.04	-5.8%	2.56	2.55	-0.4%
Pre-driving-age School Child	0.00	0.00	0.0%	2.65	2.64	-0.5%
Pre-school Child	0.00	0.00	0.0%	1.86	1.87	0.6%
Grand Total	0.52	0.49	-6.5%	2.64	2.63	-0.1%

Trip Rate Reduction - Impact of growing telecommute rate on Daily Person Out-of-home Trip Rates

	Total Daily Trip VMT		
persType label	base telecommute	higher telecommute	% Difference
Full-time Worker	19,964,222	18,514,862	-7.3%
Part-time Worker	3,630,230	3,540,045	-2.5%
University Student	1,397,685	1,367,251	-2.2%
Non-worker	4,098,603	4,085,523	-0.3%
Retiree	1,654,966	1,673,633	1.1%
Driving-age School Child	462,383	476,173	3.0%
Pre-driving-age School Child	53,951	55,345	2.6%
Pre-school Child	60,054	58,801	-2.1%
Grand Total	31,322,094	29,771,633	-5.0%

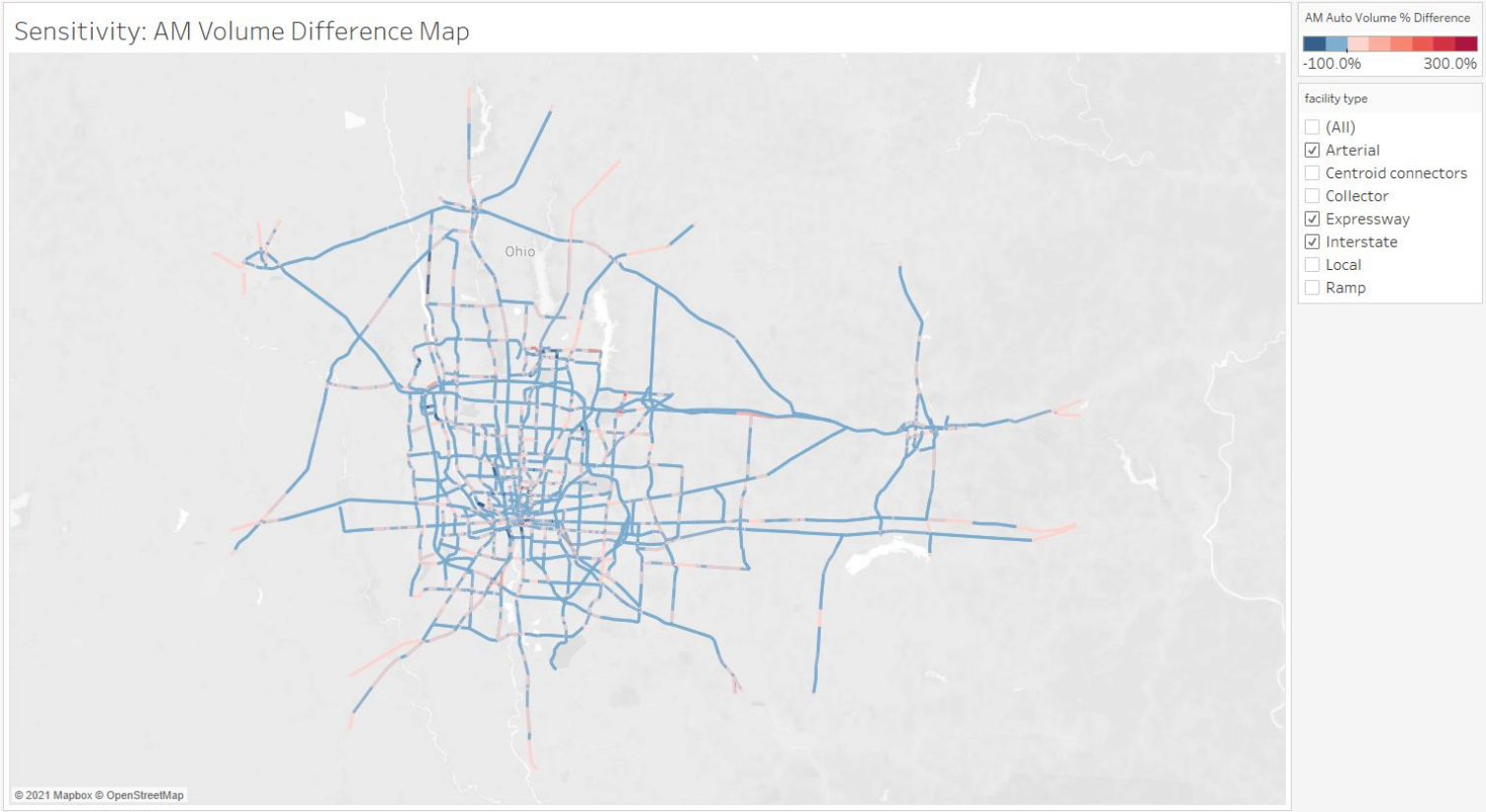
VMT Reduction by Person Type - FT & PT workers have lower VMT due to higher telecommuting rate

	number of persons			Total Daily Trip VMT		
Commuting Type	base telecommute	higher telecommute	% Difference	base telecommute	higher telecommute	% Difference
out-of-home worker	697,058	606,517	-13.0%	20,515,856	17,486,616	-14.8%
not working	118,311	118,168	-0.1%	2,126,642	2,117,187	-0.4%
telecommuter	16,247	107,183	559.7%	284,923	1,780,089	524.8%
at-home worker	45,902	45,644	-0.6%	667,030	671,016	0.6%
not a worker	946,915	946,925	0.0%	7,727,641	7,716,725	-0.1%
Grand Total	1,824,433	1,824,437	0.0%	31,322,094	29,771,633	-5.0%

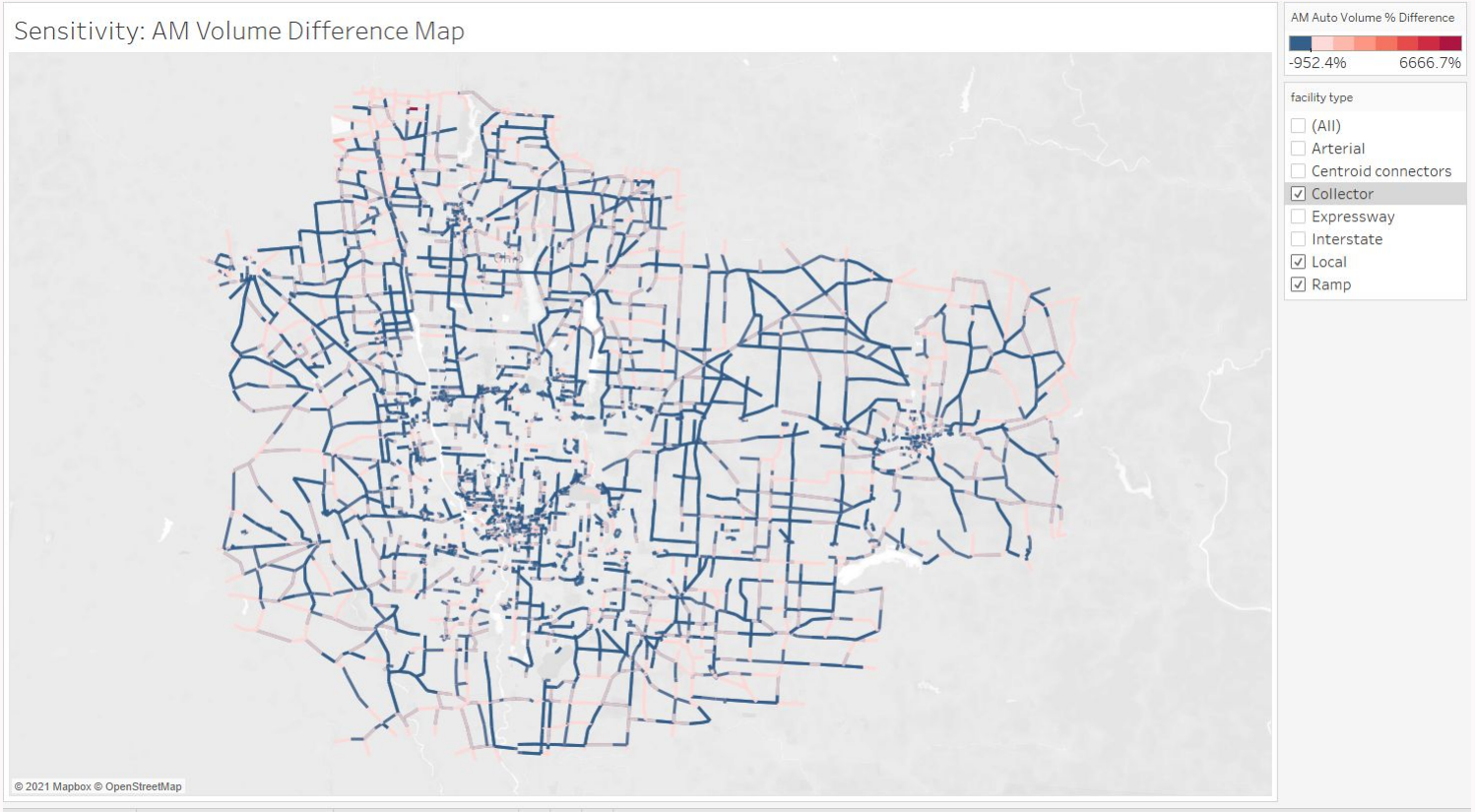
VMT Reduction by Commuting Type - Person Daily VMT savings by Commuting Type

	Daily Auto VMT			AM Auto VMT		
facility type	base telecommute	15% telecommute	%Difference	base telecommute	15% telecommute	%Difference
Interstate	13,149,015	12,742,721	-3.1%	2,503,368	2,386,799	-4.7%
Expressway	4,226,644	4,036,109	-4.5%	885,712	825,392	-6.8%
Ramp	2,185,003	2,090,266	-4.3%	435,372	407,772	-6.3%
Arterial	13,571,283	13,066,299	-3.7%	2,687,667	2,515,921	-6.4%
Collector	5,939,907	5,693,401	-4.1%	1,282,033	1,195,257	-6.8%
Local	1,878,666	1,807,809	-3.8%	390,798	367,393	-6.0%
Grand Total	**40,950,518**	**39,436,605**	-3.7%	**8,184,951**	**7,698,533**	-5.9%

Highway VMT Reduction Daily & AM - Impact of growing telecommute rate on highway Auto VMT



Traffic Reduction Map AM - Less traffic due to higher telecommuting rate



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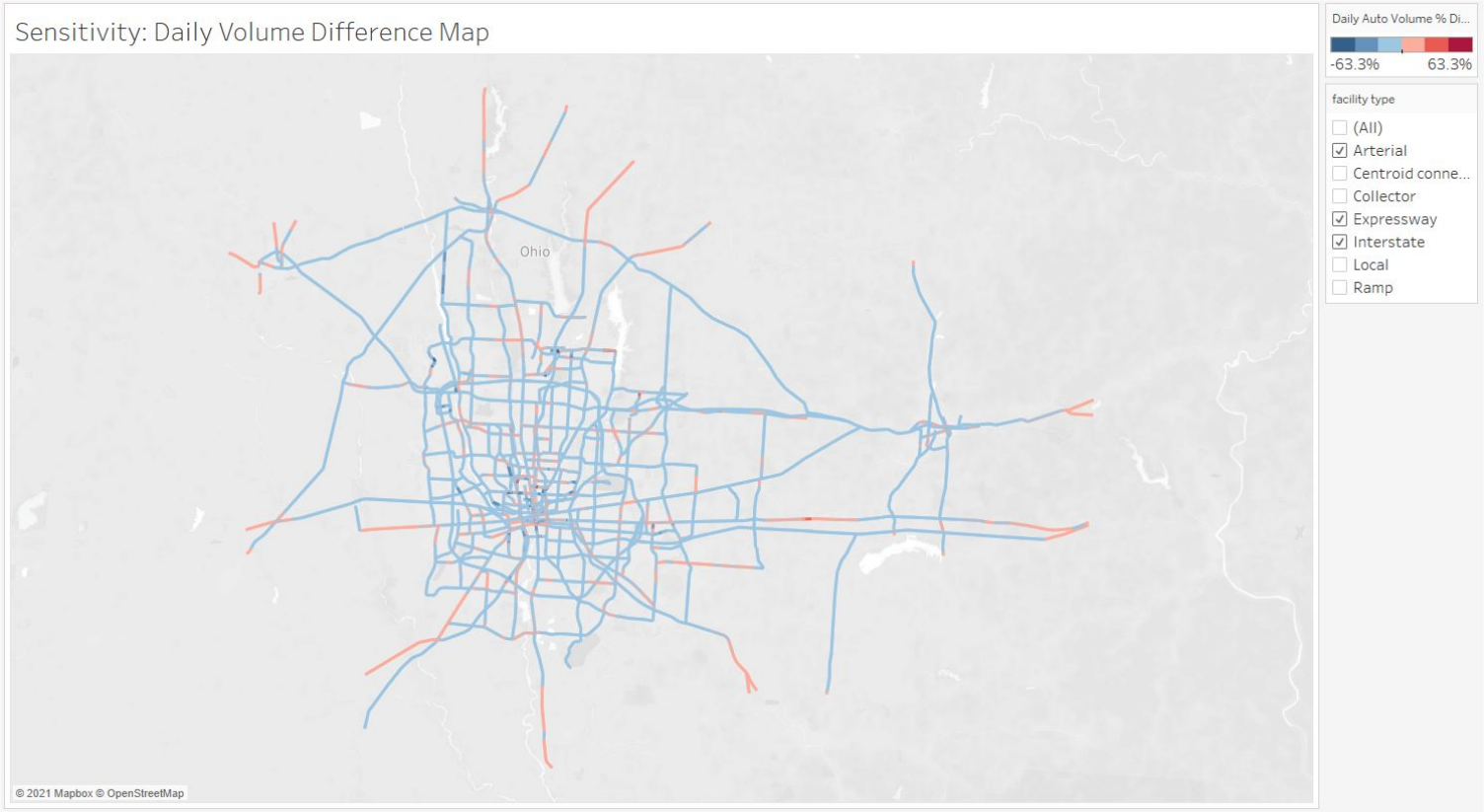

Traffic Reduction Map Daily - Less traffic due to higher telecommuting rate

4. Potential Next Steps

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