Analytical Tools for Archived Operations Data for Planning and Programming at the MPO level

MARICOPA ASSOCIATION of GOVERNMENTS

Performance Measurement and
Travel Data Management

June 5, 2014

MARICOPA ASSOCIATION of GOVERNMENTS

Data Sources and Processing Methodologies

2

- Freeway Management System FMS
- Third Party Data
- NPMRDS

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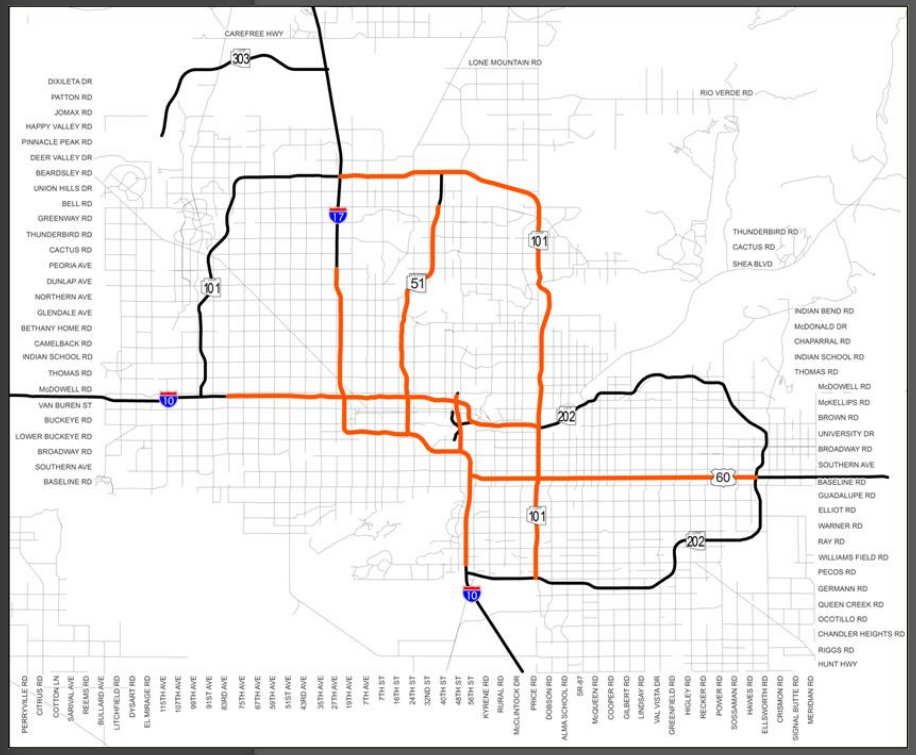
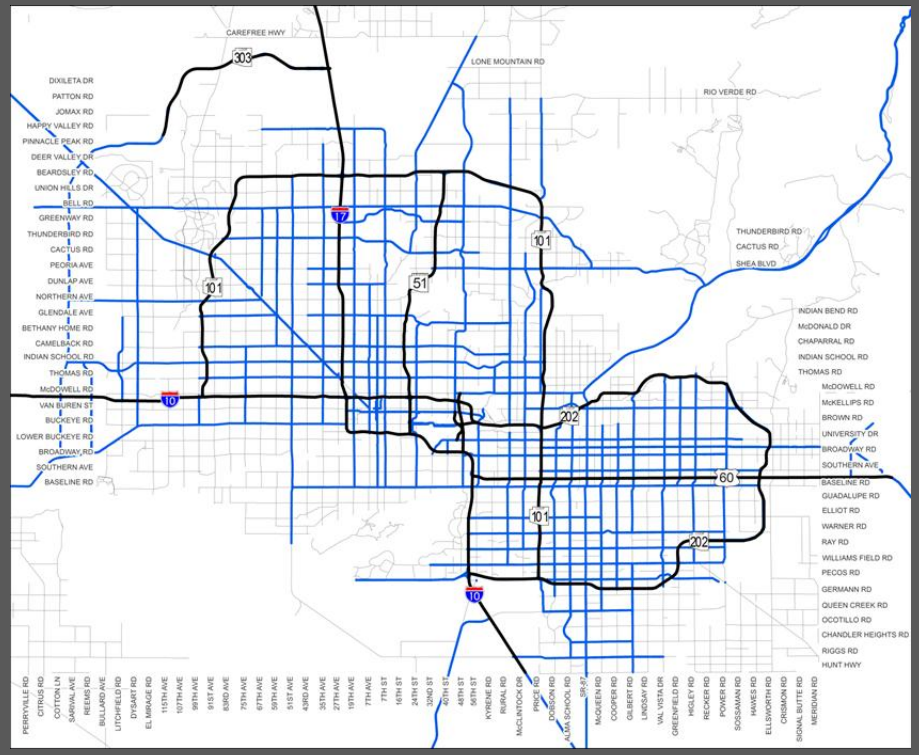
Comparing Coverage of ADOT FMS vs NPMRDS

2

ADOT FMS Coverage



NPMRDS Coverage



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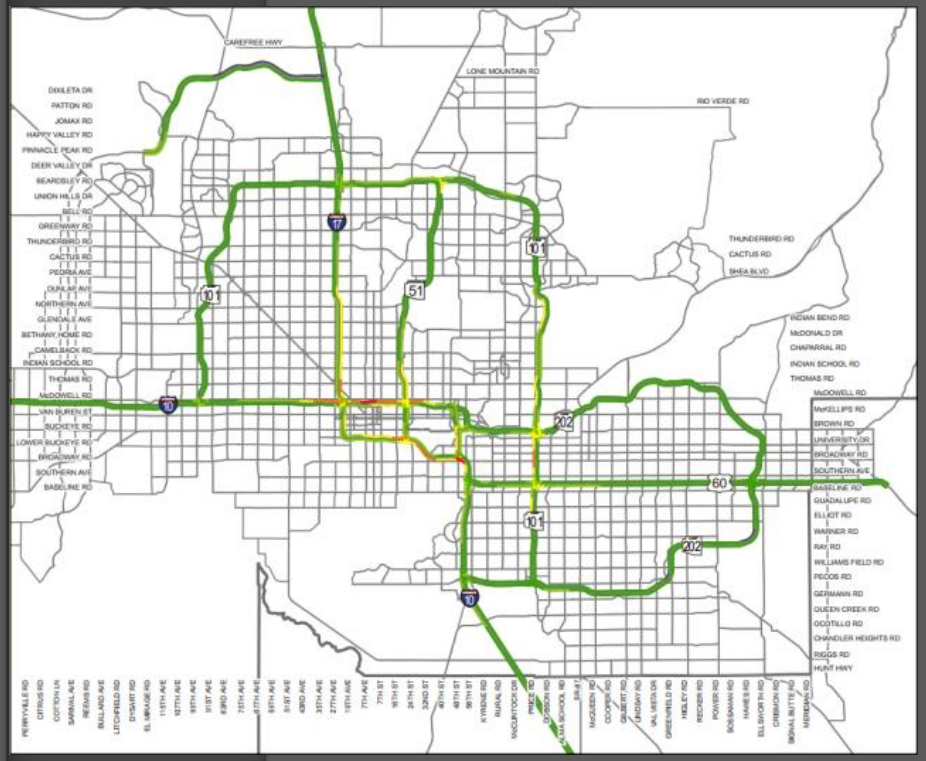
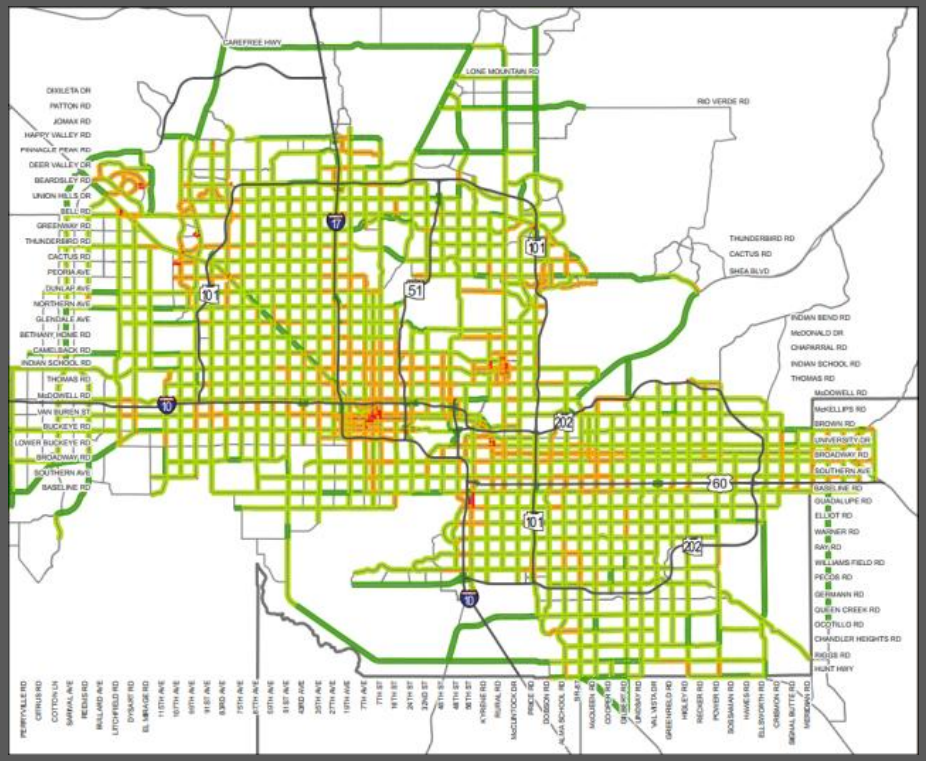
Third Party Data Coverage

2

Freeway Coverage



Arterial Coverage



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FMS – Data Processing Methodologies

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FMS

Raw data sorting

Station Level Analysis

Corridor Level Analysis

Performance Measure Reporting

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2

FMS

Raw Data

date

5 min. time periods

mph

volume

date	sum_type	lane_descr	0:00	0:05	0:10	0:15	0:20	0:25	0:30	0:35	0:40	0:45	23:30	23:35	23:40	23:45	23:50	23:55	location	route	direction	milepost	det#
1/1/2013	mph	entr	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
1/1/2013	mph	HOV	68	61	62	64	64	62	56	59	55	48	55	51	60	58	57	58	I-10___ WB 135.753 83RD AVE	I-10_	WB	135.753	1
1/1/2013	mph	lane1	52	58	52	54	58	54	56	59	55	62	61	56	57	54	60	64	I-10___ WB 135.753 83RD AVE	I-10_	WB	135.753	1
1/1/2013	mph	lane2	48	46	45	50	42	46	55	60	53	52	47	46	50	48	42	45	I-10___ WB 135.753 83RD AVE	I-10_	WB	135.753	1
1/1/2013	mph	lane3	61	56	57	60	61	59	62	63	60	60	55	55	52	53	59	67	I-10___ WB 135.753 83RD AVE	I-10_	WB	135.753	1
1/1/2013	mph	lane4	60	58	55	55	59	58	62	65	63	59	57	60	53	64	62	60	I-10___ WB 135.753 83RD AVE	I-10_	WB	135.753	1
1/1/2013	mph	lane5	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
1/1/2013	mph	lane6	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
1/1/2013	n_samples	entr	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
1/1/2013	n_samples	HOV	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	I-10___ WB 135.753 83RD AVE	I-10_	WB	135.753	1
1/1/2013	n_samples	lane1	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	I-10___ WB 135.753 83RD AVE	I-10_	WB	135.753	1
1/1/2013	n_samples	lane2	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	I-10___ WB 135.753 83RD AVE	I-10_	WB	135.753	1
1/1/2013	n_samples	lane3	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	I-10___ WB 135.753 83RD AVE	I-10_	WB	135.753	1
1/1/2013	n_samples	lane4	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	I-10___ WB 135.753 83RD AVE	I-10_	WB	135.753	1
1/1/2013	n_samples	lane5	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
1/1/2013	n_samples	lane6	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
1/1/2013	occ_0.1pct	entr	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
1/1/2013	occ_0.1pct	HOV	1	6	3	2	4	9	11	24	19	11	5	9	4	7	4	5	I-10___ WB 135.753 83RD AVE	I-10_	WB	135.753	1
1/1/2013	occ_0.1pct	lane1	9	9	10	7	11	21	30	26	31	28	11	13	53	13	75	39	I-10___ WB 135.753 83RD AVE	I-10_	WB	135.753	1
1/1/2013	occ_0.1pct	lane2	26	25	25	19	40	41	41	45	44	37	23	30	96	28	31	81	I-10___ WB 135.753 83RD AVE	I-10_	WB	135.753	1
1/1/2013	occ_0.1pct	lane3	35	43	19	22	39	37	45	53	51	56	29	21	29	24	26	24	I-10___ WB 135.753 83RD AVE	I-10_	WB	135.753	1
1/1/2013	occ_0.1pct	lane4	15	9	12	14	25	33	48	40	37	40	19	17	18	30	18	21	I-10___ WB 135.753 83RD AVE	I-10_	WB	135.753	1
1/1/2013	occ_0.1pct	lane5	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
1/1/2013	occ_0.1pct	lane6	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
1/1/2013	vol	entr	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
1/1/2013	vol	HOV	2	10	6	3	6	14	17	35	29	15	8	13	6	10	6	8	I-10___ WB 135.753 83RD AVE	I-10_	WB	135.753	1
1/1/2013	vol	lane1	13	14	16	11	15	31	42	39	46	42	17	20	19	20	15	13	I-10___ WB 135.753 83RD AVE	I-10_	WB	135.753	1
1/1/2013	vol	lane2	27	23	26	26	36	39	53	62	61	48	24	29	28	32	24	28	I-10___ WB 135.753 83RD AVE	I-10_	WB	135.753	1
1/1/2013	vol	lane3	36	48	24	25	47	46	57	66	64	72	34	25	29	28	29	28	I-10___ WB 135.753 83RD AVE	I-10_	WB	135.753	1
1/1/2013	vol	lane4	18	12	16	19	32	42	59	51	46	50	21	21	18	34	24	25	I-10___ WB 135.753 83RD AVE	I-10_	WB	135.753	1
1/1/2013	vol	lane5	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
1/1/2013	vol	lane6	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
1/1/2013	vph	entr	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
1/1/2013	vph	HOV	24	120	72	36	72	168	204	420	348	180	96	156	72	120	72	96	I-10___ WB 135.753 83RD AVE	I-10_	WB	135.753	1
1/1/2013	vph	lane1	156	168	192	132	180	372	504	468	552	504	204	240	228	240	180	156	I-10___ WB 135.753 83RD AVE	I-10_	WB	135.753	1

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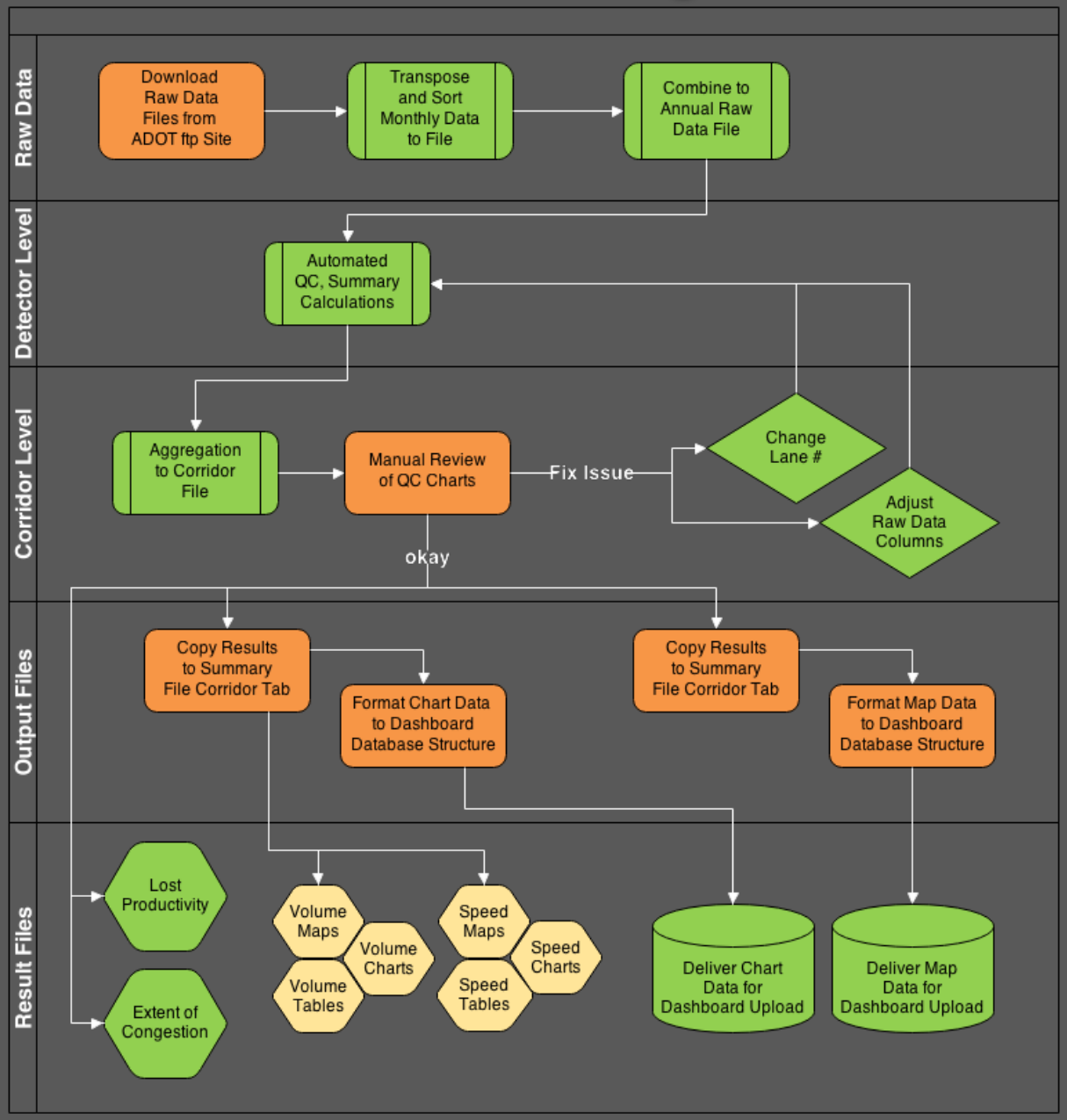
FMS

FMS Data Processing and QC



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FMS Data Quality Visualization

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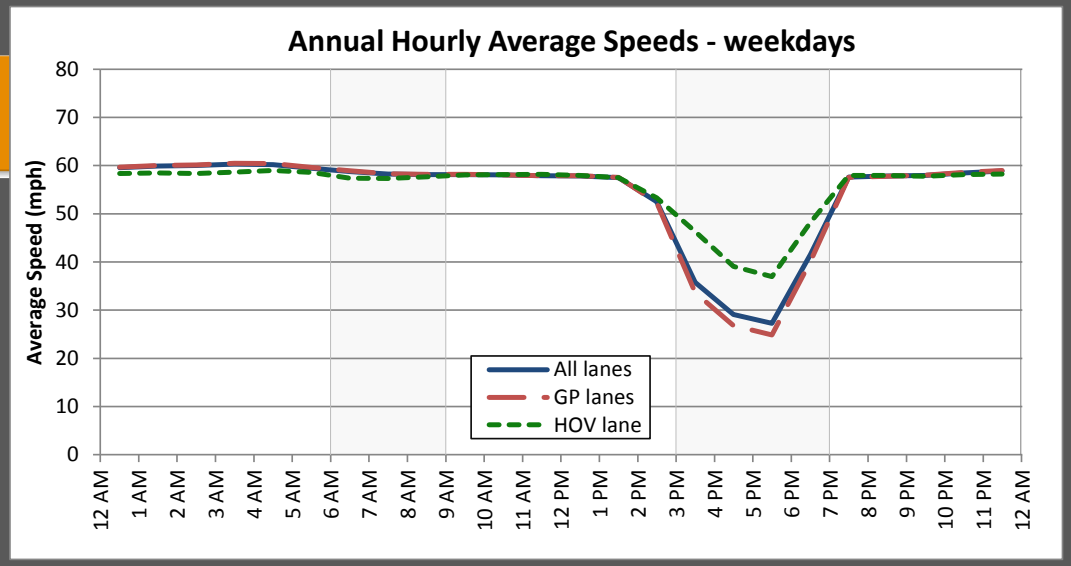

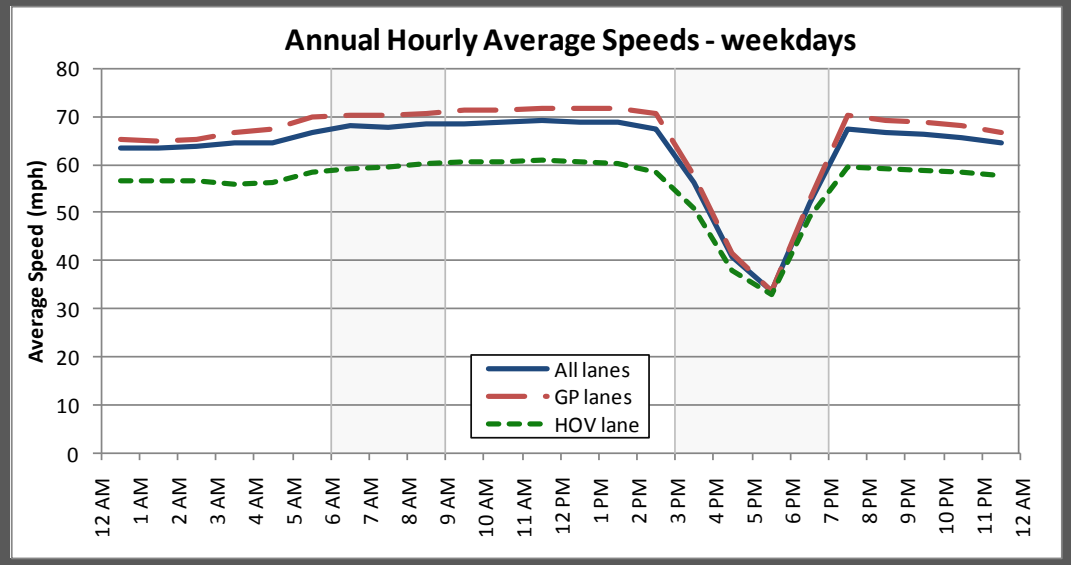

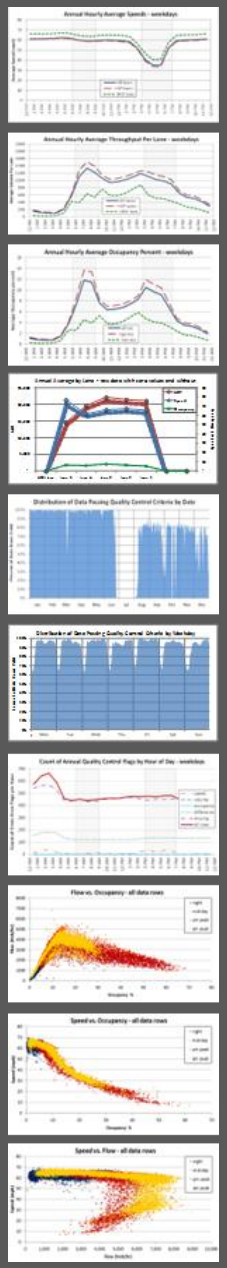

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FMS Data Quality Visualization

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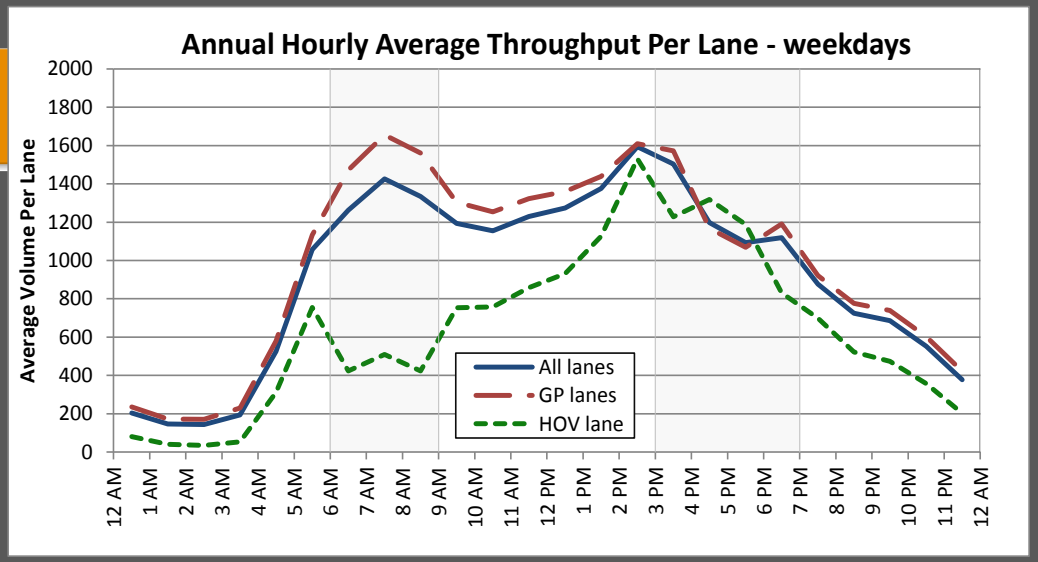

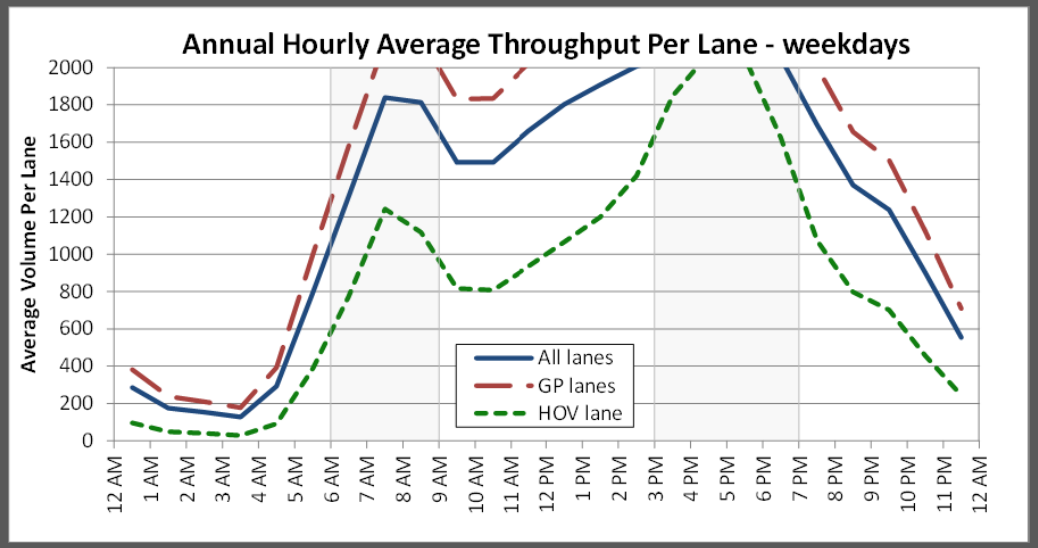

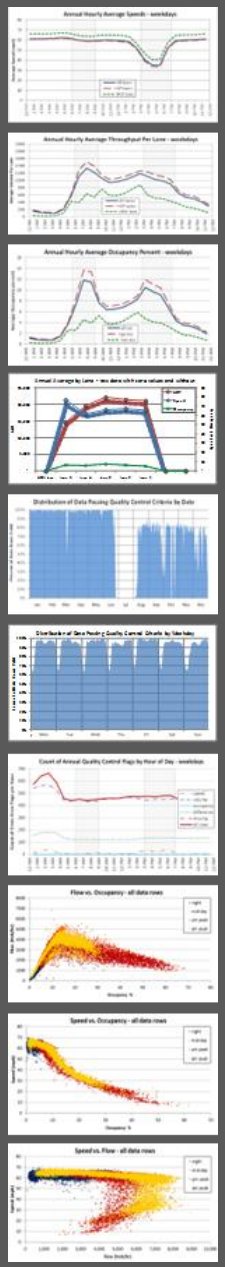

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FMS Data Quality Visualization

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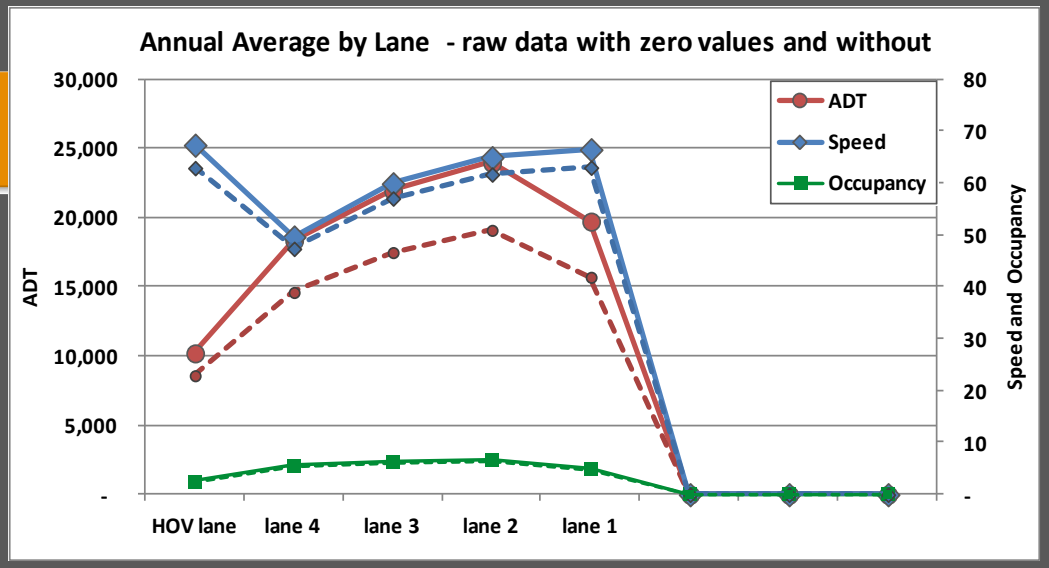

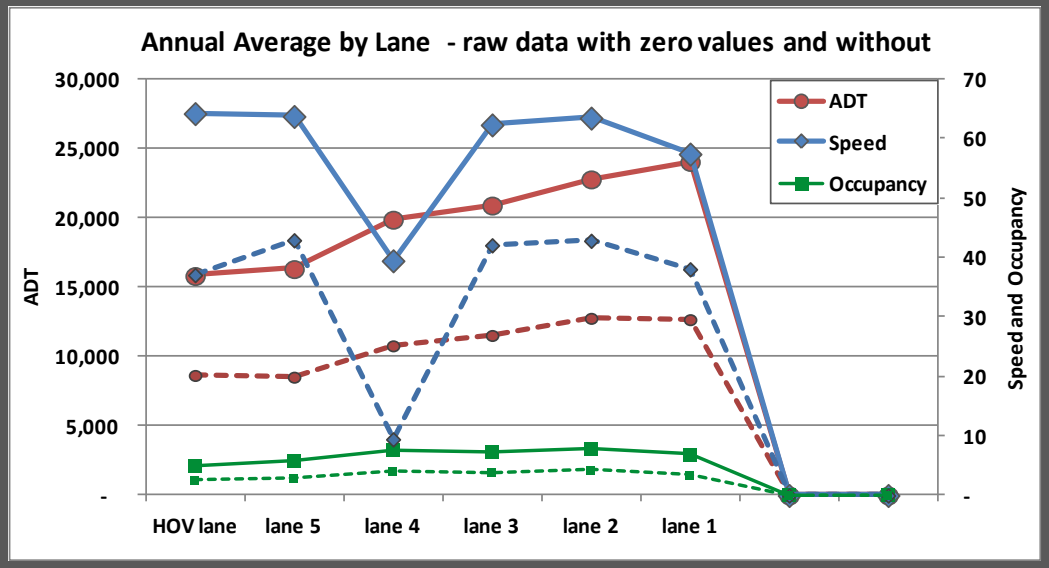

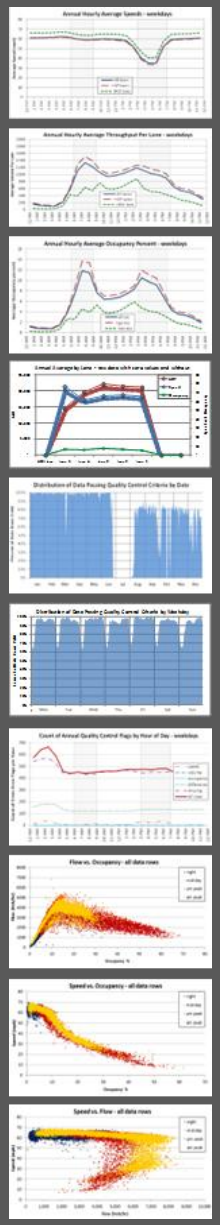

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FMS Data Quality Visualization

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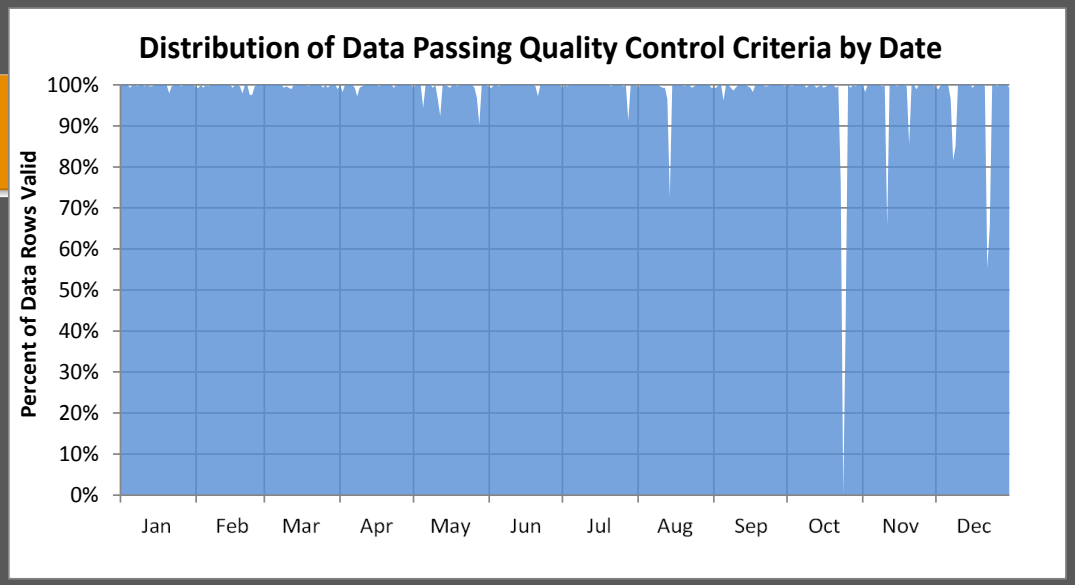

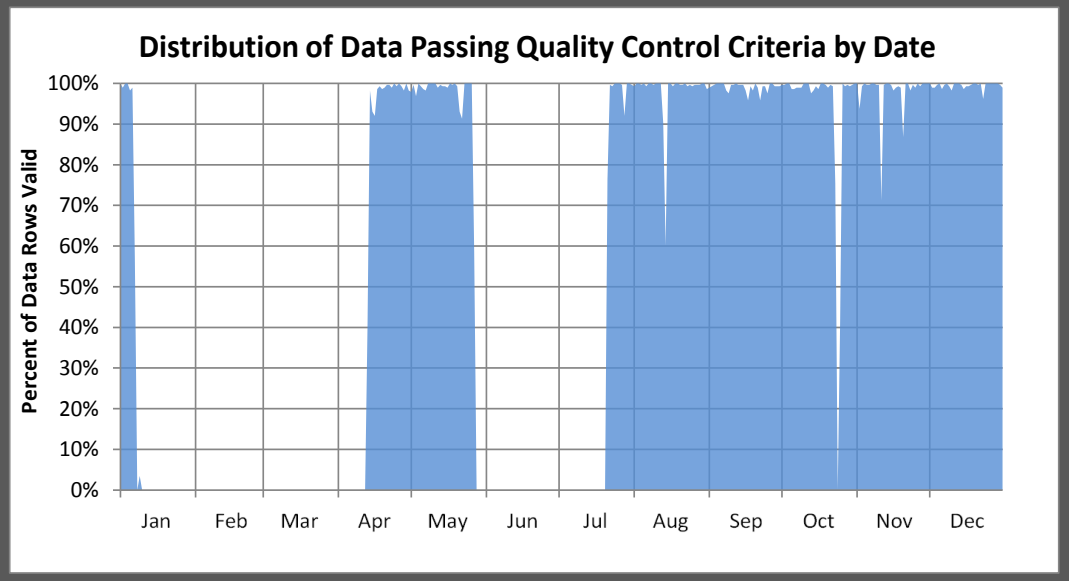

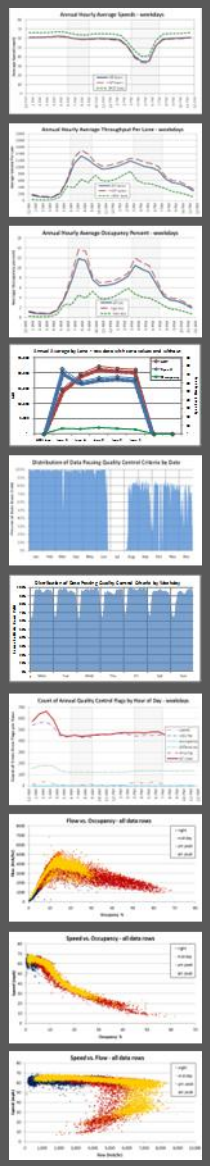

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FMS Data Quality Visualization

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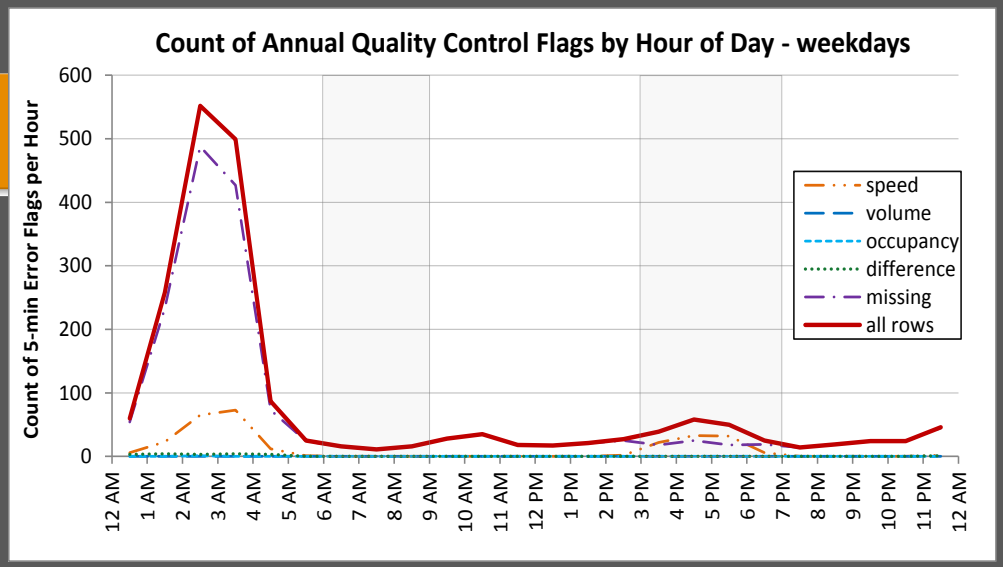

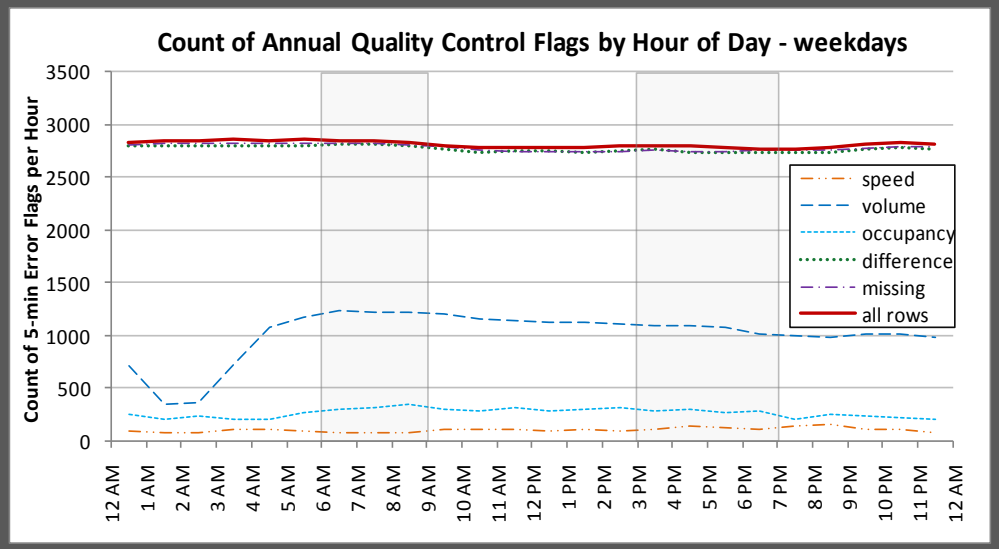

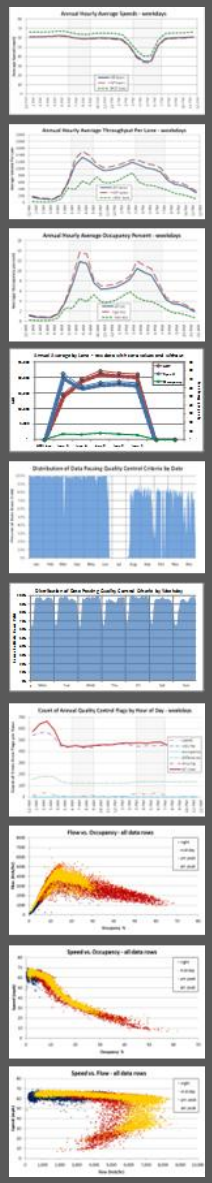

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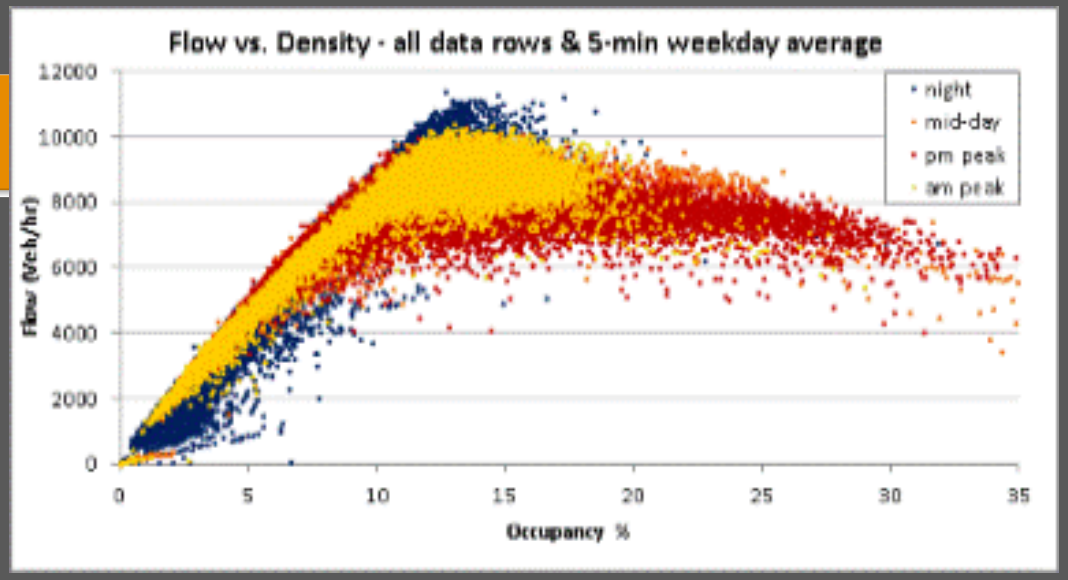

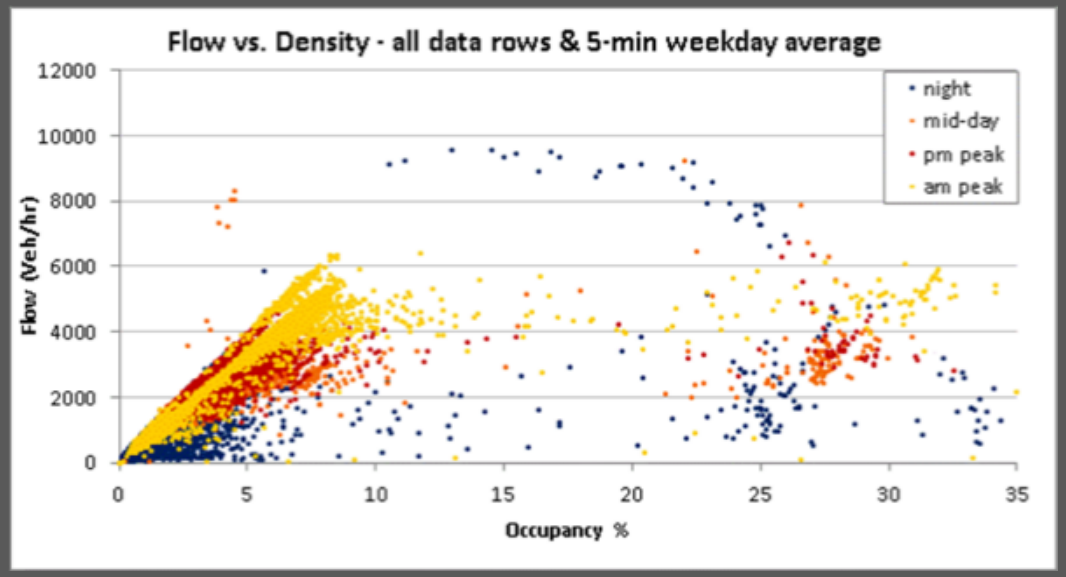

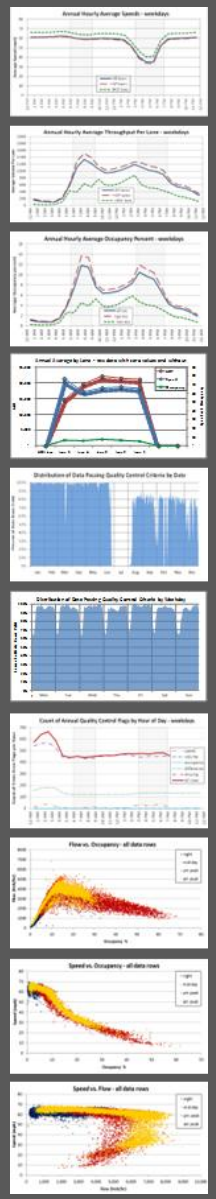

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FMS Data Quality Visualization

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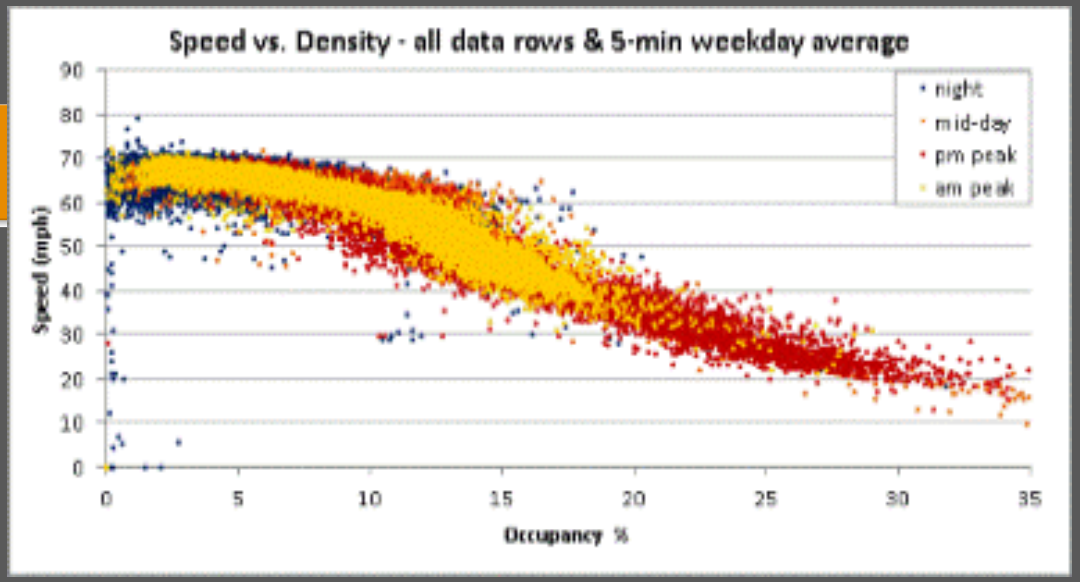

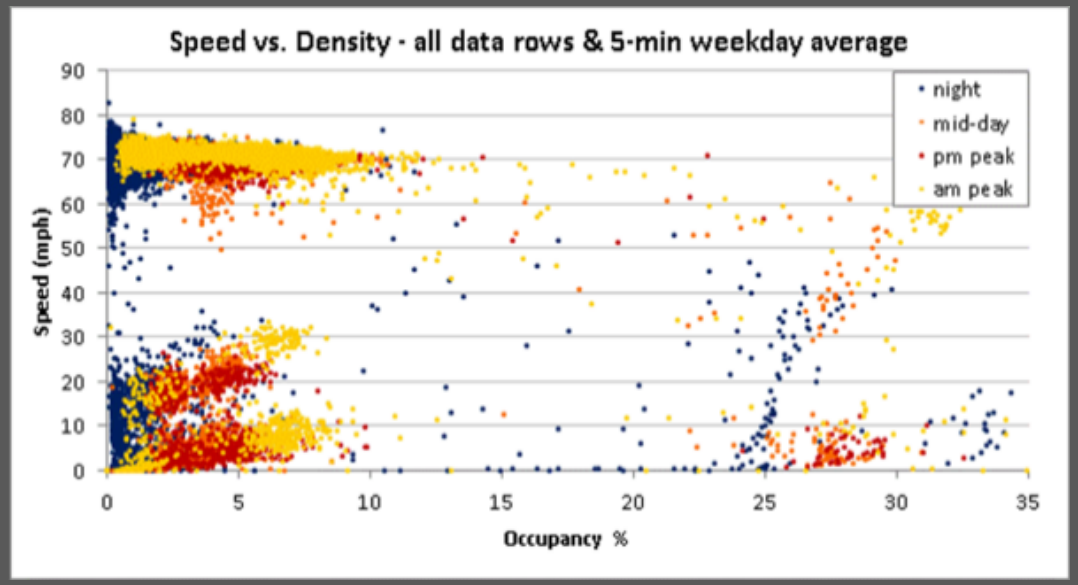

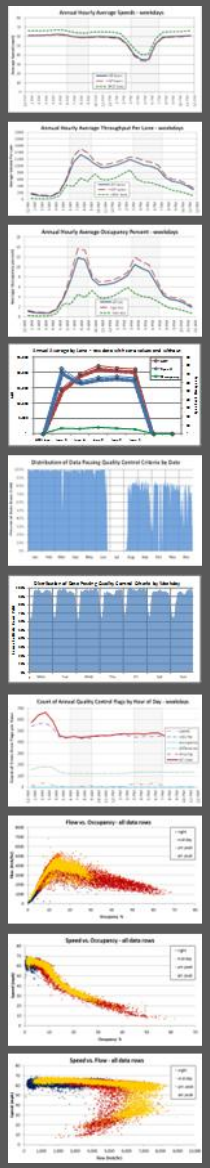

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FMS Data Quality Visualization

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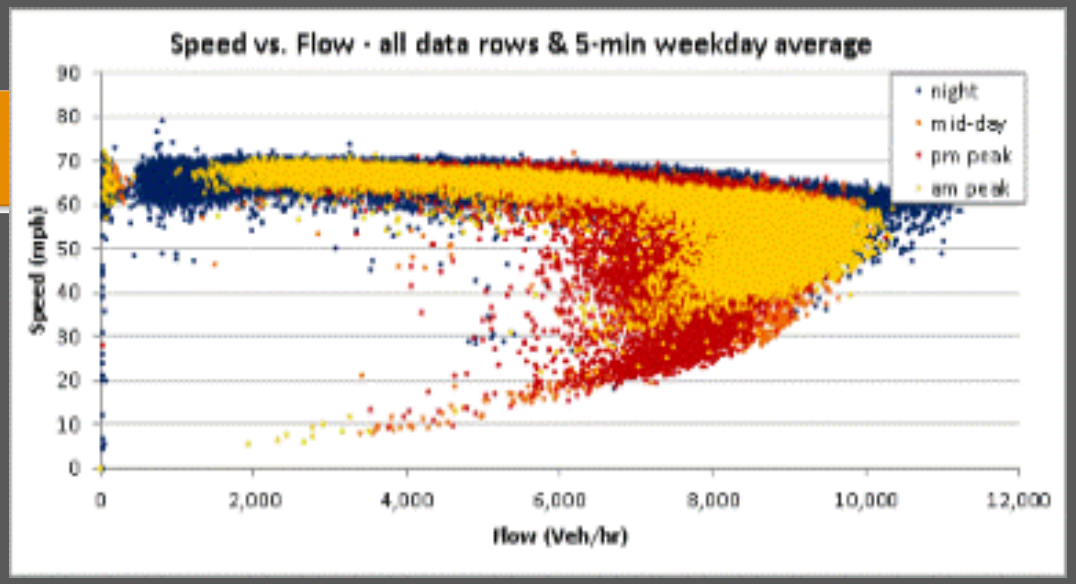

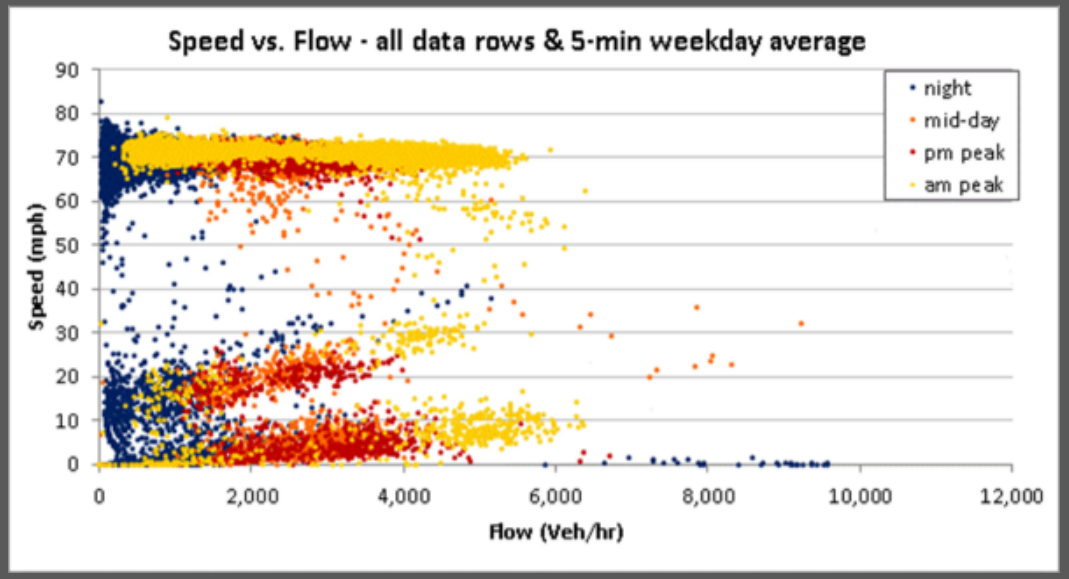

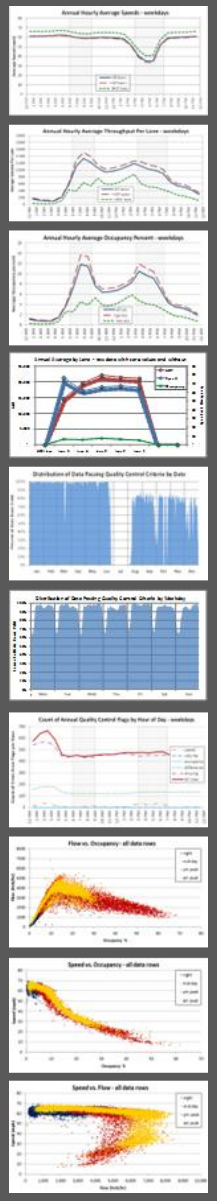

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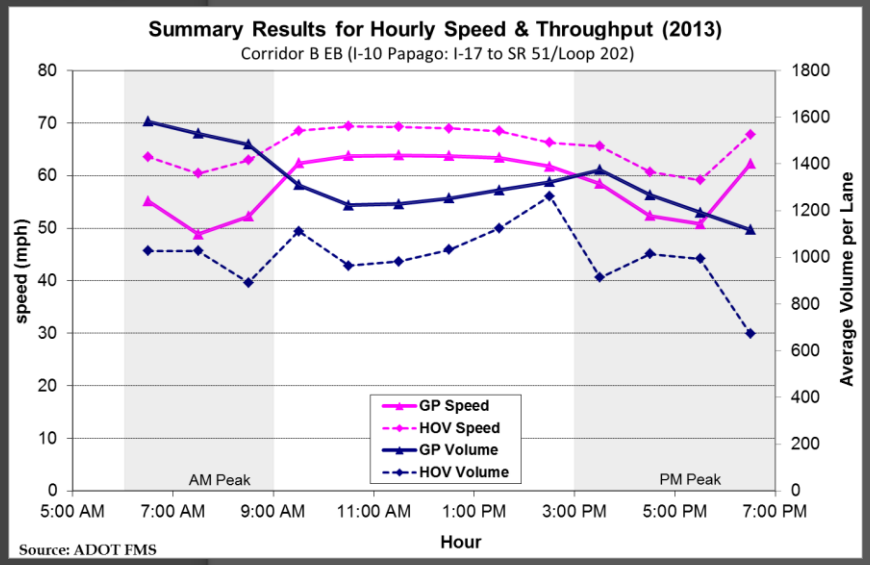
Annual Corridor File

2

FMS



Date	det#	% valid all data	% valid weekday	AADT GP lanes	AAWT GP lanes	AM Peak Vol	Mid-day Vol	PM Peak Vol	6:00 AM	7:00 AM	8:00 AM	9:00 AM	10:00 AM	11:00 AM	12:00 PM	1:0
1/1/2013	2	98.5%	98.0%	86602.54	92102.47	5624.06	4980.28	4882.43	6174.16	5441.64	5265.41	5042.80	4746.02	4747.67	4931.74	5
1/1/2013	8	97.0%	97.5%	83615.51	87392.01	4274.17	4893.44	4766.09	4742.84	3703.79	4349.26	4980.69	4689.45	4663.38	4825.45	5
1/1/2013	14	97.7%	97.1%	85741.71	90174.32	4669.48	5035.58	4836.38	5068.65	4303.60	4617.66	5112.16	4852.99	4847.29	4993.22	5
1/1/2013	20	97.7%	96.6%	88934.62	92957.27	4708.19	5188.08	5023.48	5185.89	4184.81	4703.44	5300.37	5041.49	5014.58	5127.42	5
1/1/2013	25	98.5%	98.2%	81625.44	84875.84	4535.90	4594.91	4504.06	4984.70	4146.14	4468.17	4756.55	4512.25	4459.87	4524.49	4
1/1/2013	30	99.1%	99.0%	94166.73	98494.08	5240.45	5530.91	5283.04	5694.80	4762.48	5261.13	5690.85	5395.89	5367.94	5445.28	5
1/1/2013	68	98.9%	99.1%	99427.95	105344.46	6035.88	5842.91	5577.69	6414.36	5738.61	5952.95	6033.05	5671.28	5634.28	5727.66	5
1/1/2013	133	98.3%	98.9%	82046.22	86895.49	5070.96	4750.82	4607.79	5471.31	4767.23	4973.79	4938.40	4662.10	4604.26	4658.36	4

Comments	% valid all data	% valid weekday	AADT	AAWT	AM Peak vph	Mid-day vph	PM Peak vph	6:00 AM	7:00 AM	8:00 AM	9:00 AM	10:00 AM	11:00 AM	12:00 PM	1:00 PM	2:0
	98.2%	98.1%	88673.364	93167.713	5030.635	5160.257	4984.924	1316.803	1113.769	1196.401	1272.905	1203.503	1196.561	1223.374	1259.423	12
	98.2%	98.1%	11521.743	12068.746	811.075	733.372	488.848	917.187	790.315	725.542	853.898	697.790	663.779	686.910	737.474	7
	98.2%	98.1%	88673.364	93167.713	5030.635	5160.257	4984.924	1316.803	1113.769	1196.401	1272.905	1203.503	1196.561	1223.374	1259.423	12
	98.2%	98.1%	11521.743	12068.746	811.075	733.372	488.848	917.187	790.315	725.542	853.898	697.790	663.779	686.910	737.474	7

Detector Level Result Table and Weights:

weight2	det#	Seq#	Location	x-street	Route	Cor_ID	Dir	Lanes/GP lanes	Configuration	template	HOV lane	Valid 2013
2,409	133	10522	I-10 EB 26TH	26TH AVE	I-10_	B	EB	5	Interchange	1	1	1
3,661	75	10524	I-10 EB 18TH	18TH AVE	I-10_	B	EB	5	on-ramp	1	1	1
5,604	80	10527	I-10 EB 5TH	5TH AVE	I-10_	B	EB	4	on-ramp	1	1	1
7,397	85	10530	I-10 EB 9TH	9TH ST	I-10_	B	EB	4	on-ramp	1	1	1
2,370	87	10533	I-10 EB 19TH	19TH ST	I-10_	B	EB	3	Interchange	1	1	1
21,442	5				I-10_	B	EB	4.173			5	5

Static Detector Result Table:

These results are used in the segment level performance maps

det#	Seq#	Location	x-street	Route	Cor_ID	Dir	Lanes/GP lanes	HOV lane	Valid 2013	Comments	Date	det#
133	10522	I-10 EB 26TH	26TH AVE	I-10_	A	EB	5	1	1	hov value h	1/1/2013	133
75	10524	I-10 EB 18TH	18TH AVE	I-10_	B	EB	5	1	1	hov value lo	1/1/2013	75
80	10527	I-10 EB 5TH	5TH AVE	I-10_	B	EB	4	1	1		1/1/2013	80
85	10530	I-10 EB 9TH	9TH ST	I-10_	B	EB	4	1	1		1/1/2013	85
87	10533	I-10 EB 19TH	19TH ST	I-10_	B	EB	3	1	1		1/1/2013	87

Corridor Level Result Table (live):

Type	Cor_ID	Route	Dir	Date	Length	detector type	# of det	# valid	# bad	Lanes	Comments	% valid all data
GP	B	I-10_	EB	1/1/2013	21,442	2 SAS PADs	5	5	0	4.173		96.3%
HOV	B	I-10_	EB	1/1/2013	21,442	2 SAS PADs	5	5	0	1		96.3%

Corridor Level Result Table (static):

GP	B	I-10_	EB	1/1/2013	21,442	2 SAS PADs	5	5	0	4.173		96.3%
HOV	B	I-10_	EB	1/1/2013	21,442	2 SAS PADs	5	5	0	1		96.3%

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Measures - Throughput

2

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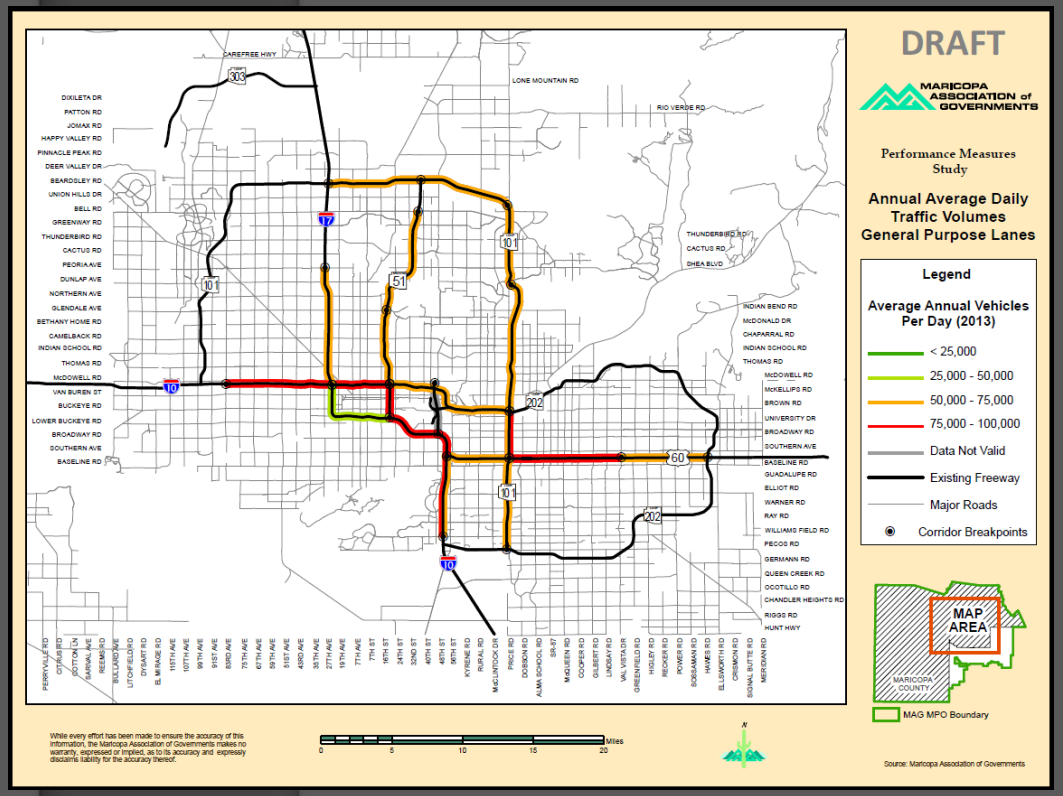
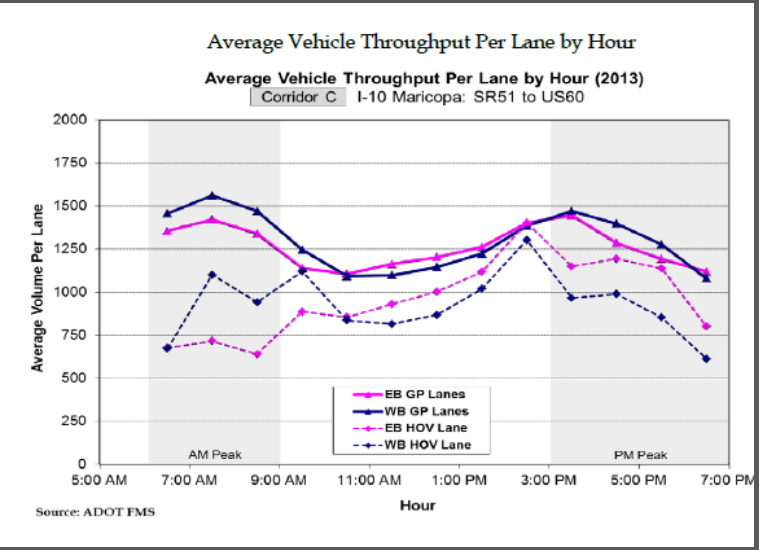


Results for Annual Average Daily Traffic (AADT) by Corridor

Corridor ID	Analysis Corridor	Dir	From	To	Annual Average Daily Traffic (AADT)					
					General-purpose Lanes			HOV Lanes		
					2012	2013	% Change	2012	2013	% Change
A	I-10 Papago	EB	83rd Avenue	I-17	88,029	88,673	0.73%	11,170	11,522	3.15%
		WB	I-17	83rd Avenue	86,003	85,392	-0.71%	10,727	11,042	2.94%
B	I-10 Papago	EB	I-17	SR 51/Loop 202	91,849	92,205	0.39%	16,066	16,697	3.93%
		WB	SR 51/Loop 202	I-17	88,960	89,091	0.15%	15,305	15,780	3.10%
C	I-10 Maricopa	EB	SR 51/Loop 202	U.S. 60	81,479	84,862	4.15%	15,698	15,450	-1.58%
		WB	U.S. 60	SR 51/Loop 202	78,377	87,436	11.56%	12,320	13,546	9.95%
D	I-10 Maricopa	EB	U.S. 60	Chandler Blvd	73,340	75,477	2.91%	9,575	10,726	12.02%
		WB	Chandler Blvd	U.S. 60	72,105	74,556	3.40%	9,742	10,302	5.75%
E	I-17	NB	Maricopa TI	I-10	48,158	48,901	1.54%	na	na	na
		SB	I-10	Maricopa TI	46,007	48,604	5.64%	na	na	na
F	I-17	NB	I-10	Peoria Ave.	61,615	61,626	0.02%	8,641	8,862	2.56%
		SB	Peoria Ave.	I-10	68,998	64,793	-6.10%	10,271	10,204	-0.64%
G	SR 51	NB	I-10/Loop 202	Glendale Avenue	55,952	55,370	-1.04%	6,529	7,108	8.88%
		SB	Glendale Avenue	I-10/Loop 202	54,382	54,329	-0.10%	5,782	6,121	5.88%
H	SR 51	NB	Glendale Avenue	Bell Road	52,271	52,919	1.24%	5,514	5,430	-1.53%
		SB	Bell Road	Glendale Avenue	52,280	52,685	0.77%	5,238	5,777	10.29%
I	Loop 202	EB	I-10/SR 51	Loop 101	71,473	74,492	4.22%	6,969	7,210	3.45%
		WB	Loop 101	I-10/SR 51	63,649	61,818	-2.88%	8,293	8,841	6.61%
J	U.S. 60	EB	I-10	Loop 101	58,987	66,870	13.36%	7,975	8,354	4.75%
		WB	Loop 101	I-10	57,878	58,101	0.39%	no data	no data	na
K	U.S. 60	EB	Loop 101	Val Vista Dr.	82,391	82,183	-0.25%	6,812	7,562	11.01%
		WB	Val Vista Dr.	Loop 101	85,232	77,042	-9.61%	5,994	6,630	10.60%
L	U.S. 60	EB	Val Vista Dr.	Loop 202	57,739	60,555	4.88%	3,365	4,316	28.27%
		WB	Loop 202	Val Vista Dr.	59,652	60,179	0.88%	3,530	3,624	2.67%
M	SR 143	NB	I-10	Loop 202/ McDowell	no data	no data	na	na	na	na
		SB	Loop 202/ McDowell	I-10	no data	no data	na	na	na	na
N	Loop 101	NB	Loop 202 Santan	U.S. 60	61,765	61,003	-1.23%	6,168	6,709	8.76%



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Measures - Speed

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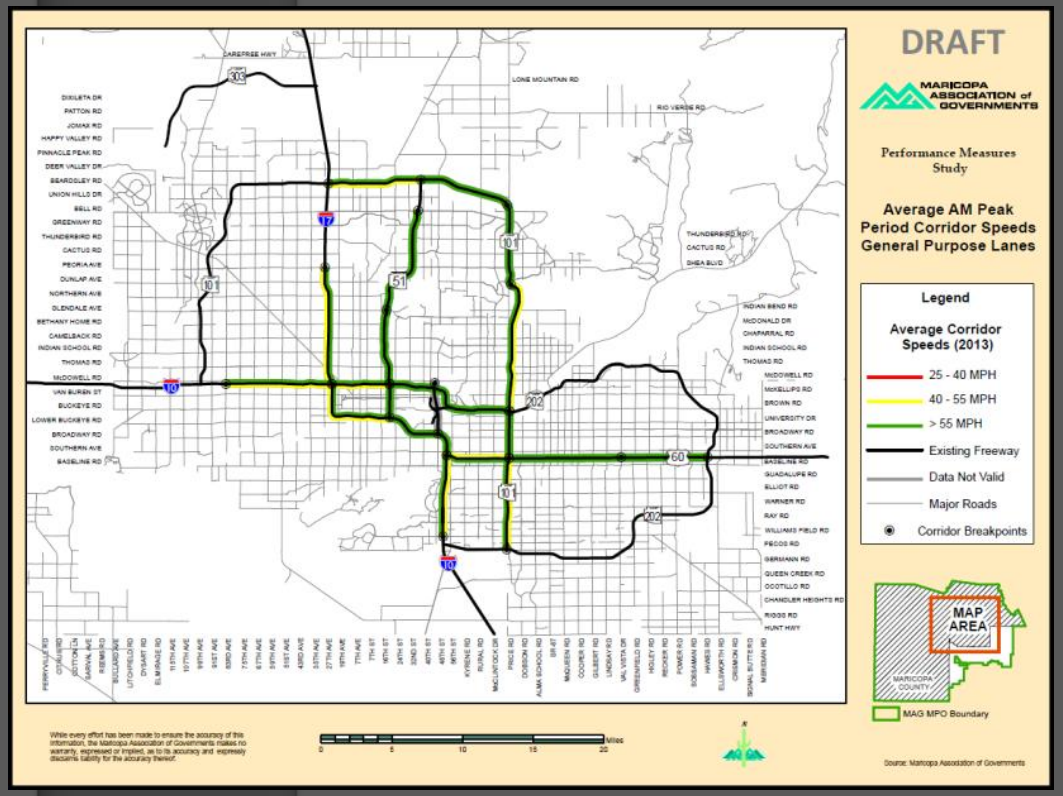
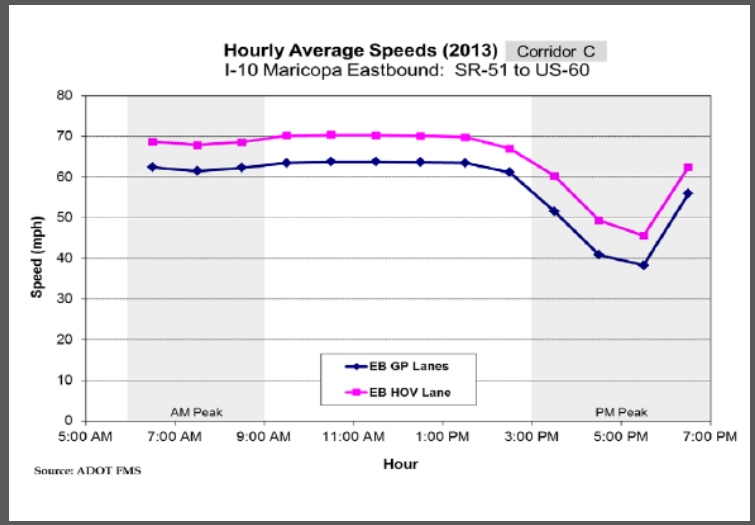


Results for Annual Average Peak Period Speed by Corridor

Corridor ID	Freeway Corridor	Dir	From	To	Average AM Peak Period Speed (mph)					
					General-purpose Lanes			HOV Lanes		
					2012	2013	% Change	2012	2013	% Change
A	I-10 Papago	EB	83rd Avenue	I-17	50.2	46.9	-6.53%	54.5	52.2	-4.08%
		WB	I-17	83rd Avenue	66.4	67.1	1.14%	68.1	68.2	0.13%
B	I-10 Papago	EB	I-17	SR 51/Loop 202	53.1	52.1	-1.99%	62.6	62.3	-0.43%
		WB	SR 51/Loop 202	I-17	62.8	63.1	0.55%	70.4	70.7	0.41%
C	I-10 Maricopa	EB	SR 51/Loop 202	U.S. 60	61.9	62.0	0.24%	67.6	68.3	1.00%
		WB	U.S. 60	SR 51/Loop 202	57.5	57.9	0.66%	63.6	63.8	0.30%
D	I-10 Maricopa	EB	U.S. 60	Chandler Blvd	65.5	65.1	-0.54%	71.0	71.9	1.35%
		WB	Chandler Blvd	U.S. 60	44.3	43.8	-1.23%	58.3	60.1	3.07%
E	I-17	NB	Maricopa TI	I-10	61.5	61.4	-0.16%	na	na	na
		SB	I-10	Maricopa TI	52.9	49.5	-6.40%	na	na	na
F	I-17	NB	I-10	Peoria Ave.	59.5	58.7	-1.29%	60.4	59.7	-1.25%
		SB	Peoria Ave.	I-10	53.8	50.9	-5.53%	58.6	53.4	-8.80%
G	SR 51	NB	I-10/Loop 202	Glendale Avenue	63.4	62.7	-1.14%	64.5	63.1	-2.09%
		SB	Glendale Avenue	I-10/Loop 202	55.8	55.1	-1.24%	59.2	54.9	-7.17%
H	SR 51	NB	Glendale Avenue	Bell Road	67.7	66.7	-1.48%	68.8	71.9	4.47%
		SB	Bell Road	Glendale Avenue	63.3	61.4	-3.01%	67.0	66.9	-0.22%
I	Loop 202	EB	I-10/SR 51	Loop 101	65.9	66.9	1.43%	70.5	71.2	0.90%
		WB	Loop 101	I-10/SR 51	57.8	57.1	-1.15%	66.7	64.4	-3.55%
J	U.S. 60	EB	I-10	Loop 101	63.7	63.9	0.22%	63.5	66.9	5.37%
		WB	Loop 101	I-10	52.9	51.4	-2.82%	not available	not available	na
K	U.S. 60	EB	Loop 101	Val Vista Dr.	65.3	64.9	-0.56%	67.1	67.6	0.73%
		WB	Val Vista Dr.	Loop 101	61.7	60.7	-1.57%	69.8	69.6	-0.19%
L	U.S. 60	EB	Val Vista Dr.	Loop 202	68.4	67.4	-1.49%	71.2	70.0	-1.64%
		WB	Loop 202	Val Vista Dr.	69.1	69.7	0.84%	71.2	71.6	0.58%
M	SR 143	NB	I-10	Loop 202/ McDowell	not available	not available	na	not available	not available	na
		SB	Loop 202/ McDowell	I-10	not available	not available	na	not available	not available	na



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Measures - Extent and Duration of Congestion

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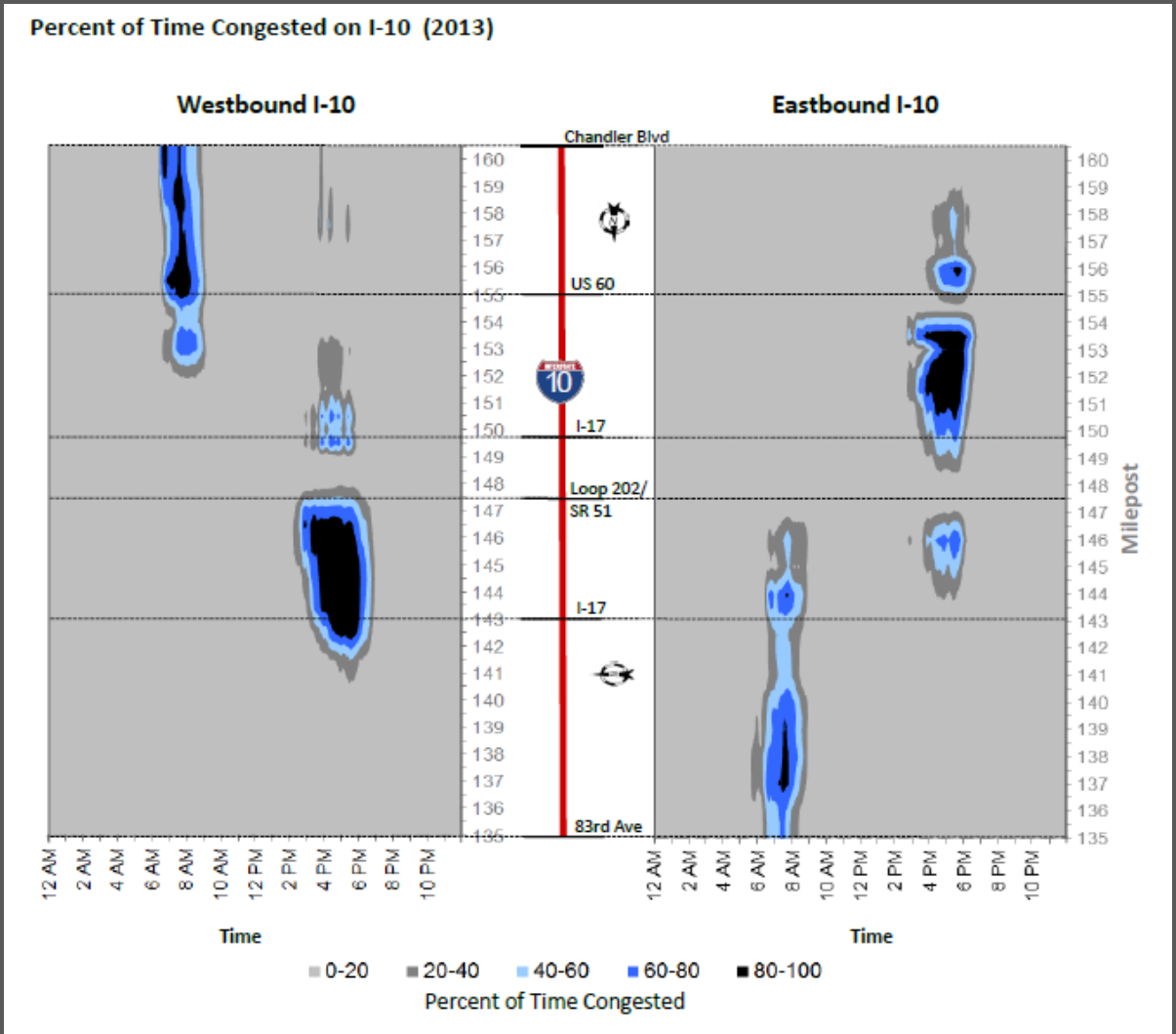

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Measures – Lost Productivity

2

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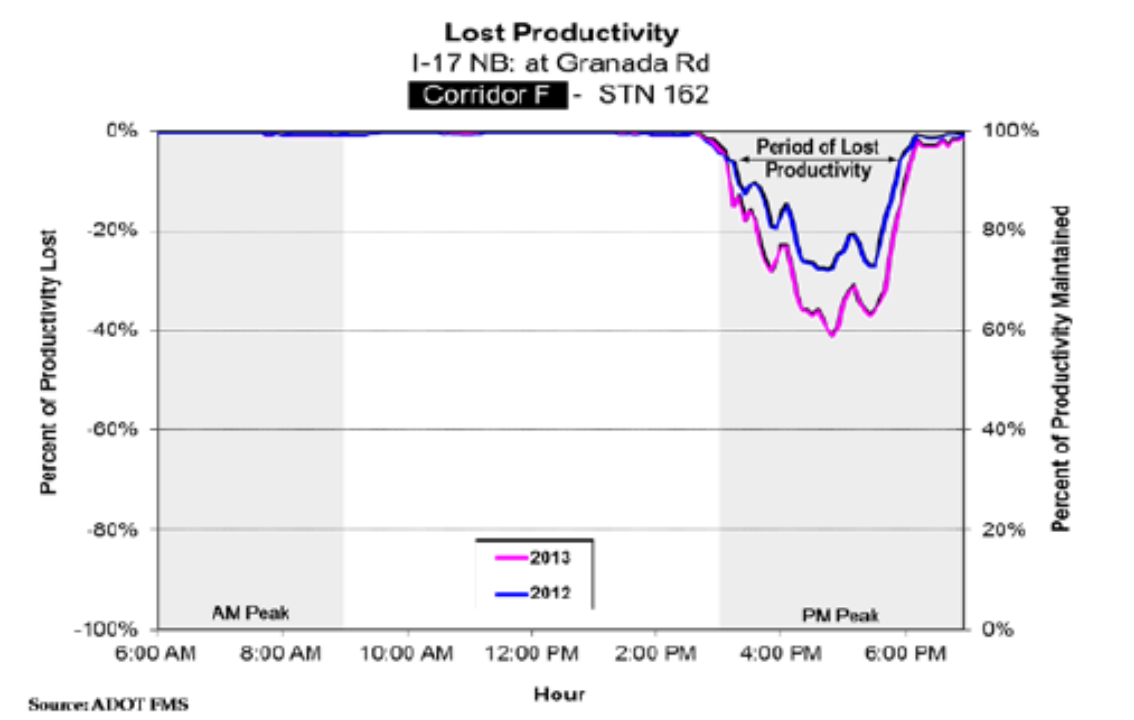

Average Productivity Lost Durring Peak Period

Corridor ID	Analysis Corridor	Milepost	Detector ID	Nearest Cross Street	Peak Period	Average % of Peak Period Productivity Lost (2013)
A	I-10 Papago EB	138.8	20	58th Ave.	AM	27.9
A	I-10 Papago WB	141.5	35	36th Ave.	PM	7.7
B	I-10 Papago EB	145.0	80	5th Ave.	PM	7.7
B	I-10 Papago WB	145.7	84	4th St.	PM	29.9
C	I-10 Maricopa EB	152.4	55	42nd St.	PM	32.2
C	I-10 Maricopa WB	154.9	425	Meadowlark Cir.	AM	16.8
D	I-10 Maricopa EB	155.5	396	Donner Dr.	PM	12.5
D	I-10 Maricopa WB	156.5	420	Calle Biehn	AM	11.4
E	I-17 NB	199.3	156	Lincoln St.	PM	24.9
E	I-17 SB	195.9	103	9th St.	AM	11.2
F	I-17 NB	201.1	162	Granada Rd.	PM	21.1
F	I-17 SB	207.7	361	Townley Ave.	AM	23.8
G	SR 51 NB	1.8	206	Avalon Dr.	PM	20.7
G	SR 51 SB	3.3	195	Meadowbrook Ave.	AM	8.9
H	SR 51 NB	9.0	323	32nd St.	PM	0.3
H	SR 51 SB	6.9	294	Royal Palm Rd.	AM	10.4
I	Loop 202 EB	5.4	243	Sky Harbor Ramp	PM	3.5
I	Loop 202 WB	1.6	220	31st St.	PM	17.6
J	US 60 EB	173.7	432	Forest Ave.	PM	3.5

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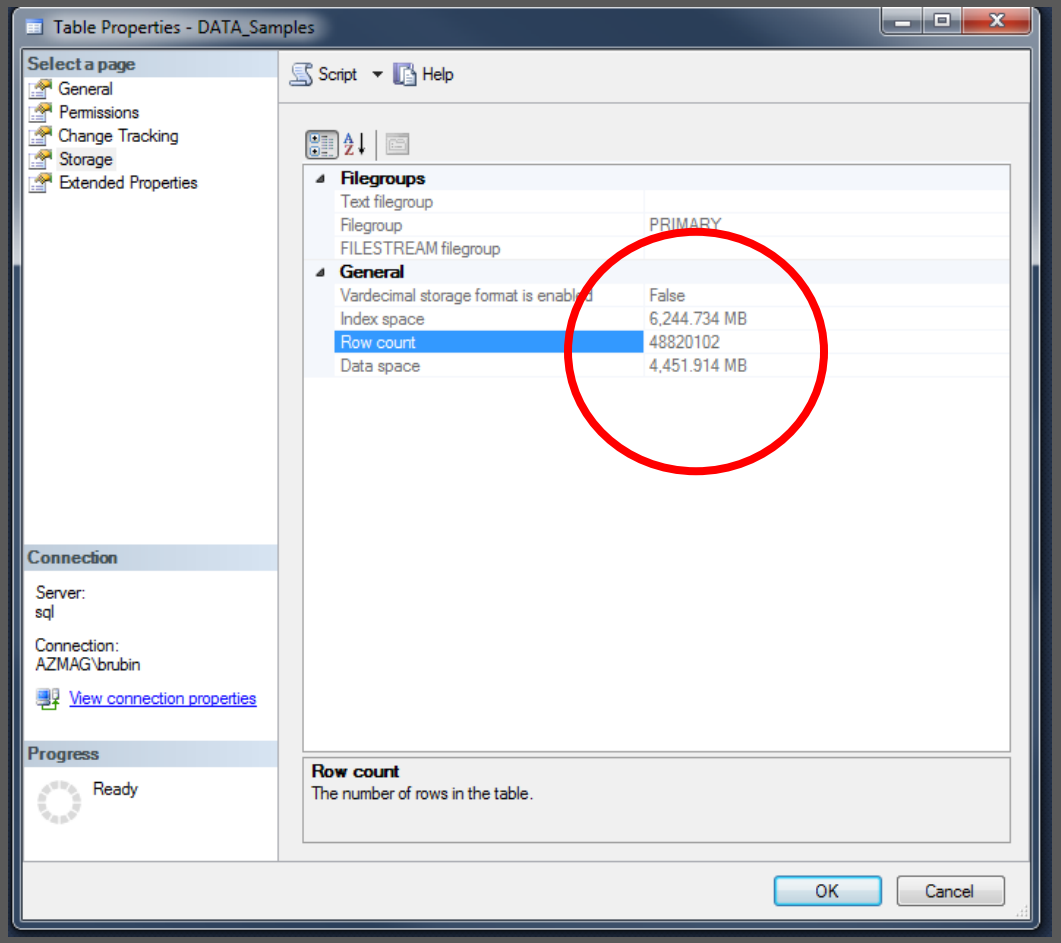
Raw Data in SQL Database

2

Third Party Data



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Raw Data in SQL Database

MARICOPA ASSOCIATION of GOVERNMENTS

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Third Party Data

TMC EPOCH 15 min.

	LINK_ID	YR	MON	DOW	EPOCH	START_TIME	END_TIME	AVG_SPEED	SAMPLES	STD_DEV	AVG_SPD_Filtered
1	115P11202	2012	1	7	15	03:30:00	03:45:00	25.5	2	37	25.5
2	115P11202	2012	1	7	49	12:00:00	12:15:00	43.5	3	5	43.5
3	115P11202	2012	1	7	68	16:45:00	17:00:00	61.5	3	3	61.5
4	115P11202	2012	2	2	32	07:45:00	08:00:00	39.1	9	21	39.1
5	115P11202	2012	2	2	49	12:00:00	12:15:00	20.5	1	0	20.5
6	115P11202	2012	2	2	64	15:45:00	16:00:00	26.1	13	29	26.1
7	115P11202	2012	2	3	77	19:00:00	19:15:00	65.9	1	0	65.9
8	115P11202	2012	2	4	5	01:00:00	01:15:00	41.6	1	0	41.6
9	115P11202	2012	2	4	51	12:30:00	12:45:00	54.7	1	0	54.7
10	115P11202	2012	2	6	31	07:30:00	07:45:00	37.9	10	10	37.9
11	115P11202	2012	2	6	54	13:15:00	13:30:00	46.6	3	24	46.6
12	115P11202	2012	2	6	82	20:15:00	20:30:00	52.8	1	0	52.8
13	115P11202	2012	2	7	80	19:45:00	20:00:00	38.5	3	13	38.5
14	115P11202	2012	3	1	56	13:45:00	14:00:00	18.6	1	0	18.6
15	115P11202	2012	3	1	60	14:45:00	15:00:00	73.9	1	0	73.9
16	115P11202	2012	3	1	94	23:15:00	23:30:00	60.3	2	9	60.3
17	115P11202	2012	3	2	25	06:00:00	06:15:00	11.8	1	0	11.8
18	115P11202	2012	3	3	2	00:15:00	00:30:00	68.4	2	1	68.4
19	115P11202	2012	3	3	61	15:00:00	15:15:00	28	2	12	28
20	115P11202	2012	3	4	28	06:45:00	07:00:00	26.1	3	16	26.1
21	115P11202	2012	3	4	41	10:00:00	10:15:00	40.4	3	10	40.4
22	115P11202	2012	3	4	65	16:00:00	16:15:00	23	14	31	23
23	115P11202	2012	3	5	24	05:45:00	06:00:00	51.6	1	0	51.6
24	115P11202	2012	3	5	48	11:45:00	12:00:00	24.2	1	0	24.2
25	115P11202	2012	3	5	60	14:45:00	15:00:00	32.9	3	15	32.9
26	115P11202	2012	3	6	5	01:00:00	01:15:00	66.5	1	0	66.5
27	115P11202	2012	4	1	90	22:15:00	22:30:00	40.4	2	14	40.4

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TMC Level Data in SQL Database

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Third Party Data

TMC ↓ AVG ↓ AM ↓ MID ↓ PM ↓

	TMC_ID	TMC_Length_Pt	Type	TMC_SL	FF85	FF90	SpeedAVG	SpeedAM	SpeedMID	SpeedPM	FF_DelayAVG	FF_DelayAM
1	115N04098	8600.205	Fwy	55.0001209123931	62.1	63.4	56.357192460318	53.8444444444444	57.24048611111112	47.08322916666667	5.90725628049006	8.88825088075036
2	115N04099	3890.77679	Fwy	55.0001093555473	61.5	62.8	57.0133556547626	49.1758333333333	56.3096527777778	54.4853125	4.60651432817872	14.6701049122301
3	115N04100	5352.711	Fwy	55.0001045310451	61.5	62.1	56.8067088293659	46.1704166666667	56.1943750000001	56.7664583333334	4.83621116093616	19.4354205181449
4	115N04101	4921.271	Fwy	55.0001110953126	61.5	62.1	55.6360367063497	44.18375	54.5563194444445	57.0290625	6.16967721357869	22.9413335523006
5	115N04102	6487.153	Fwy	55.0001058149854	62.1	63.4	57.8991071428579	47.3508333333333	58.487013888889	59.4708333333334	4.20611012365034	18.057214507088
6	115N04103	309.2722	Fwy	55.0001127763506	58.4	61.5	56.4103918650799	51.55375	57.7022222222222	57.8435416666667	2.17419295904708	8.18619614652748
7	115N04104	3551.244	Fwy	55.0001060869195	64	64.6	59.4468129960325	53.6895833333334	59.0515277777779	59.8254166666667	4.30833472923545	10.8021128400139
8	115N04105	2634.389	Fwy	55.0001130233772	64.6	65.9	59.8386532738102	54.7750000000001	59.4833333333334	60.2860416666667	4.43422759595386	9.99585978665877
9	115N04106	4725.449	Fwy	51.6187562030776	65.2	66.5	60.6368427579369	57.8604166666666	61.1186111111111	59.08	4.15512180208622	7.00397769029777
10	115N04107	2981.503	Fwy	55.0001160105153	63.4	64.6	57.5430431547626	51.6570833333334	57.1925000000001	53.1384375	5.77952892010766	12.9080114050868
11	115N04108	5945.764	Fwy	55.000110623949	64.6	65.2	59.9008556547625	54.1754166666666	59.1216666666668	58.4558333333334	4.37175426351369	10.7232499213095
12	115N04109	5340.467	Fwy	55.0001075028848	64	65.2	59.6306299603184	53.7009722222222	58.8546527777778	58.2907291666666	4.12165802869505	10.7878924445295
13	115N04110	5124.604	Fwy	55.0001121372168	64.6	65.9	59.9526041666672	50.9677777777777	59.0942361111112	59.3273958333334	4.3198791227811	14.9053075413465
14	115N04111	5370.606	Fwy	55.0001076361567	65.2	65.9	59.9555679563498	48.6138888888889	59.3204166666667	59.3015625000001	4.82974104509572	18.8381873358332
15	115N04112	5436.061	Fwy	55.0001052104311	65.2	66.5	59.8428819444451	46.1222222222222	58.8809027777778	59.3982291666667	4.94280664412333	22.8387571625139
16	115N04113	5152.671	Fwy	55.0001102160681	65.2	65.9	59.1940972222226	44.5634722222222	58.2461111111112	58.7554166666667	5.60215087931379	25.568927357525
17	115N04114	5122.063	Fwy	55.0001143763979	67.1	67.7	60.6486731150793	45.6527777777778	60.1054861111111	60.4571875	5.70699805815908	25.2048330210189
18	115N04115	4748.457	Fwy	61.3832980850496	68.4	69	62.7776289682545	46.5923611111112	62.2884722222222	62.8152083333334	4.71368972820476	24.6343057201824
19	115N04116	5912.966	Fwy	65.0001258176665	68.4	69.6	62.8901785714289	47.7713888888889	62.0097916666667	62.6186458333333	4.61106341389028	22.7273353260518
20	115N04117	4930.488	Fwy	65.0001274104411	68.4	69.6	62.9857390873019	49.8984722222222	62.1645833333333	62.9687500000001	4.52421619238838	19.5149185238857
21	115N04118	5907.439	Fwy	65.000130219062	68.4	69	63.3840649801593	55.4581944444445	62.6325	62.5767708333333	4.16503075456352	12.2821824194268
22	115N04119	4237.17	Fwy	65.0001377513882	68.4	69.6	64.5265749007943	60.9741666666667	63.7903472222223	63.781875	3.1593878835037	6.4098183657013
23	115N04120	5216.96	Fwy	65.0001343284754	69	69.6	65.7579985119057	64.4969444444444	65.4188194444445	66.1339583333334	2.57227877299268	3.64268464202799
24	115N04121	6419.201	Fwy	65.0001269203856	69	70.2	66.0079365079373	65.8731944444443	65.5135416666666	66.301875	2.36498319314487	2.47654121733862
25	115N04122	5356.289	Fwy	65.0001240457643	69	70.2	65.9222842261911	65.1545833333333	64.97125	66.4125	2.4358451324939	3.07929886921657
26	115N04123	4704.736	Fwy	65.0001260430496	69	70.2	65.8211433531752	64.5259722222222	64.9841666666667	66.3541666666667	2.51975857330833	3.61757488020452
27	115N04124	21198.43	Fwy	65.0001311757432	70.2	71.5	67.7824652777782	67.6363888888889	67.2263194444445	68.6198958333334	1.82902966265764	1.94373529732946
28	115N04125	8900.282	Fwy	66.9841771807037	72.1	73.3	69.0846354166664	68.3936111111111	68.8015277777778	70.5351041666666	2.17934303873406	2.70584357673689
29	115N04126	10862.98	Fwy	65.0001255772504	67.7	69	64.5456225198422	63.0127777777777	64.4004166666666	64.3707291666667	2.59872725857841	3.95549419187701
30	115N04127	5632.504	Fwy	65.0001273813859	68.4	69.6	64.6248759920639	62.4726388888889	64.1138194444444	65.3295833333333	3.07452407775907	4.99364809647076
31	115N04128	6241.231	Fwy	65.0001318741951	69	69.6	64.7742559523817	62.7719444444445	64.0511805555556	65.3278125000001	3.40372265559504	5.17654872509311
32	115N04129	5155.229	Fwy	65.0001340614453	69	69.6	64.8348338293655	63.05875	64.3575694444445	65.0742708333334	3.35179416315393	4.91570576437948
33	115N04130	3526.409	Fwy	65.0001242630579	69.6	70.8	65.0042286706354	63.4190277777779	64.0503472222222	65.8438541666667	3.65687456033042	5.04115990062738
34	115N04131	5962.387	Fwy	65.0001243765519	69	70.2	64.7073412698416	63.0897222222222	63.7109027777778	65.3776041666667	3.4611961937771	4.88767913344791
35	115N04132	10735.24	Fwy	65.0001219675706	69	70.2	64.763405257937	63.5601388888889	63.839375	65.3954166666667	3.41303433308525	4.46535903698796
36	115N04133	4990.746	Fwy	65.0001317083613	69	69.6	64.8152157738102	63.795138888889	64.3588194444445	66.1330208333334	3.3686005009208	4.25671886203517
37	115N04134	7820.841	Fwy	65.0001346093548	69.6	70.8	65.6825396825403	63.115	64.9590277777777	67.3477083333333	3.08494858418975	5.31460087907405
38	115N04135	5286.739	Fwy	65.000126166506	69.6	70.8	65.1682787698419	58.9222222222223	64.7731944444445	66.8457291666666	3.51746224555298	9.37335405463392
39	115N04136	4863.559	Fwy	65.0001256747455	69	69.6	64.2542038690486	56.917361111111	63.9423611111111	66.1265625000001	3.85354949168714	11.0756812757713
40	115N04137	5970.318	Fwy	65.0001268780893	68.4	69.6	64.0658978174611	57.2719444444444	63.7363888888889	65.8979166666667	3.56056262313218	10.2264230799962

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Joining Data to Shapefile

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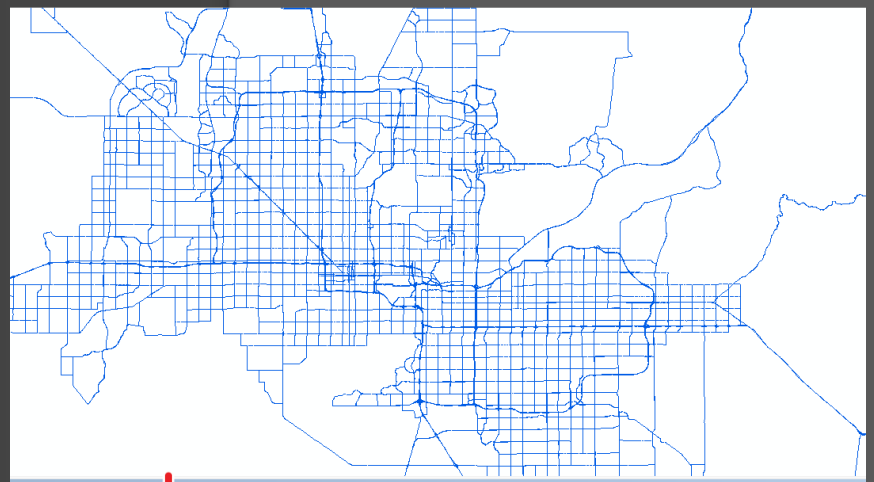
Third Party Data

TMC Level Data in Excel

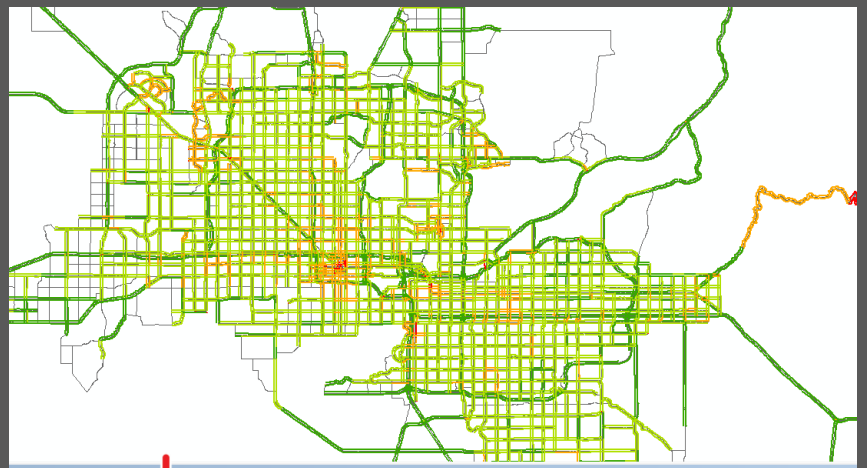
	A	B	C	D	E	F	G	H	I	J	K	L	M	N
1	TMC_ID	TMC_Length_Ft	Type	TMC_SL	FF85	FF90	SpeedAVG	SpeedAM	SpeedMID	SpeedPM	FF_DelayAVG	FF_DelayAM	FF_DelayMid	FF_Dela
2	115N04098	8600.205	Fwy	55.0	62.1	63.4	56.36	53.84	57.24	47.08	5.91	8.89	4.92	1
3	115N04099	3890.77679	Fwy	55.0	61.5	62.8	57.01	49.18	56.31	54.49	4.61	14.67	5.40	
4	115N04100	5352.711	Fwy	55.0	61.5	62.1	56.81	46.17	56.19	56.77	4.84	19.44	5.53	
5	115N04101	4921.271	Fwy	55.0	61.5	62.1	55.64	44.18	54.56	57.03	6.17	22.94	7.45	
6	115N04102	6487.153	Fwy	55.0	62.1	63.4	57.90	47.35	58.49	59.47	4.21	18.06	3.58	
7	115N04103	309.2722	Fwy	55.0	58.4	61.5	56.41	51.55	57.70	57.84	2.17	8.19	0.75	
8	115N04104	3551.244	Fwy	55.0	64	64.6	59.45	53.69	59.05	59.83	4.31	10.80	4.71	
9	115N04105	2634.389	Fwy	55.0	64.6	65.9	59.84	54.78	59.48	60.29	4.43	10.00	4.79	
10	115N04106	4725.449	Fwy	51.6	65.2	66.5	60.64	57.86	61.12	59.08	4.16	7.00	3.69	
11	115N04107	2981.503	Fwy	55.0	63.4	64.6	57.54	51.66	57.19	53.14	5.78	12.91	6.16	1
12	115N04108	5945.764	Fwy	55.0	64.6	65.2	59.90	54.18	59.12	58.46	4.37	10.72	5.16	
13	115N04109	5340.467	Fwy	55.0	64	65.2	59.63	53.70	58.85	58.29	4.12	10.79	4.92	
14	115N04110	5124.604	Fwy	55.0	64.6	65.9	59.95	50.97	59.09	59.33	4.32	14.91	5.19	

Third Party GIS Network



ASS	DIR_TRAVEL	Offset	TMC_ID	Type	Length_Ft	Corridor	Corridor_Segment	Street	From_	
	F	R-	115N04098	Fwy	1617.071	I-17 SB	20	I-17	I-10	I-10
	F	R-	115N04099	Fwy	57.96679	I-17 SB	20	I-17	I-10	I-10
	T	L+	115N04099	Fwy	3832.81	I-17 SB	20	I-17	I-10	I-10
	F	R-	115N04100	Fwy	1153.864	I-17 SB	20	I-17	I-10	I-10
	T	L+	115N04100	Fwy	4198.847	I-17 SB	20	I-17	I-10	I-10
	F	R-	115N04101	Fwy	2129.369	I-17 SB	20	I-17	I-10	I-10
	T	L+	115N04101	Fwy	2791.902	I-17 SB	20	I-17	I-10	I-10
	F	R-	115N04102	Fwy	1868.07	I-17 SB	20	I-17	I-10	I-10
	T	L+	115N04102	Fwy	4619.083	I-17 SB	20	I-17	I-10	

Joined Data Displayed on Map



ASS	DIR_TRAVEL	Offset	TMC_ID	Type	Length_Ft	TMC_ID_1	TMC_Length_Ft	Type_1	TMC_SL	FF85	FF90	SpeedAVG	SpeedAM	SpeedMID	SpeedPM	FF_DelayAVG	F
	F	R-	115N04098	Fwy	1617.071	115N04098	8600.205	Fwy	55.000121	62.1	63.4	56.357192	53.844444	57.240486	47.083229	5.907256	
	T	L+	115N04098	Fwy	3242.441	115N04098	8600.205	Fwy	55.000121	62.1	63.4	56.357192	53.844444	57.240486	47.083229	5.907256	
	F	R-	115N04098	Fwy	1993.735	115N04098	8600.205	Fwy	55.000121	62.1	63.4	56.357192	53.844444	57.240486	47.083229	5.907256	
	T	L+	115N04098	Fwy	1746.958	115N04098	8600.205	Fwy	55.000121	62.1	63.4	56.357192	53.844444	57.240486	47.083229	5.907256	
	F	R-	115N04099	Fwy	57.96679	115N04099	3890.77679	Fwy	55.000109	61.5	62.8	57.013356	49.175833	56.309653	54.485312	4.606514	
	T	L+	115N04099	Fwy	3832.81	115N04099	3890.77679	Fwy	55.000109	61.5	62.8	57.013356	49.175833	56.309653	54.485312	4.606514	
	F	R-	115N04100	Fwy	1153.864	115N04100	5352.711	Fwy	55.000105	61.5	62.1	56.806709	46.170417	56.194375	56.766458	4.836211	
	T	L+	115N04100	Fwy	4198.847	115N04100	5352.711	Fwy	55.000105	61.5	62.1	56.806709	46.170417	56.194375	56.766458	4.836211	
	F	R-	115N04101	Fwy	2129.369	115N04101	4921.271	Fwy	55.000111	61.5	62.1	55.636037	44.18375	54.556319	57.029063	6.169677	
	T	L+	115N04101	Fwy	2791.902	115N04101	4921.271	Fwy	55.000111	61.5	62.1	55.636037	44.18375	54.556319	57.029063	6.169677	
	F	R-	115N04102	Fwy	1868.07	115N04102	6487.153	Fwy	55.000106	62.1	63.4	57.899107	47.350833	58.487014	59.470833	4.20611	

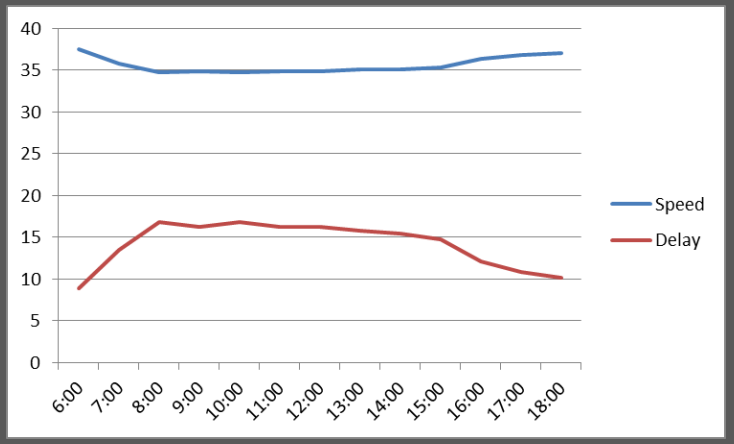
Segment Analysis in Excel

MARICOPA ASSOCIATION of GOVERNMENTS

2

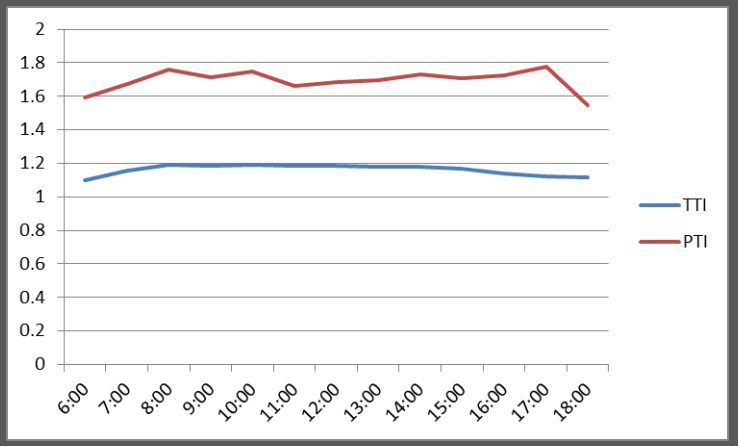
Third Party Data

SPEED / DELAY



N1EB			N1EB	Loop 303 to Dysart Rd					
Loop 303 to Dysart Rd									
TMC_ID	MON	DOW	START_TIME	END_TIME	CLEAN_SPEED	FF85	TMC_SL	Length	TT
115P09090	1	2	6:00:00	6:15:00	30.4	44	45.0001	5719.9	2.14
115P09090	1	3	6:00:00	6:15:00	36.7	44	45.0001	5719.9	1.77
115P09090	1	4	6:00:00	6:15:00	41	44	45.0001	5719.9	1.59
115P09090	1	5	6:00:00	6:15:00	38.5	44	45.0001	5719.9	1.69
115P09090	1	6	6:00:00	6:15:00	55.9	44	45.0001	5719.9	1.16
115P09090	2	2	6:00:00	6:15:00	34.2	44	45.0001	5719.9	1.9
115P09090	2	3	6:00:00	6:15:00	34.2	44	45.0001	5719.9	1.9
115P09090	2	4	6:00:00	6:15:00	29.2	44	45.0001	5719.9	2.23
115P09090	2	5	6:00:00	6:15:00	28.6	44	45.0001	5719.9	2.27
115P09090	2	6	6:00:00	6:15:00	36	44	45.0001	5719.9	1.81
115P09090	3	2	6:00:00	6:15:00	29.8	44	45.0001	5719.9	2.18
115P09090	3	3	6:00:00	6:15:00	37	44	45.0001	5719.9	1.76
115P09090	3	4	6:00:00	6:15:00	29.2	44	45.0001	5719.9	2.23
115P09090	3	5	6:00:00	6:15:00	43.5	44	45.0001	5719.9	1.49
115P09090	3	6	6:00:00	6:15:00	15.5	44	45.0001	5719.9	4.19
115P09090	4	2	6:00:00	6:15:00	39.1	44	45.0001	5719.9	1.66
115P09090	4	3	6:00:00	6:15:00	32.3	44	45.0001	5719.9	2.01
115P09090	4	4	6:00:00	6:15:00	42.3	44	45.0001	5719.9	1.54
115P09090	4	5	6:00:00	6:15:00	34.8	44	45.0001	5719.9	1.87
115P09090	4	6	6:00:00	6:15:00	41	44	45.0001	5719.9	1.59
115P09090	5	2	6:00:00	6:15:00	38	44	45.0001	5719.9	1.71
115P09090	5	3	6:00:00	6:15:00	37	44	45.0001	5719.9	1.76
115P09090	5	4	6:00:00	6:15:00	41	44	45.0001	5719.9	1.59
115P09090	5	5	6:00:00	6:15:00	39	44	45.0001	5719.9	1.67

TTI / PTI



TMCs	Length	Segment_Length	FF_Speed	TMC_SL	6:00	7:00	8:00	9:00
115P09090	5719.8699	25736.34563	44	45.000092	35.09708	34.21875	33.72958	34.16375
115P09091	6199.2908	25736.34563	44	45.000093	39.30917	38.38417	37.44125	37.80292
115P09093	69.211108	25736.34563	44	45.00009	42.8925	38.10917	33.075	32.70542
115P09094	6394.3815	25736.34563	37	45.000091	36.97583	34.19375	31.93958	32.715
115P09095	5701.1449	25736.34563	41	45.000086	39.05792	36.8625	35.905	35.14083
115P09096	105.41811	25736.34563	41	45.000089	40.85	34.905	27.44167	27.33333
115P09097	1547.0292	25736.34563	40.4	45.000089	35.78208	34.1975	34.49667	33.89708

	6:00	7:00	8:00	9:00	10:00	11:00	12:00	13:00
Speed	37.541578	35.81353354	34.67939415	34.848904	34.68708	34.87743	34.85538	35.02428
Delay	8.8689427	13.49592424	16.78330692	16.27837	16.7603	16.19388	16.25918	15.76112
Congestion	0.8342556	0.7958547	0.770651653	0.7744185	0.770823	0.775052	0.774562	0.778316
Travel Time	7.7902552	8.166144027	8.433205949	8.3921857	8.431337	8.385322	8.390627	8.350165
Travel Time Index	1.1019129	1.155081475	1.192856743	1.1870545	1.192592	1.186084	1.186834	1.181111
Planning Time Index	1.5954749	1.674874944	1.762256073	1.7137994	1.746796	1.664544	1.683122	1.698399
95% Travel Time	11.279618	11.84095695	12.4587202	12.116144	12.34942	11.76792	11.89926	12.00727

FF_Speed	41.367549
FF_TT	7.0697559
Weighted_SL	45.000091

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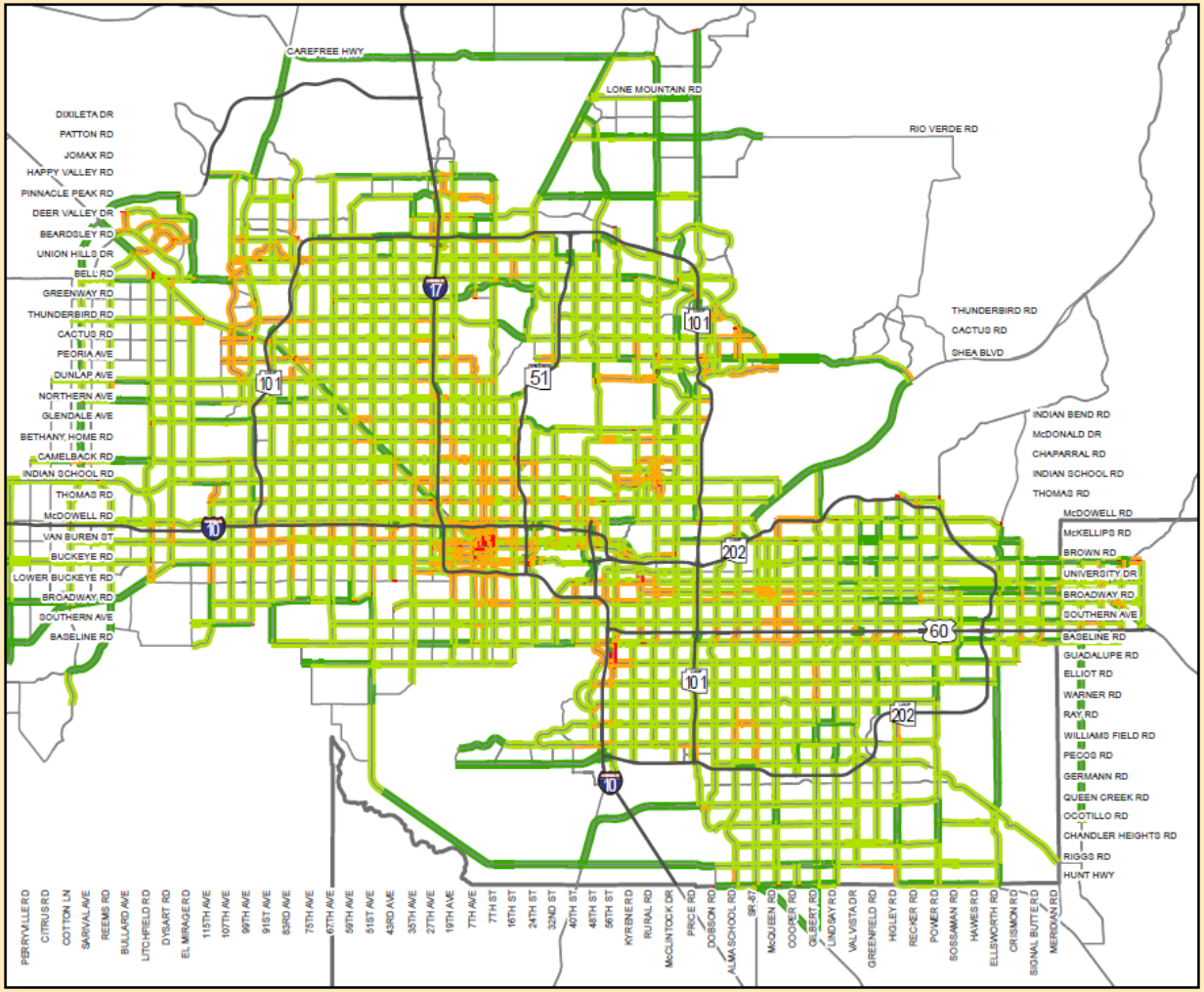
Speed Output

2

Third Party Data



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MARICOPA ASSOCIATION of GOVERNMENTS

Performance Measures Study

2012
Average AM Peak Period Speeds
Arterial Roadways

Legend

Average Speed (mph)
6AM - 9AM (2012)

- 0 - 20
- 20 - 30
- 30 - 40
- 40+
- Freeways
- Major Roads

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Miles
0 5 10 15 20

N

Map derived from weekday speed data for analysis year.
Source: Maricopa Association of Governments

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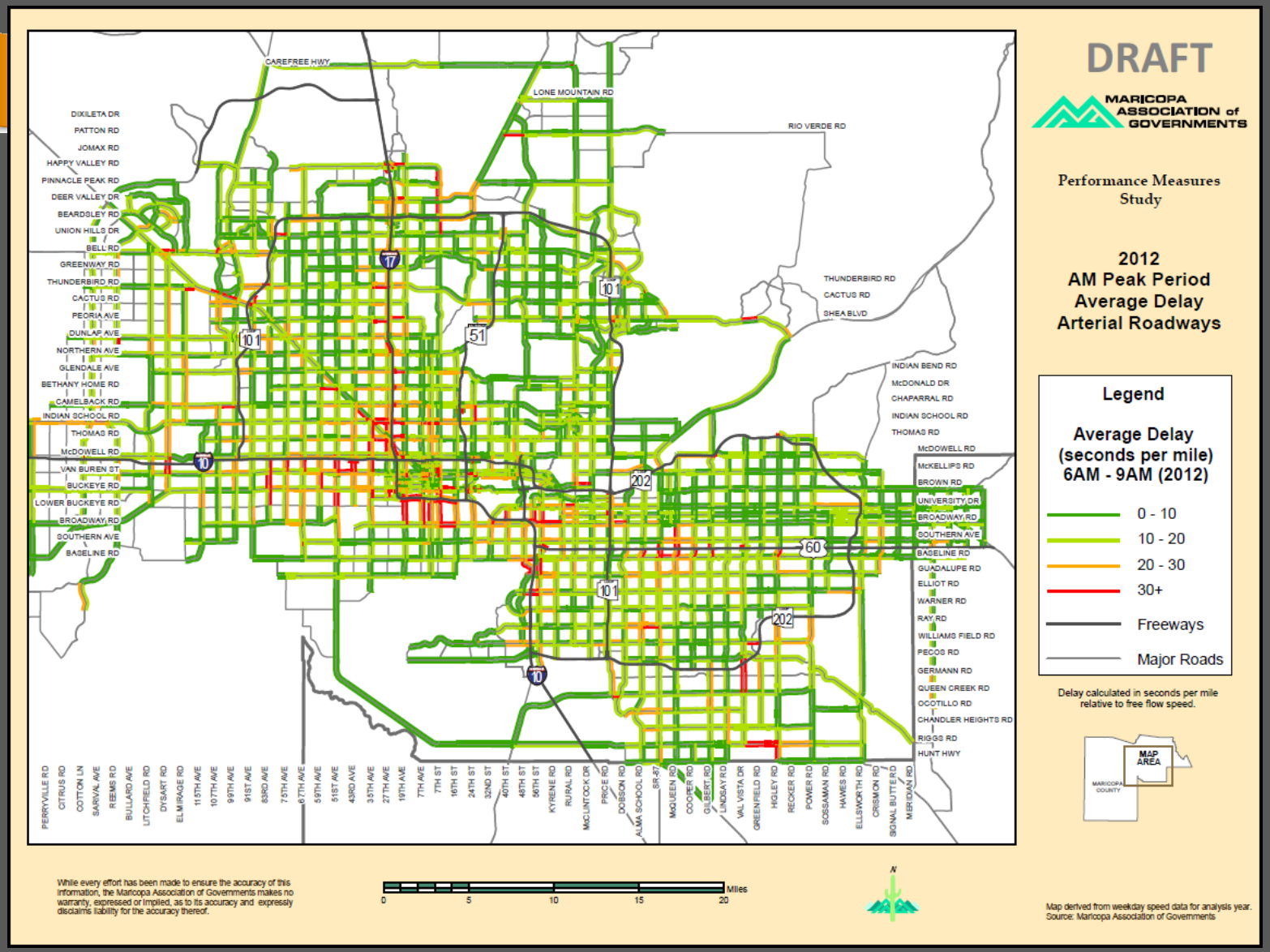
Delay Output

2

Third Party Data



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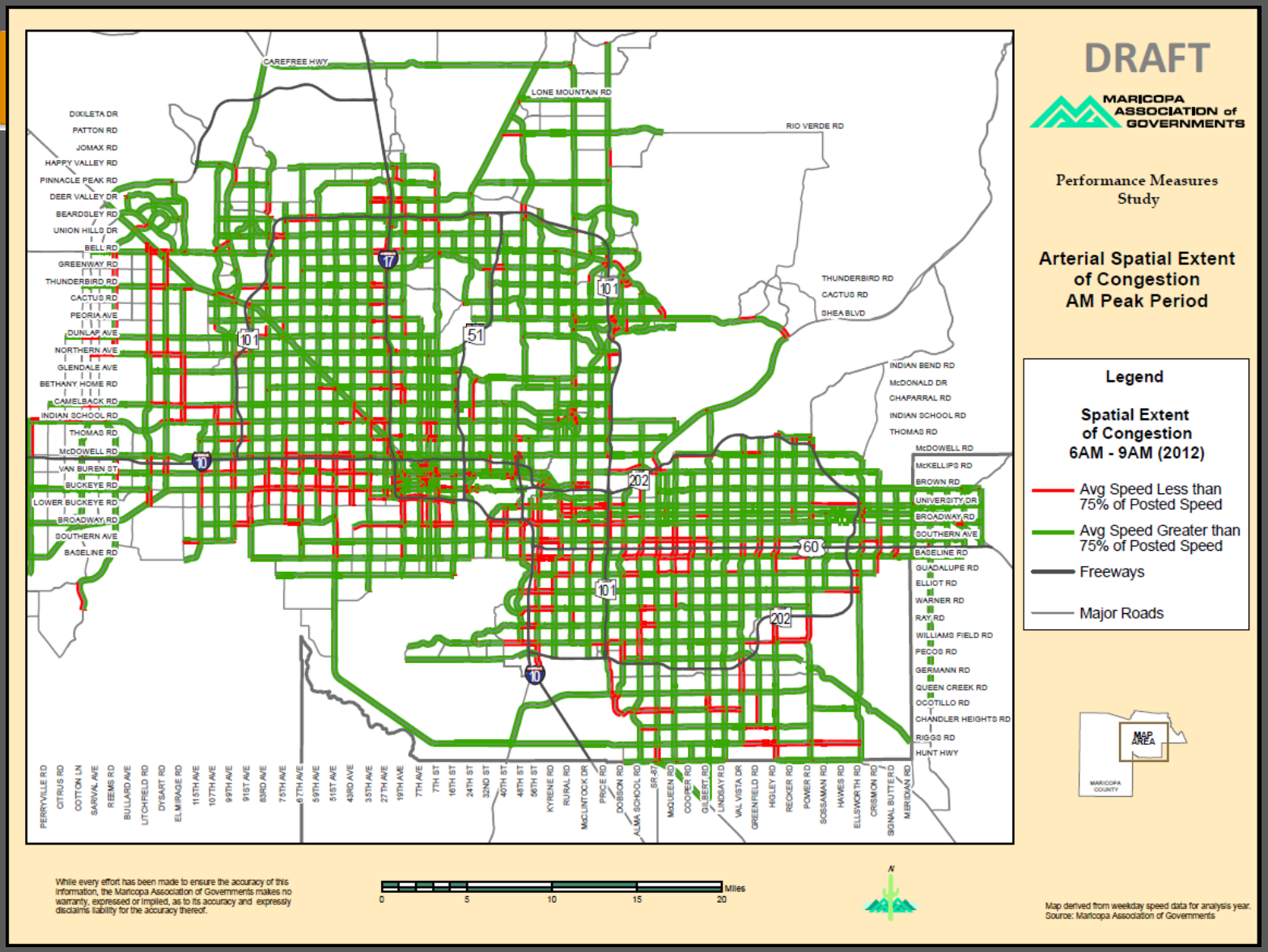
Congestion Output

2

Third Party Data



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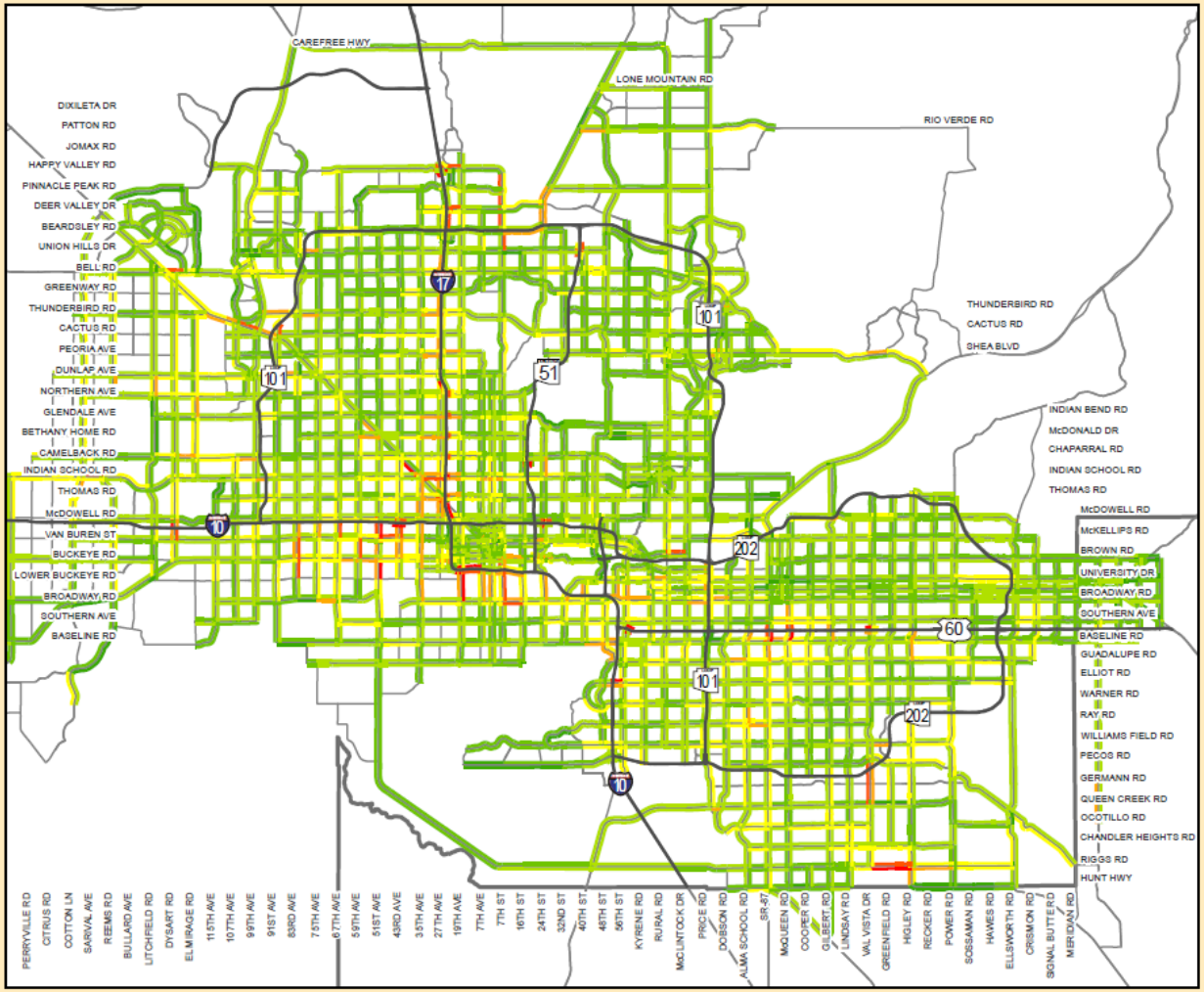
Travel Time Index Output

2

Third Party Data



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MARICOPA ASSOCIATION of GOVERNMENTS

Performance Measures Study

2012
AM Peak Period
Travel Time Index
Arterial Roadways

Legend

Travel Time Index
6AM - 9AM (2012)

- 0 - 1.0
- 1.0 - 1.1
- 1.1 - 1.2
- 1.2 - 1.3
- 1.3 - 1.4
- 1.4 - 1.5
- 1.5+
- Freeways
- Major Roads

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Miles
0 5 10 15 20

N

Map derived from weekday speed data for analysis year.
Source: Maricopa Association of Governments

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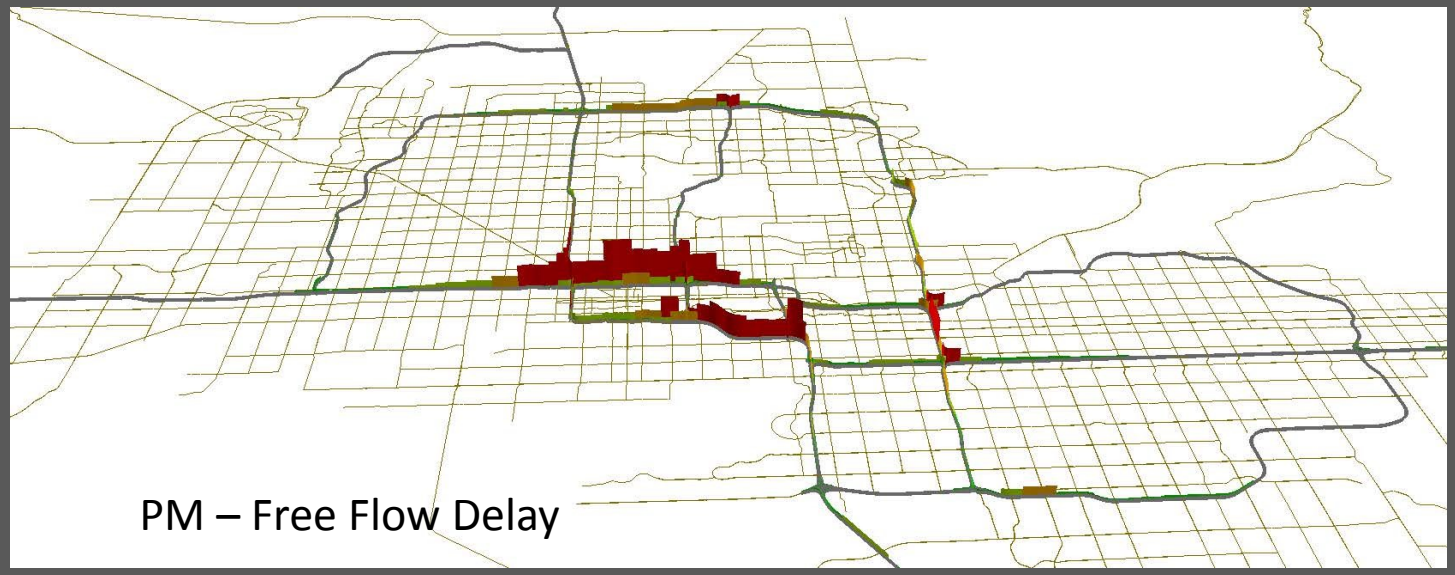
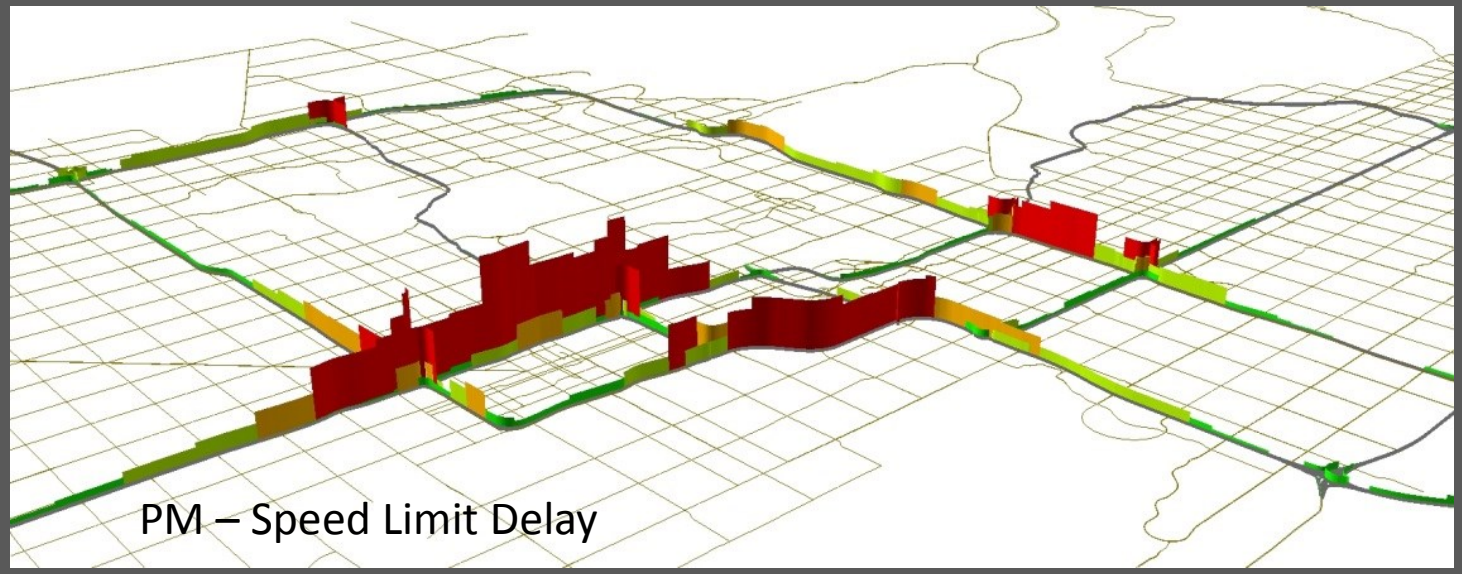
Spatial Analyst QC Routine





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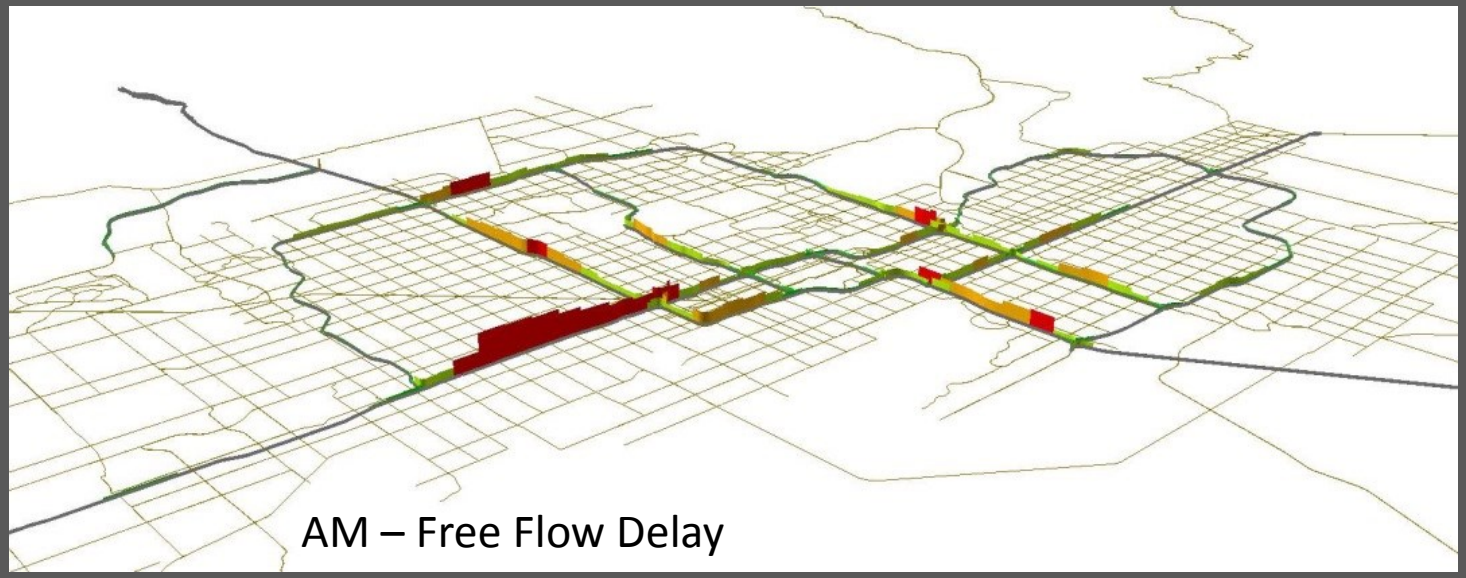
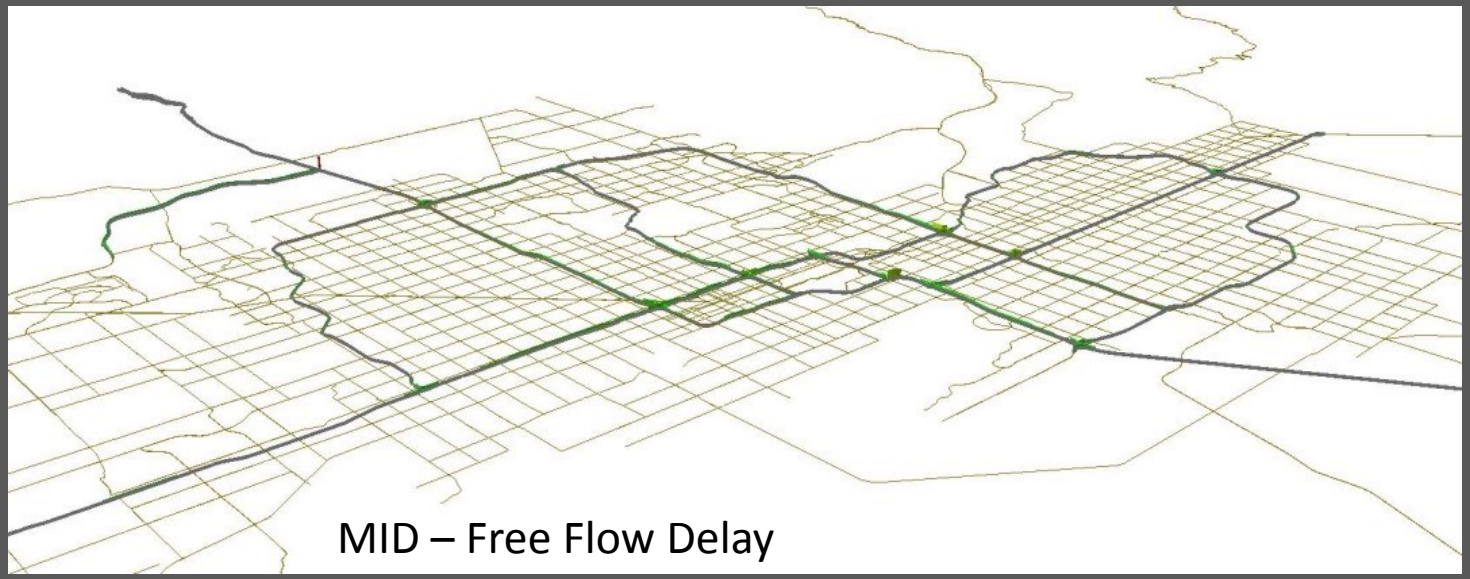
Spatial Analyst QC Routine





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What is NPMRDS Data

- NPMRDS (National Performance Management Research Data Set) http://www.ops.fhwa.dot.gov/freight/freight_analysis/perform_meas/vpds/npmrdsfaqs.htm
- Provided by FHWA to public agencies for free, HERE as vendor. Everything can be downloaded from a website after the application is approved.
- Travel time data on TMC (Traffic Message Channel) level. NHS Only.
- Travel time for “all vehicles”, “passenger vehicles”, and “freight trucks”
- Data by 5-min, for every day
- No data imputation. Many “NULL” in the data.
- Sample rates unknown, less “freight truck” data than “passenger vehicle” data.

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2

What is NPMRDS Data

TMC	DATE	EPOCH	Travel_TIME_ALL_VEHICLES	Travel_TIME_PASSENGER_VEHICLES	Travel_TIME_FREIGHT_TRUCKS
115N04098	10052013	262	97	97	
115N04098	10012013	34	101	101	
115N04098	10012013	66	100		100
115N04098	10012013	98	112	111	126
115N04098	10012013	130	110	113	100
115N04098	10012013	162	95	100	91
115N04098	10012013	194	87	87	
115N04098	10012013	226	786	786	
115N04098	10012013	258	104		104
115N04098	10022013	67	96	98	94
115N04098	10022013	99	125	129	107
115N04098	10022013	131	122	122	
115N04098	10022013	163	97	93	100
115N04098	10022013	227	106	100	112
115N04098	10032013	4	95		95
115N04098	10032013	68	97	89	106
115N04098	10032013	100	105	106	100
115N04098	10032013	132	110		110
115N04098	10032013	164	97	95	98
115N04098	10032013	196	99	99	
115N04098	10032013	228	89	89	
115N04098	10042013	37	96	96	
115N04098	10042013	69	98	98	
115N04098	10042013	101	110	110	

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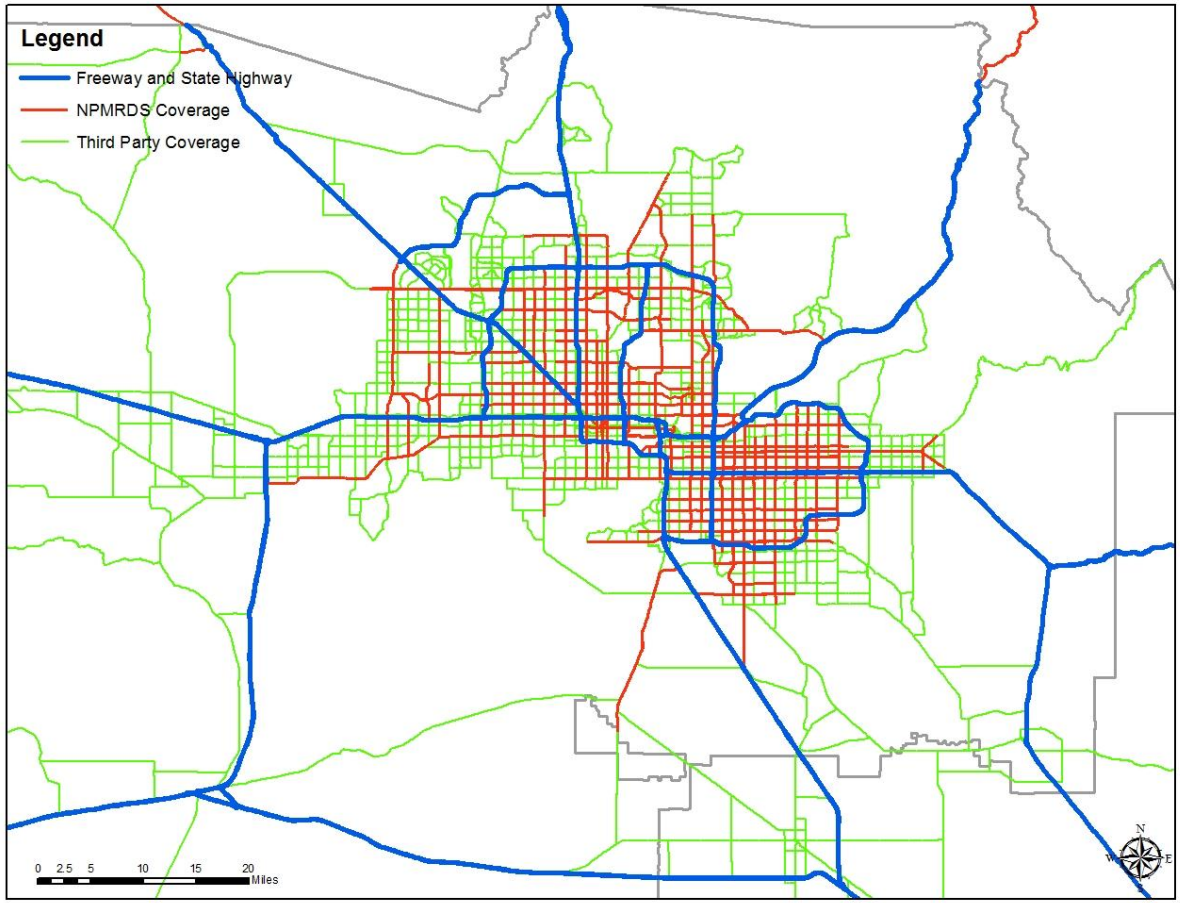
Coverage: NPMRDS vs. Third Party Data

2



Data Set	# of TMC	Tot Length (miles)
NPMRDS	3,136	3,599
Third Party Data	5,740	6,801
Percentage (NPMRDS/3rd Party)	55%	53%

- NPMRDS covers all freeways and state highways, and arterials in NHS (National Highway System).
- About 50% of arterials are not covered by NPMRDS

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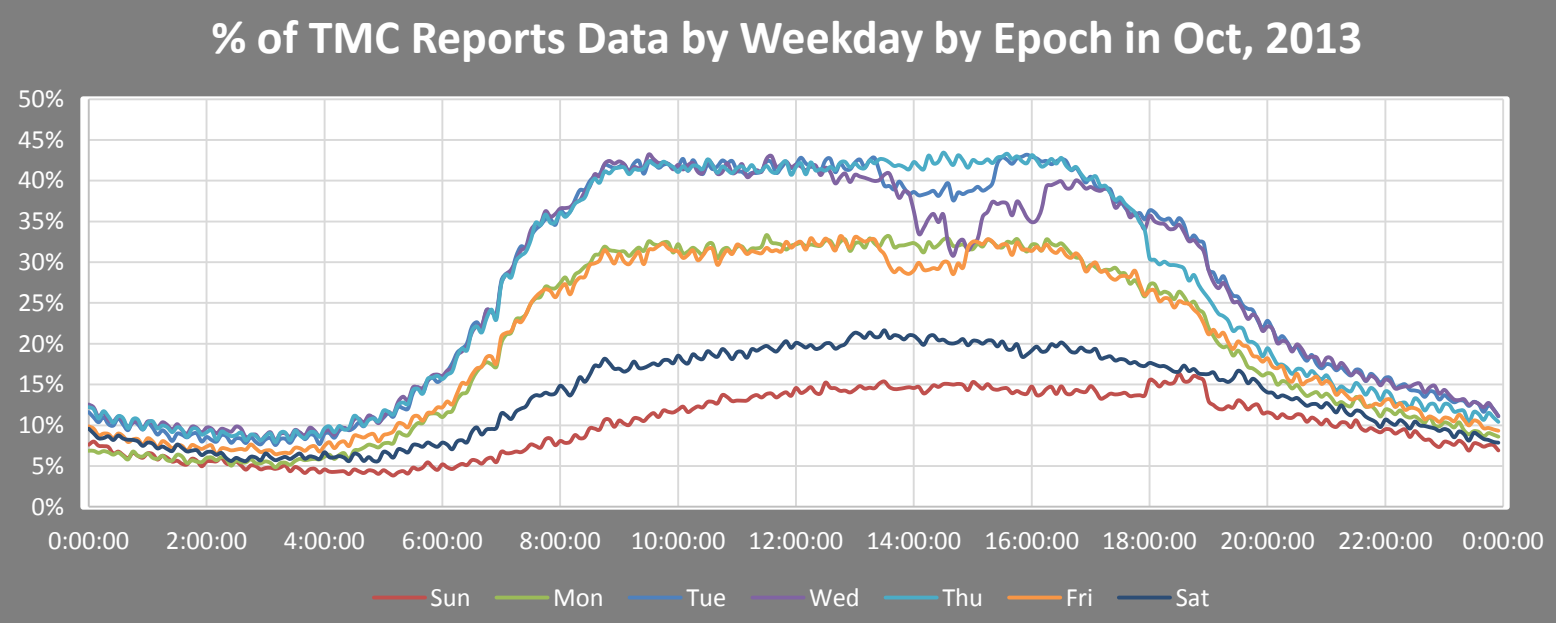
NPMRDS Temporal Coverage

2

- A TMC doesn't necessarily report a travel time on every 5-min epoch (all vehicles).
- More data reported during daylight, less data over night.



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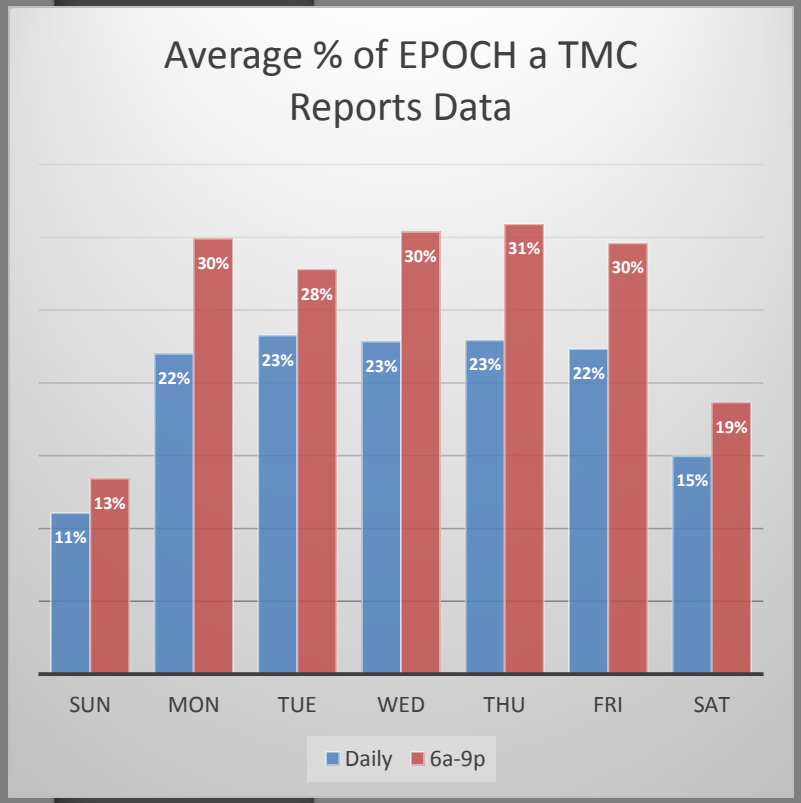
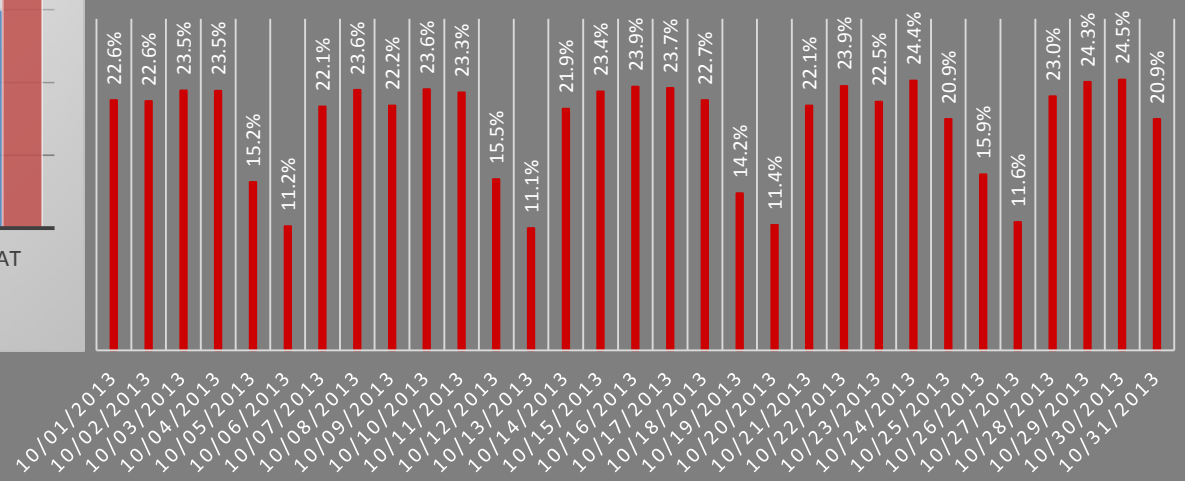
NPMRDS Temporal Coverage

2

- More data reported in weekdays than on weekends.



Oct, 2013	Sun	Mon	Tue	Wed	Thu	Fri	Sat
Week 1			23%	23%	24%	23%	15%
Week2	11%	22%	24%	22%	24%	23%	15%
Week 3	11%	22%	23%	24%	24%	23%	14%
Week 4	11%	22%	24%	22%	24%	21%	16%
Week 5	12%	23%	24%	24%	21%		



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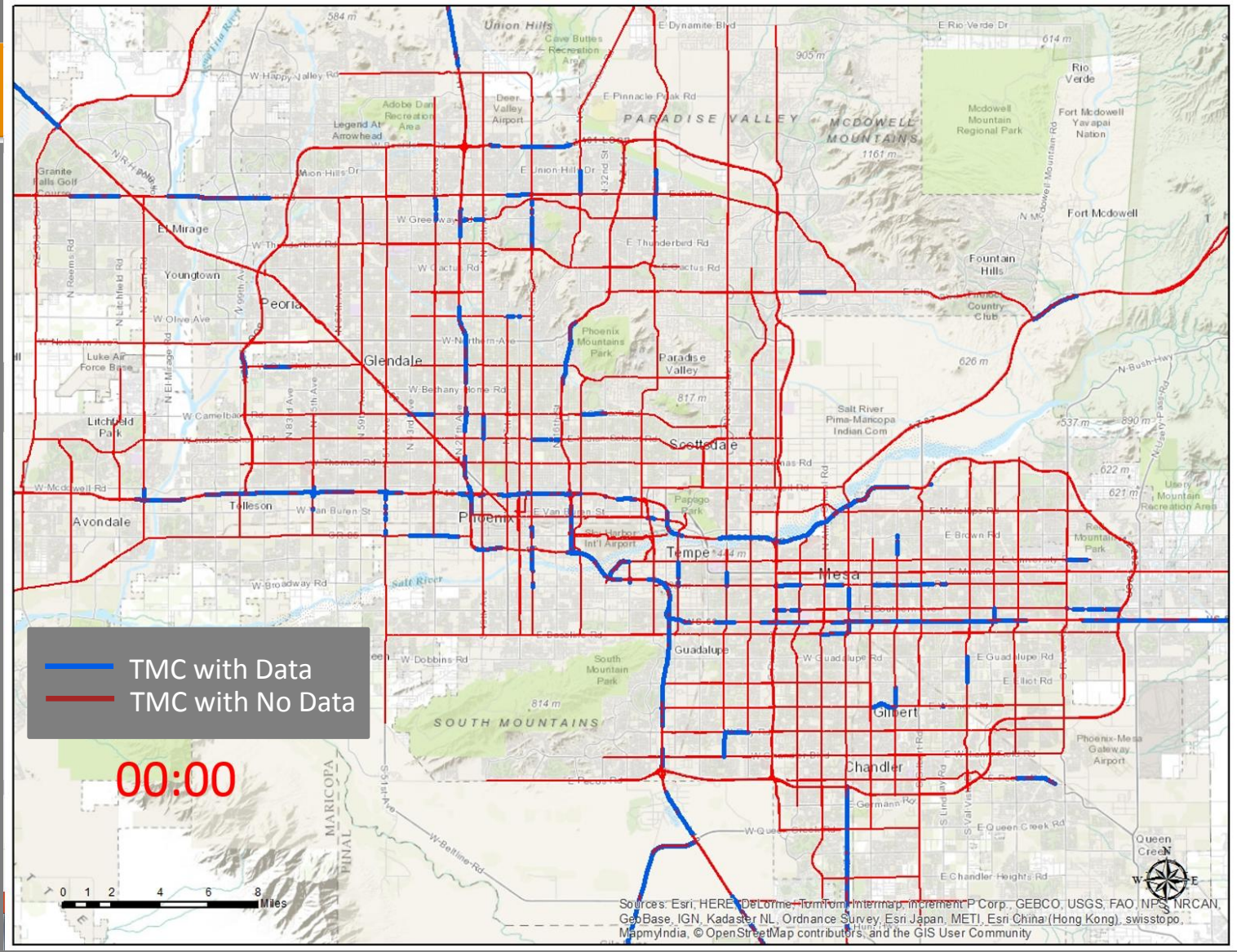
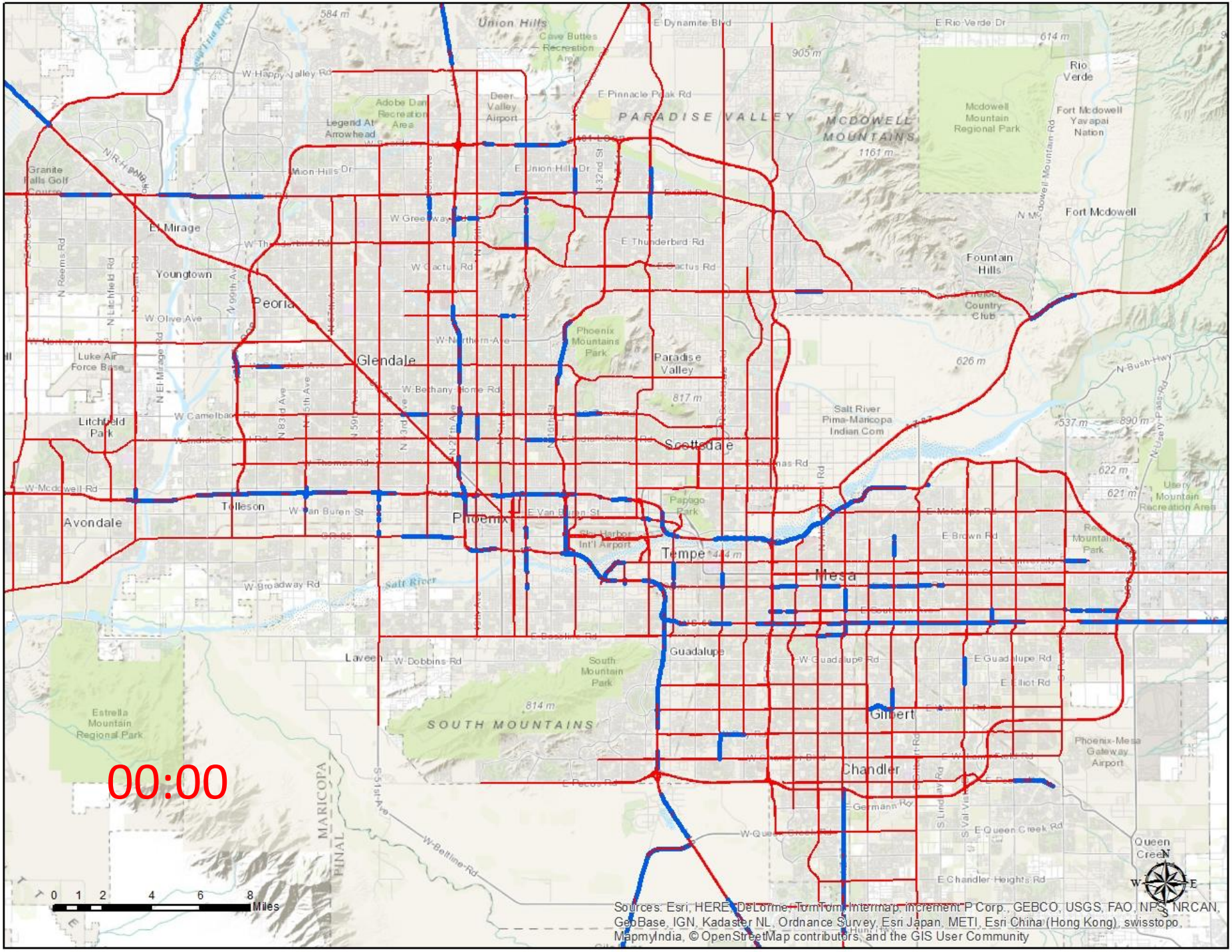
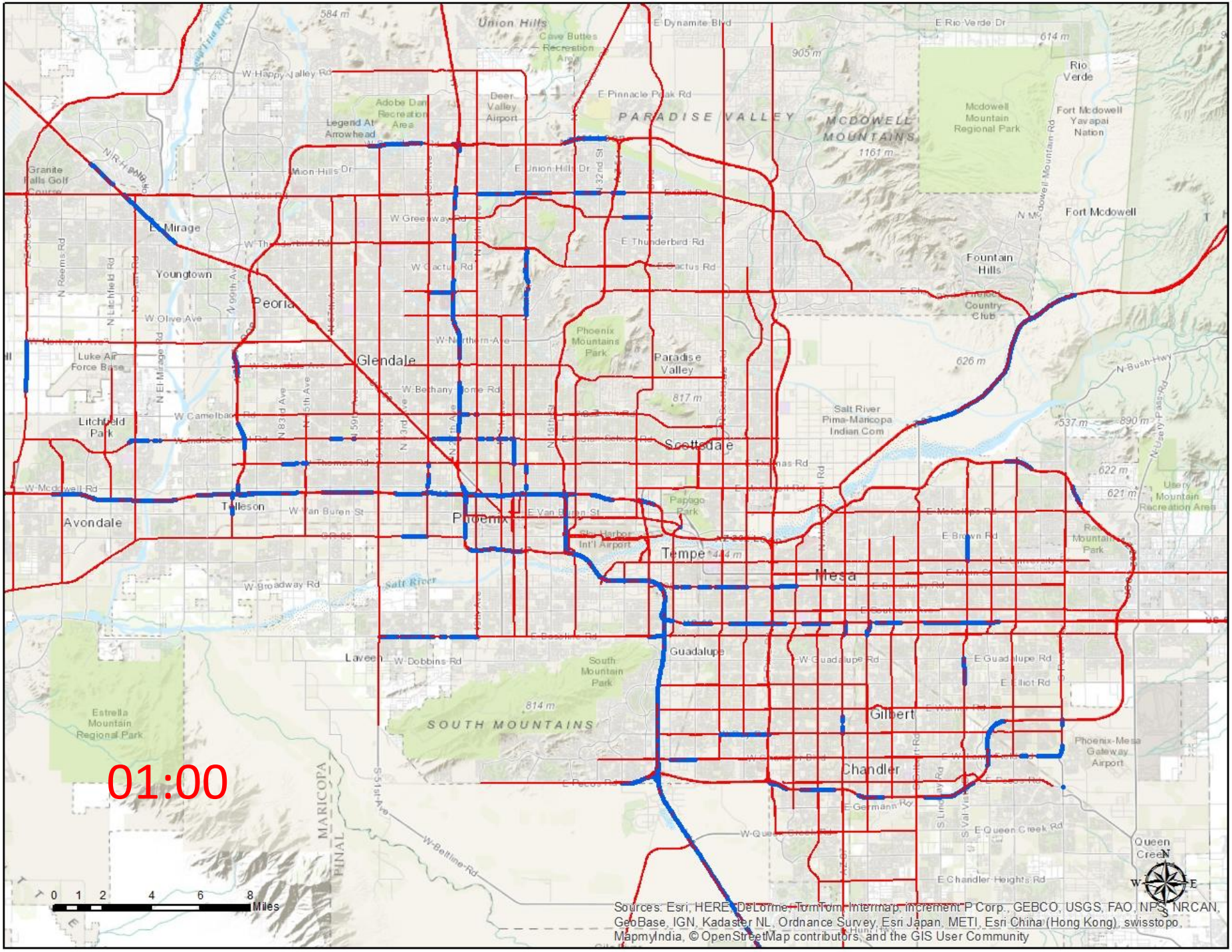
MARICOPA ASSOCIATION of GOVERNMENTS

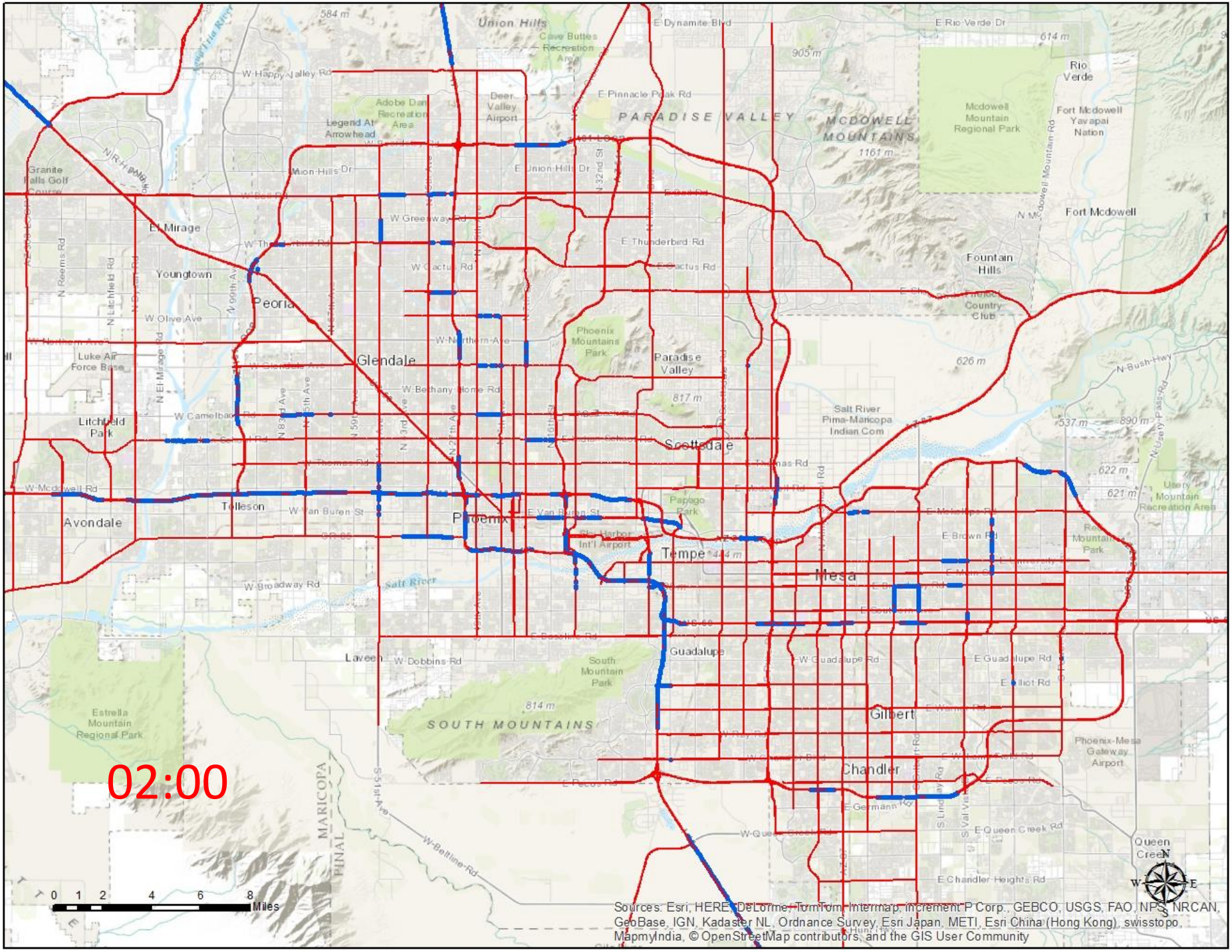
2

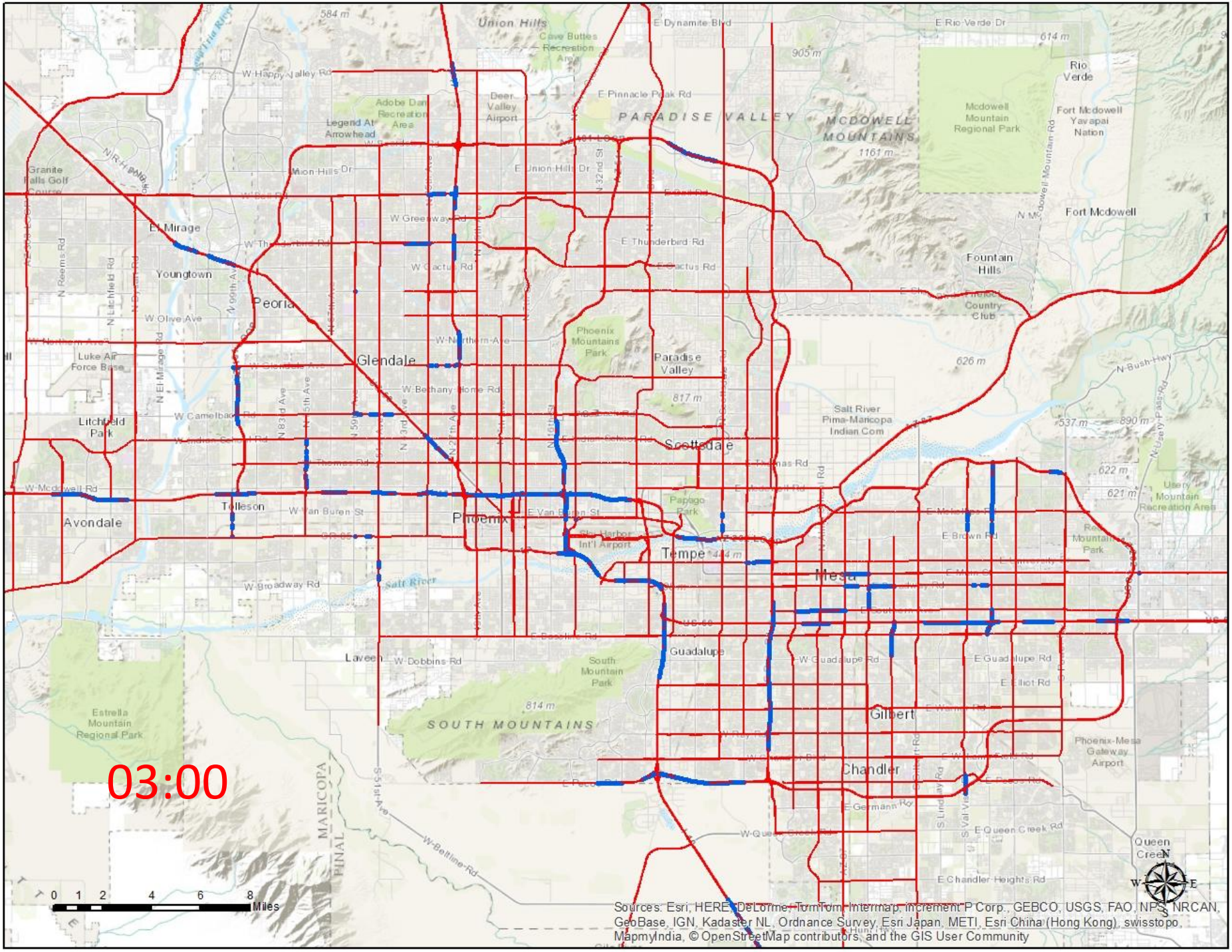
NPMRDS Data Completeness




00:00
Union Hills
Cave Buttes Recreation Area
E Dynamite Blvd
E Rio Verde Dr
Rio Verde
W Happy Valley Rd
Adobe Dam Recreation Area
Legend At Arrowhead
Deer Valley Airport
E Pinnacle Peak Rd
PARADISE VALLEY
MCDOWELL MOUNTAINS
Mcdowell Mountain Regional Park
Fort Mcdowell Yavapai Nation
Granite Falls Golf Course
Union Hills Dr
E Union Hills Dr
Fort Mcdowell
El Mirage
W Greenway Rd
E Thunderbird Rd
Fountain Hills
Youngtown
W Cactus Rd
E Cactus Rd
Peoria
W Olive Ave
Phoenix Mountains Park
Luke Air Force Base
Glendale
Paradise Valley
W Bethany Home Rd
Salt River Pima-Maricopa Indian Com
Litchfield Park
W Camelback Rd
Scottsdale
Thomas Rd
W Mcdowell Rd
Tolleson
W Van Buren St
Phoenix
E Van Buren St
Papago Park
Avondale
Sky Harbor Int'l Airport
Tempe
Usery Mountain Recreation Area
Mesa
W Broadway Rd
Salt River
Laveen
W Dobbins Rd
South Mountain Park
Guadalupe
E Guadalupe Rd
Estrella Mountain Regional Park
SOUTH MOUNTAINS
Gilbert
Phoenix-Mesa Gateway Airport
Chandler
MARICOPA
PINAL
W Queen Creek Rd
E Queen Creek Rd
Queen Creek
E Chandler Heights Rd
W Beltline Rd
0 1 2 4 6 8 Miles
Sources: Esri, HERE, DeLorme, TomTom, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community


01:00
Union Hills
Cave Buttes Recreation Area
E Dynamite Blvd
E Rio Verde Dr
Rio Verde
W Happy Valley Rd
Adobe Dam Recreation Area
Legend At Arrowhead
Deer Valley Airport
E Pinnacle Peak Rd
PARADISE VALLEY
McDOWELL MOUNTAINS
Mcdowell Mountain Regional Park
Fort Mcdowell Yavapai Nation
Granite Falls Golf Course
Union Hills Dr
E Mirage
W Greenway Rd
E Thunderbird Rd
Fort Mcdowell
Fountain Hills
Youngtown
W Cactus Rd
E Cactus Rd
Peoria
W Olive Ave
Phoenix Mountains Park
Paradise Valley
Luke Air Force Base
Glendale
W Bethany Home Rd
Litchfield Park
W Camelback Rd
Salt River Pima-Maricopa Indian Com
Scottsdale
Thomas Rd
W Mcdowell Rd
Tolleson
Avondale
W Van Buren St
Phoenix
E Van Buren St
Papago Park
Sky Harbor Int'l Airport
Tempe
Usery Mountain Recreation Area
E Brown Rd
Mesa
W Broadway Rd
Salt River
Laveen
W Dobbins Rd
South Mountain Park
Guadalupe
E Guadalupe Rd
E Elliot Rd
Estrella Mountain Regional Park
SOUTH MOUNTAINS
Gilbert
Phoenix-Mesa Gateway Airport
Chandler
MARICOPA
PINAL
W Beltline Rd
E Germann Rd
E Queen Creek Rd
Queen Creek
E Chandler Heights Rd
0 1 2 4 6 8 Miles
Sources: Esri, HERE, DeLorme, TomTom, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community


02:00
Union Hills
Cave Buttes Recreation Area
E Dynamite Blvd
E Rio Verde Dr
Rio Verde
W Happy Valley Rd
Adobe Dam Recreation Area
Deer Valley Airport
E Pinnacle Peak Rd
PARADISE VALLEY
MCDOWELL MOUNTAINS
Mcdowell Mountain Regional Park
Fort Mcdowell Yavapai Nation
Legend At Arrowhead
Granite Falls Golf Course
Union Hills Dr
E Union Hills Dr
Fort Mcdowell
El Mirage
W Greenway Rd
E Thunderbird Rd
Youngtown
W Cactus Rd
E Cactus Rd
Fountain Hills
Peoria
W Olive Ave
W Northern Ave
Phoenix Mountains Park
Paradise Valley
Luke Air Force Base
Glendale
W Bethany Home Rd
Litchfield Park
W Camelback Rd
Salt River Pima-Maricopa Indian Com
Scottsdale
Thomas Rd
W Mcdowell Rd
Tolleson
W Van Buren St
Phoenix
E Van Buren St
Papago Park
Avondale
Sky Harbor Int'l Airport
Tempe
E Brown Rd
Usery Mountain Recreation Area
Mesa
W Broadway Rd
Salt River
Guadalupe
Laveen
W Dobbins Rd
South Mountain Park
E Guadalupe Rd
E Elliot Rd
Estrella Mountain Regional Park
SOUTH MOUNTAINS
Gilbert
Phoenix-Mesa Gateway Airport
Chandler
MARICOPA
PINAL
W Beltline Rd
E Germann Rd
E Queen Creek Rd
Queen Creek
E Chandler Heights Rd
0 1 2 4 6 8 Miles
Sources: Esri, HERE, DeLorme, TomTom, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community


03:00
Union Hills
Cave Buttes Recreation Area
E Dynamite Blvd
E Rio Verde Dr
Rio Verde
W Happy Valley Rd
Adobe Dam Recreation Area
Legend At Arrowhead
Deer Valley Airport
E Pinnacle Peak Rd
PARADISE VALLEY
MCDOWELL MOUNTAINS
Mcdowell Mountain Regional Park
Fort Mcdowell Yavapai Nation
Granite Falls Golf Course
Union Hills Dr
E Union Hills Dr
Fort Mcdowell
W Greenway Rd
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Youngtown
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Peoria
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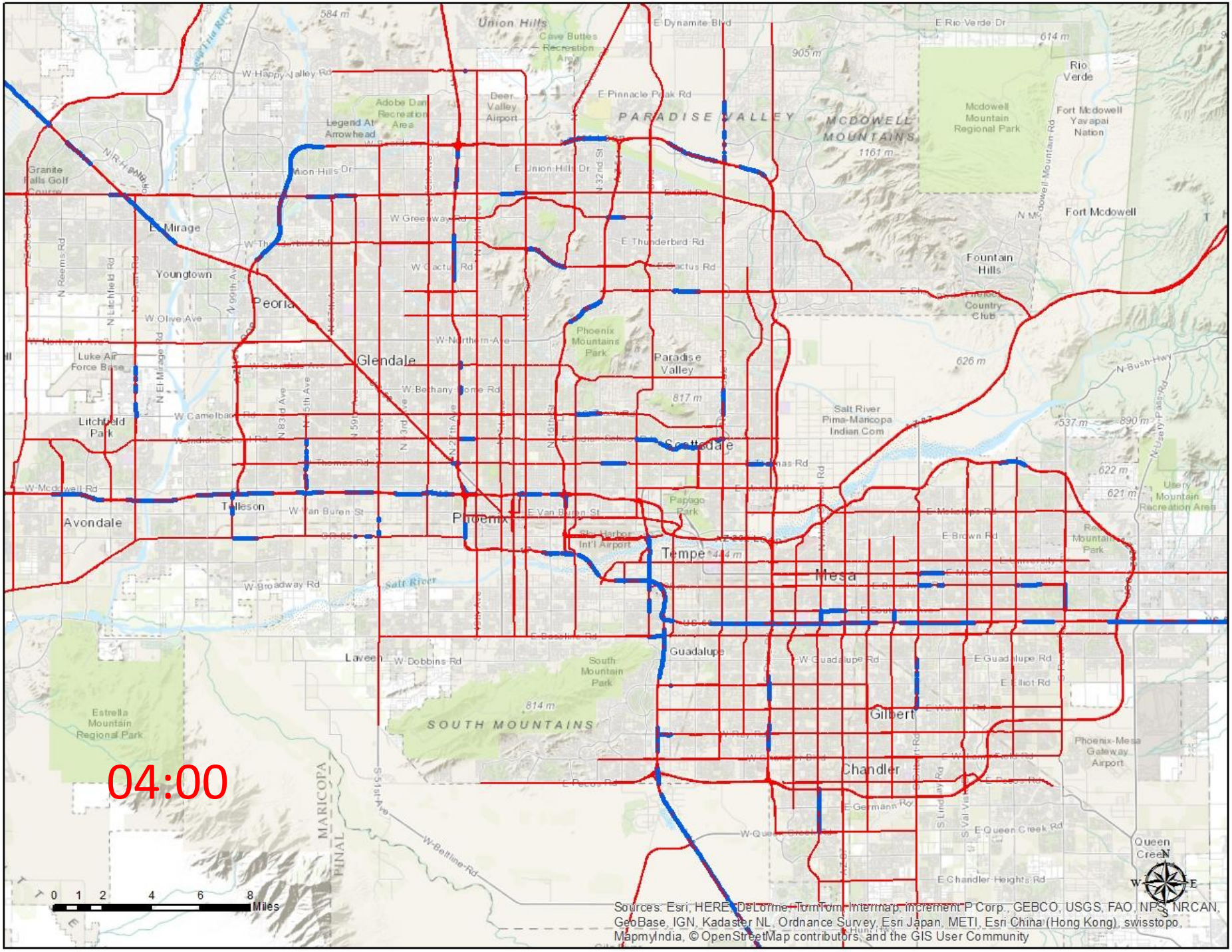
Phoenix Mountains Park
W Northern Ave
Glendale
Paradise Valley
Luke Air Force Base
W Bethany Home Rd
Salt River Pima-Maricopa Indian Com
Litchfield Park
W Camelback Rd
Scottsdale
Thomas Rd
W Mcdowell Rd
Tolleson
W Van Buren St
Phoenix
E Van Buren St
Papago Park
Avondale
Sky Harbor Int'l Airport
Tempe
E Brown Rd
Usery Mountain Recreation Area
Mesa
W Broadway Rd
Salt River
Guadalupe
Laveen
W Dobbins Rd
South Mountain Park
W Guadalupe Rd
E Guadalupe Rd
E Elliot Rd
Estrella Mountain Regional Park
SOUTH MOUNTAINS
Gilbert
Phoenix-Mesa Gateway Airport
Chandler
MARICOPA
PINAL
W Beltline Rd
E Germann Rd
E Queen Creek Rd
Queen Creek
E Chandler Heights Rd
0 1 2 4 6 8 Miles
Sources: Esri, HERE, DeLorme, TomTom, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community


04:00
Union Hills
Cave Buttes Recreation Area
E Dynamite Blvd
E Rio Verde Dr
Rio Verde
W Happy Valley Rd
Adobe Dam Recreation Area
Legend At Arrowhead
Deer Valley Airport
E Pinnacle Peak Rd
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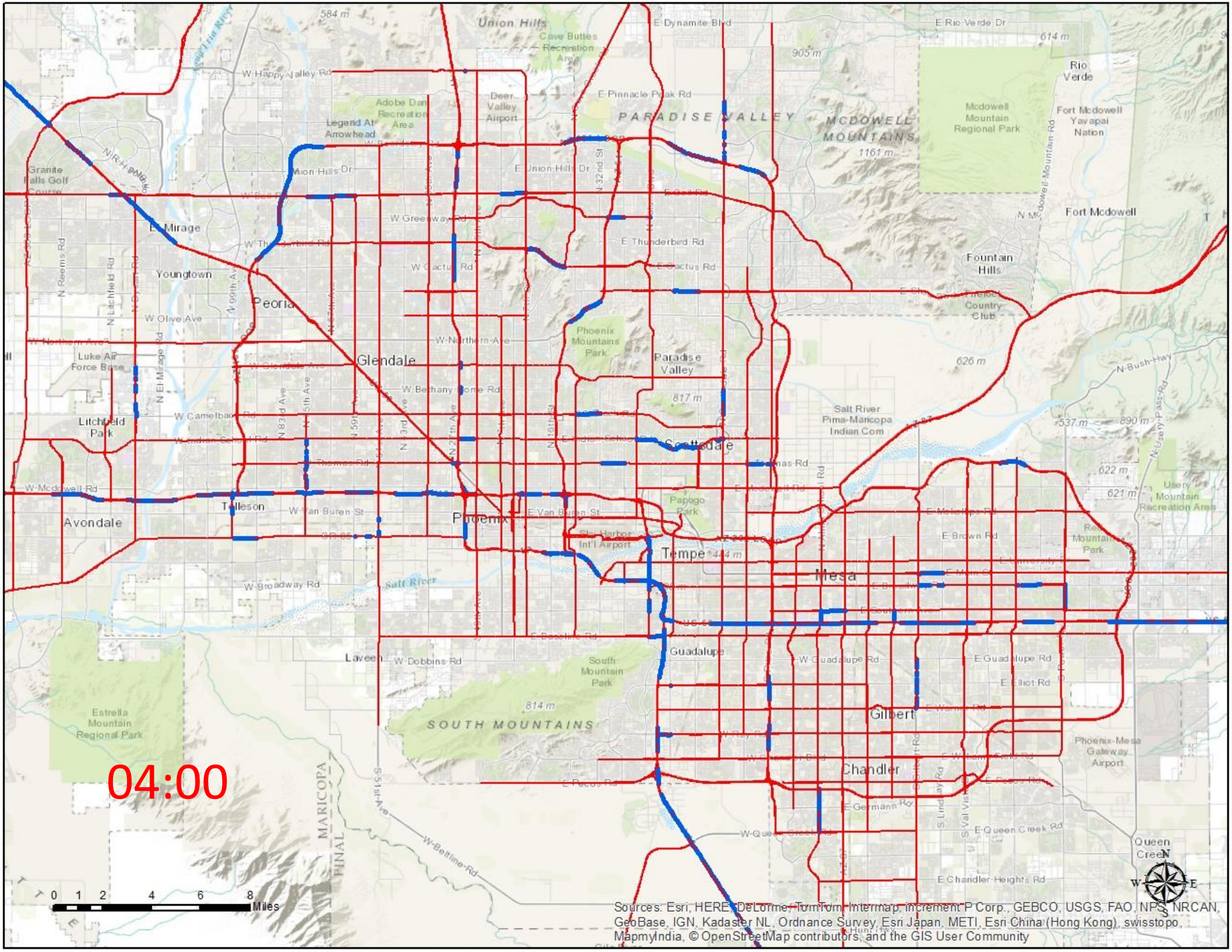
04:00
Union Hills
Cave Buttes Recreation Area
E Dynamite Blvd
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Rio Verde
W Happy Valley Rd
Adobe Dam Recreation Area
Legend At Arrowhead
Deer Valley Airport
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E Thunderbird Rd
Fountain Hills
Youngtown
W Cactus Rd
E Cactus Rd
Peoria
W Olive Ave
Phoenix Mountains Park
W Northern Ave
Luke Air Force Base
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Paradise Valley
W Bethany Home Rd
Salt River Pima-Maricopa Indian Com
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W Thomas Rd
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Phoenix
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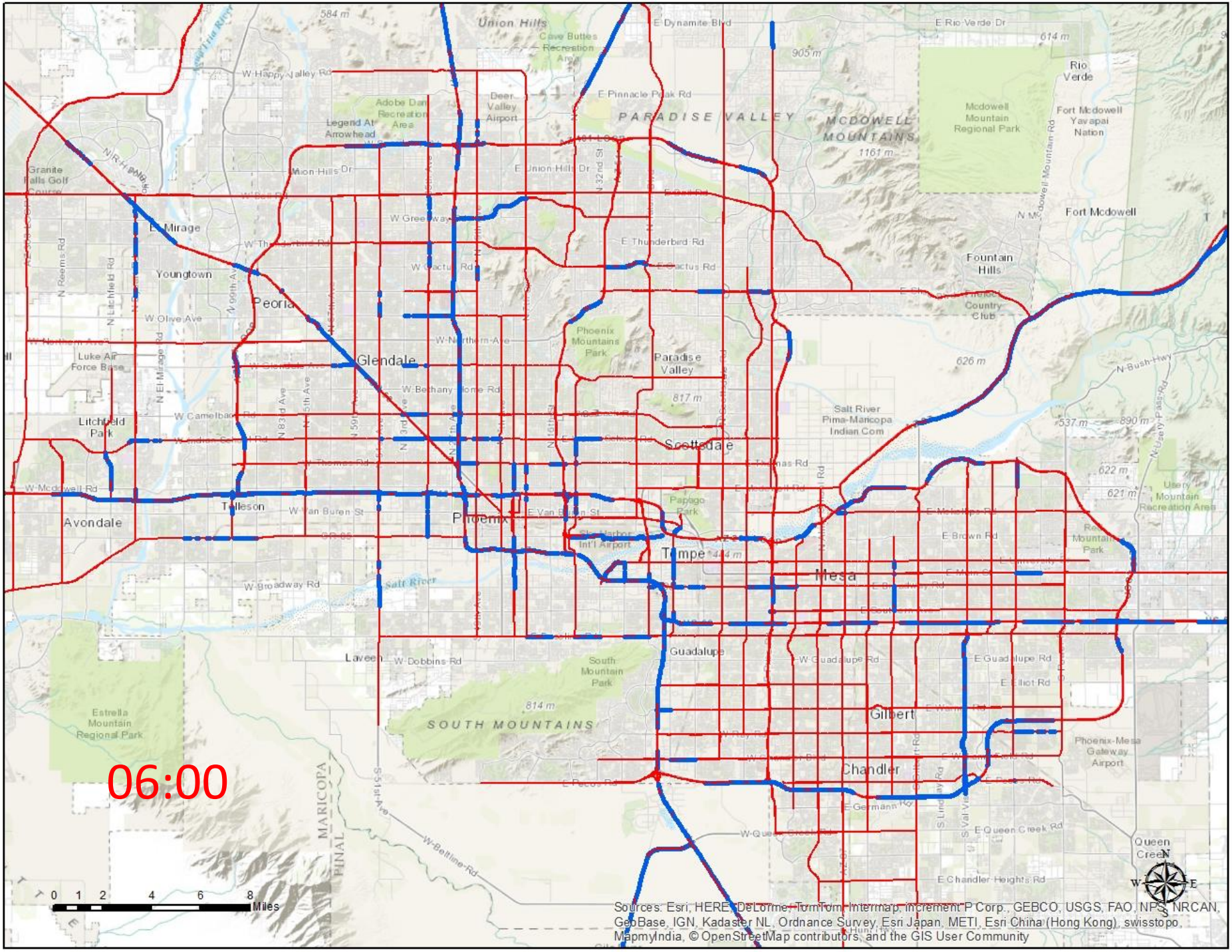
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Union Hills
Cave Buttes Recreation Area
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Rio Verde
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Adobe Dam Recreation Area
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E Cactus Rd
Fountain Hills
Peoria
W Olive Ave
Country Club
Phoenix Mountains Park
W Northern Ave
Glendale
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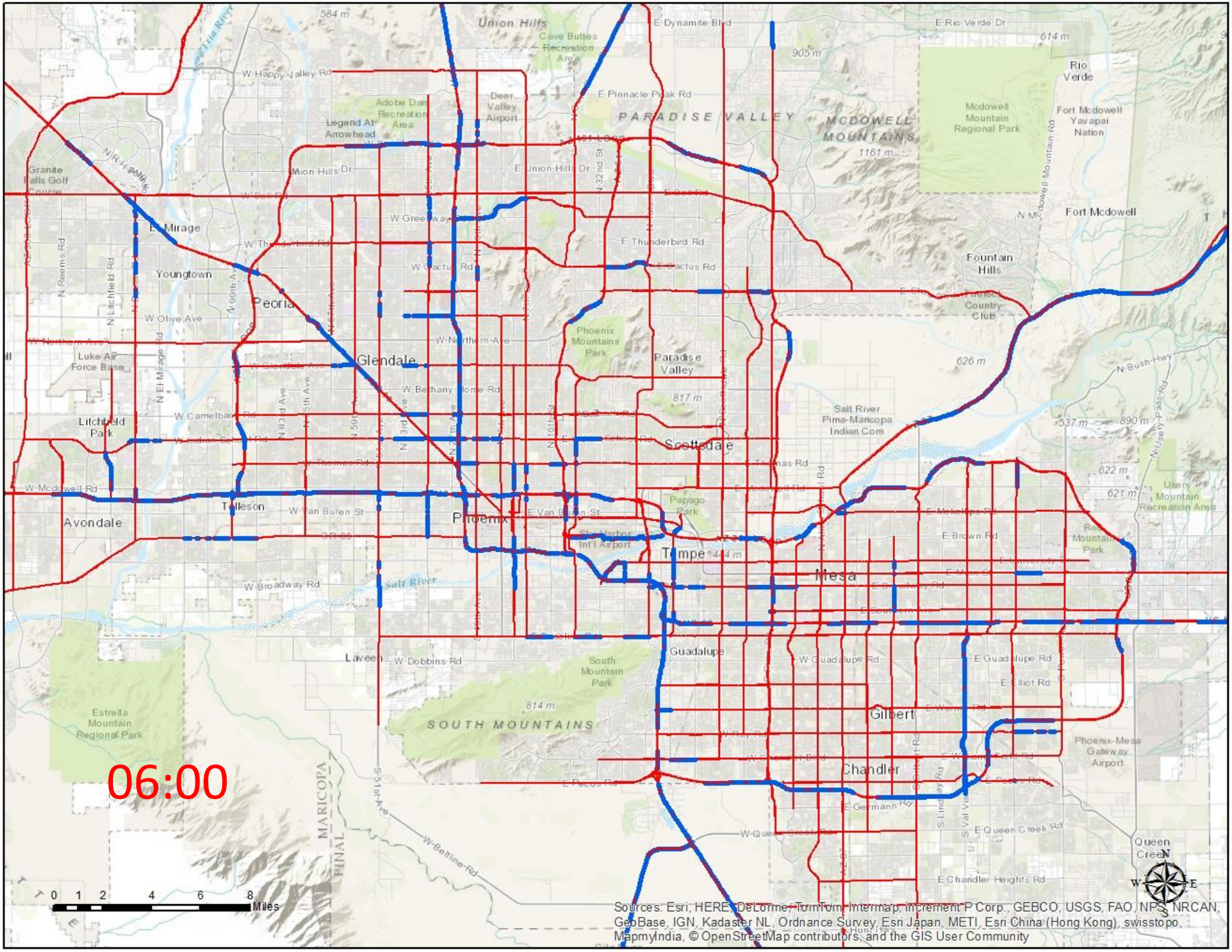
Sources: Esri, HERE, DeLorme, TomTom, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community


06:00
Union Hills
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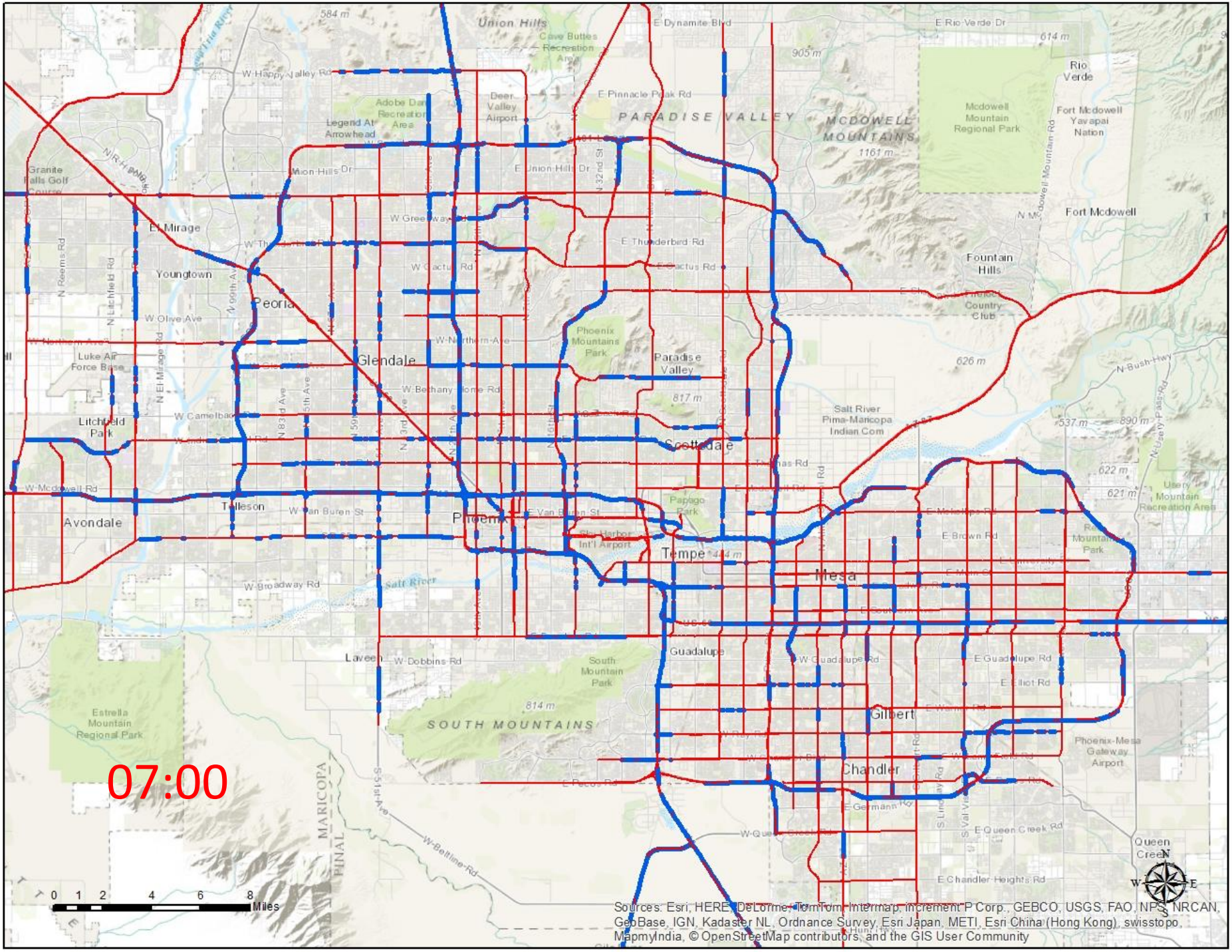
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Union Hills
Cave Buttes Recreation Area
E Dynamite Blvd
E Rio Verde Dr
Rio Verde
W Happy Valley Rd
Adobe Dam Recreation Area
Legend At Arrowhead
Deer Valley Airport
E Pinnacle Peak Rd
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Tolleson
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MARICOPA
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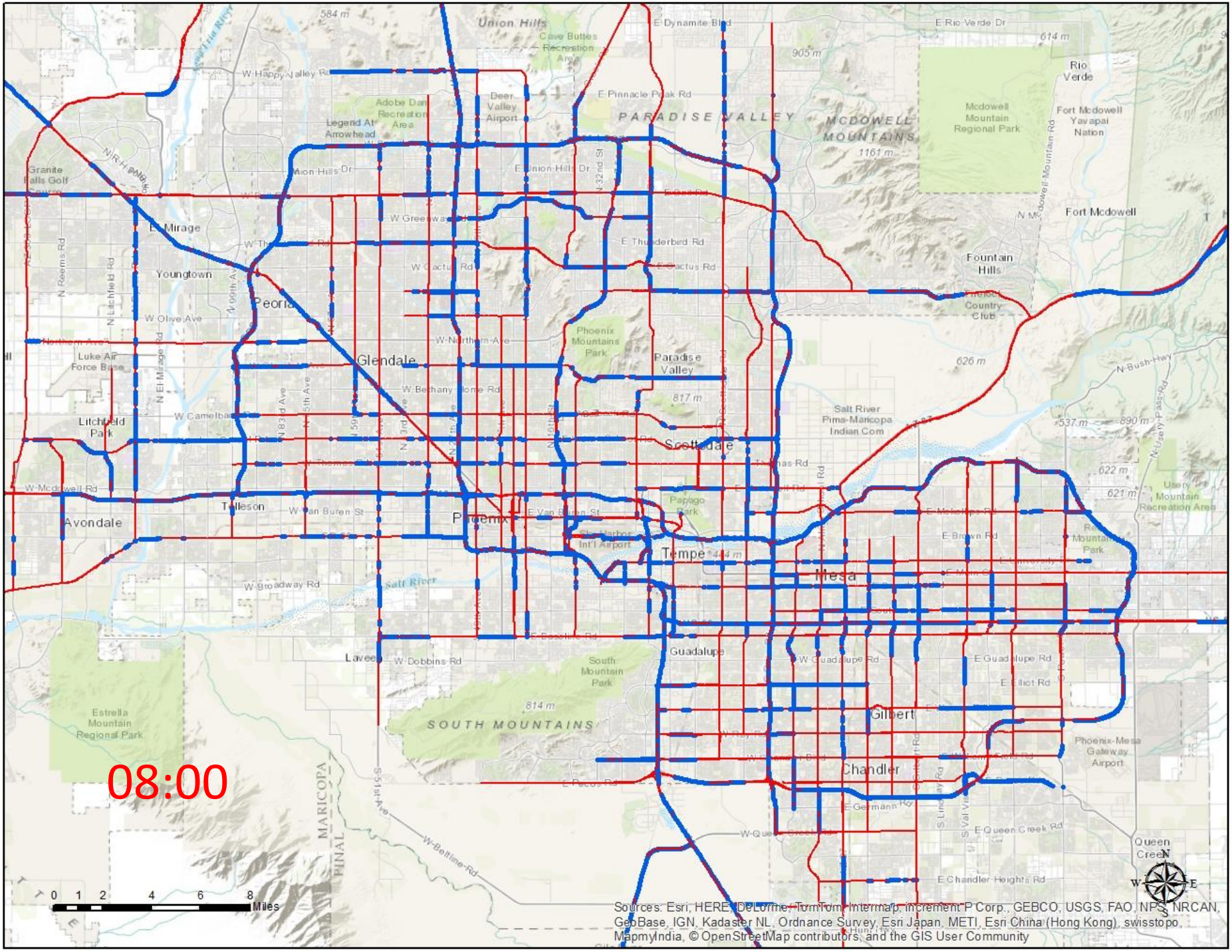
W Beltline Rd
E Germann Rd
E Queen Creek Rd
Queen Creek
E Chandler Heights Rd
0 1 2 4 6 8 Miles
Sources: Esri, HERE, DeLorme, TomTom, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community


08:00
Union Hills
Cave Buttes Recreation Area
E Dynamite Blvd
E Rio Verde Dr
Rio Verde
W Happy Valley Rd
Adobe Dam Recreation Area
Deer Valley Airport
E Pinnacle Peak Rd
PARADISE VALLEY
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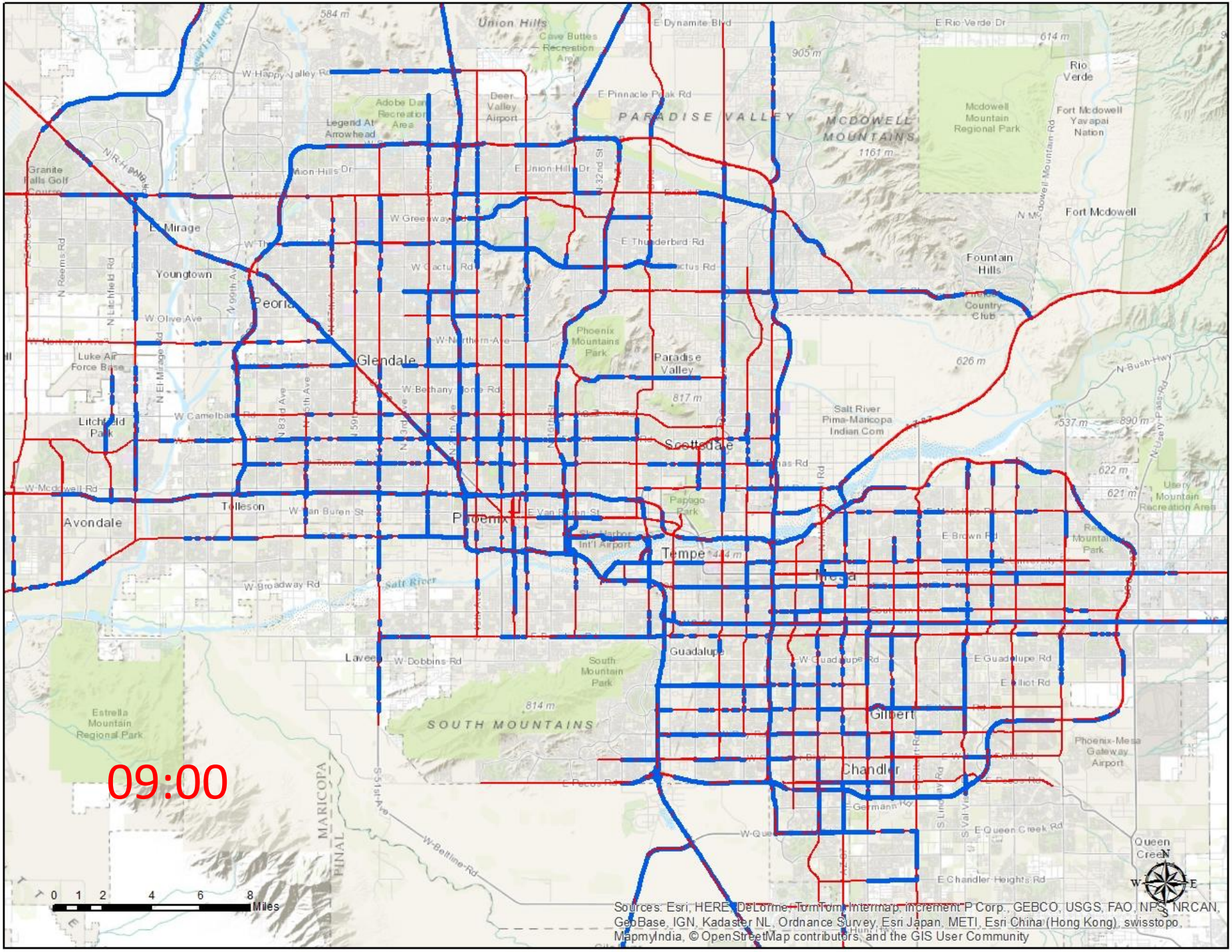
E Chandler Heights Rd
0 1 2 4 6 8 Miles
Sources: Esri, HERE, DeLorme, TomTom, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community


09:00
Union Hills
Cave Buttes Recreation Area
E Dynamite Blvd
E Rio Verde Dr
584 m
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Rio Verde
W Happy Valley Rd
Adobe Dam Recreation Area
Legend At Arrowhead
Deer Valley Airport
E Pinnacle Peak Rd
PARADISE VALLEY
McDOWELL MOUNTAINS
1161 m
Mcdowell Mountain Regional Park
Fort Mcdowell Yavapai Nation
Granite Falls Golf Course
E Union Hills Dr
N 32nd St
Fort Mcdowell
El Mirage
W Greenway Rd
E Thunderbird Rd
Fountain Hills
Youngtown
W Cactus Rd
Country Club
Peoria
W Olive Ave
W Northern Ave
Phoenix Mountains Park
Luke Air Force Base
Glendale
Paradise Valley
626 m
N Bush Hwy
W Bethany Home Rd
817 m
Salt River Pima-Maricopa Indian Com
537 m
890 m
Litchfield Park
W Camelback Rd
Scottsdale
622 m
621 m
W Mcdowell Rd
Usery Mountain Recreation Area
Tolleson
W Van Buren St
Papago Park
Avondale
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Sky Harbor Int'l Airport
Tempe
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South Mountain Park
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E Elliot Rd
814 m
Estrella Mountain Regional Park
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Phoenix-Mesa Gateway Airport
Chandler
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E Queen Creek Rd
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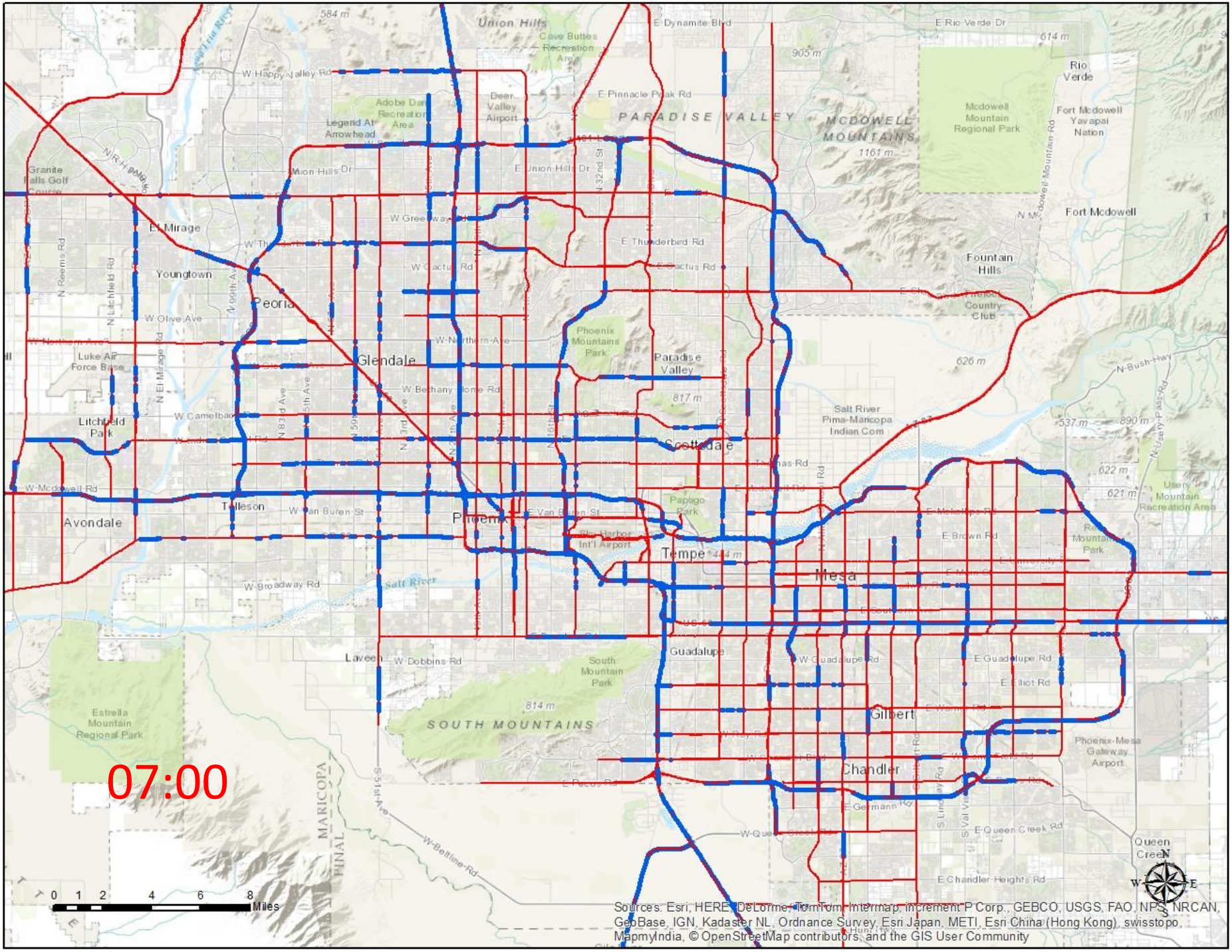
Sources: Esri, HERE, DeLorme, TomTom, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community


07:00
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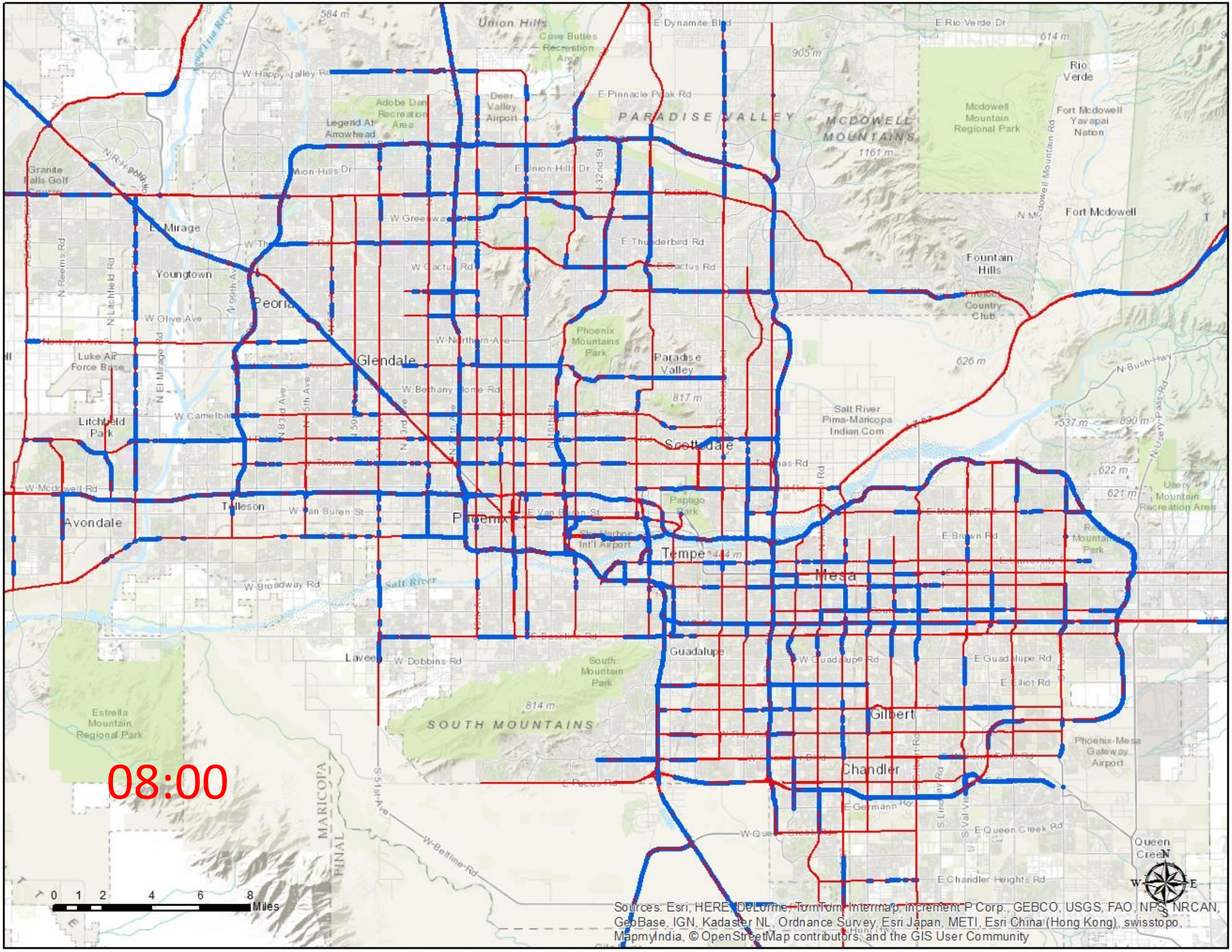
08:00
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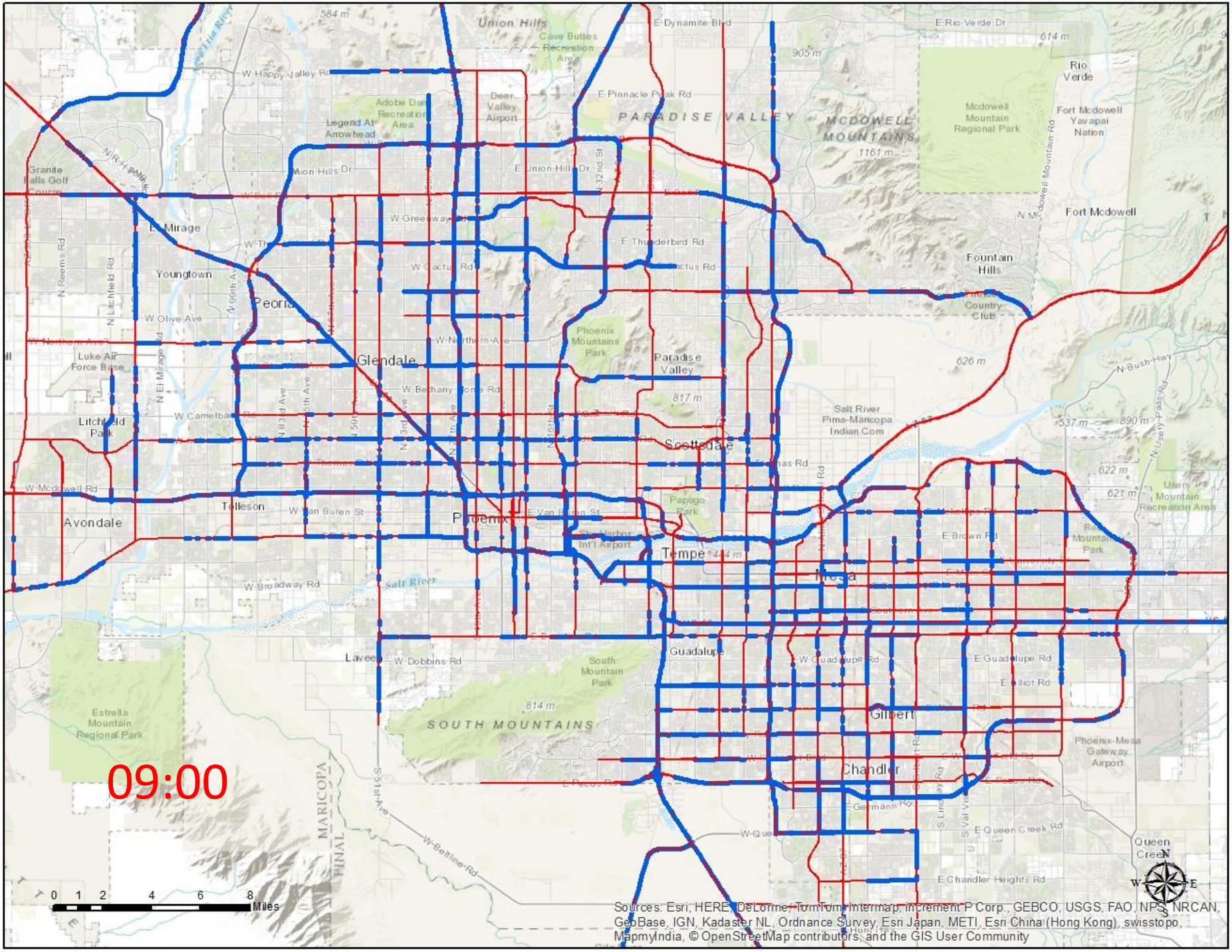
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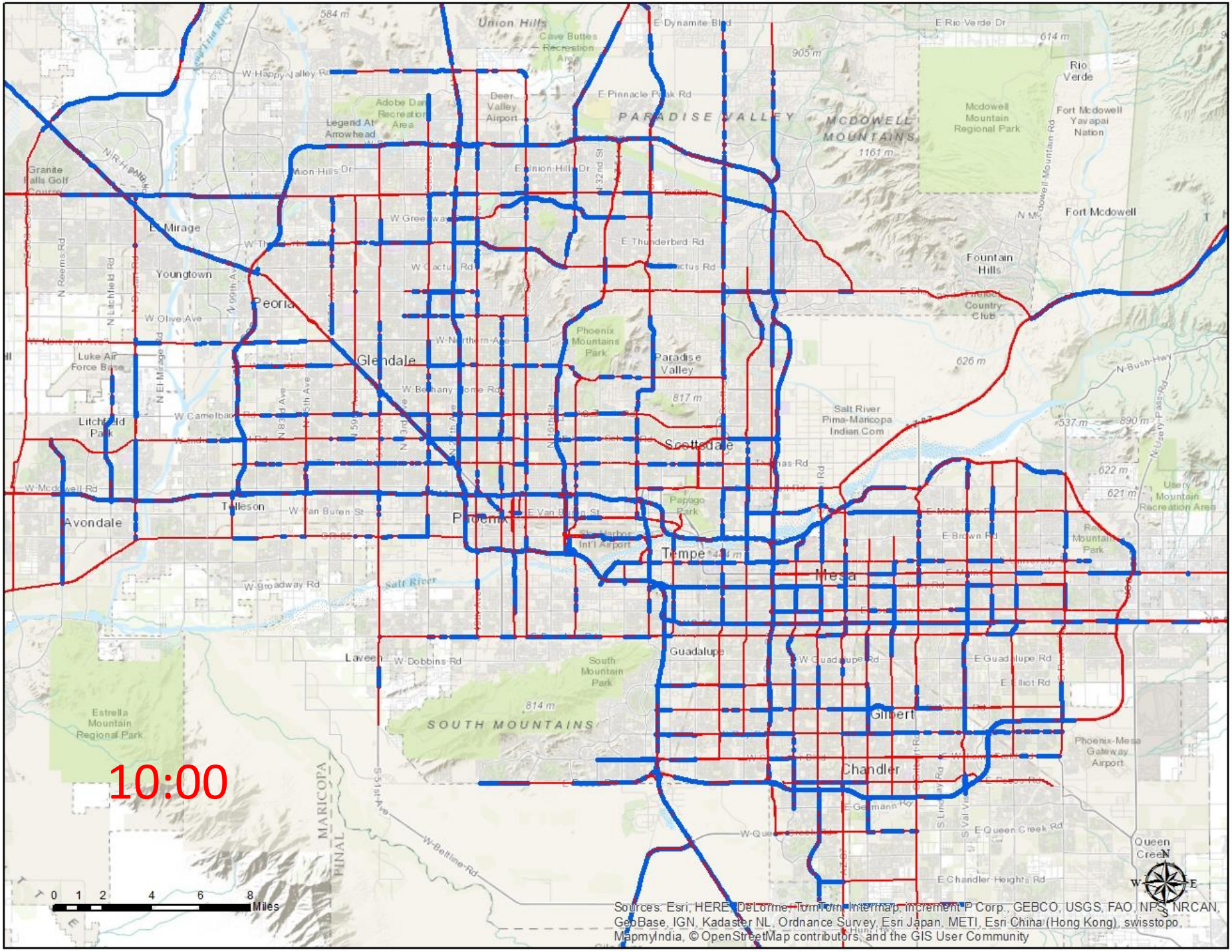
10:00
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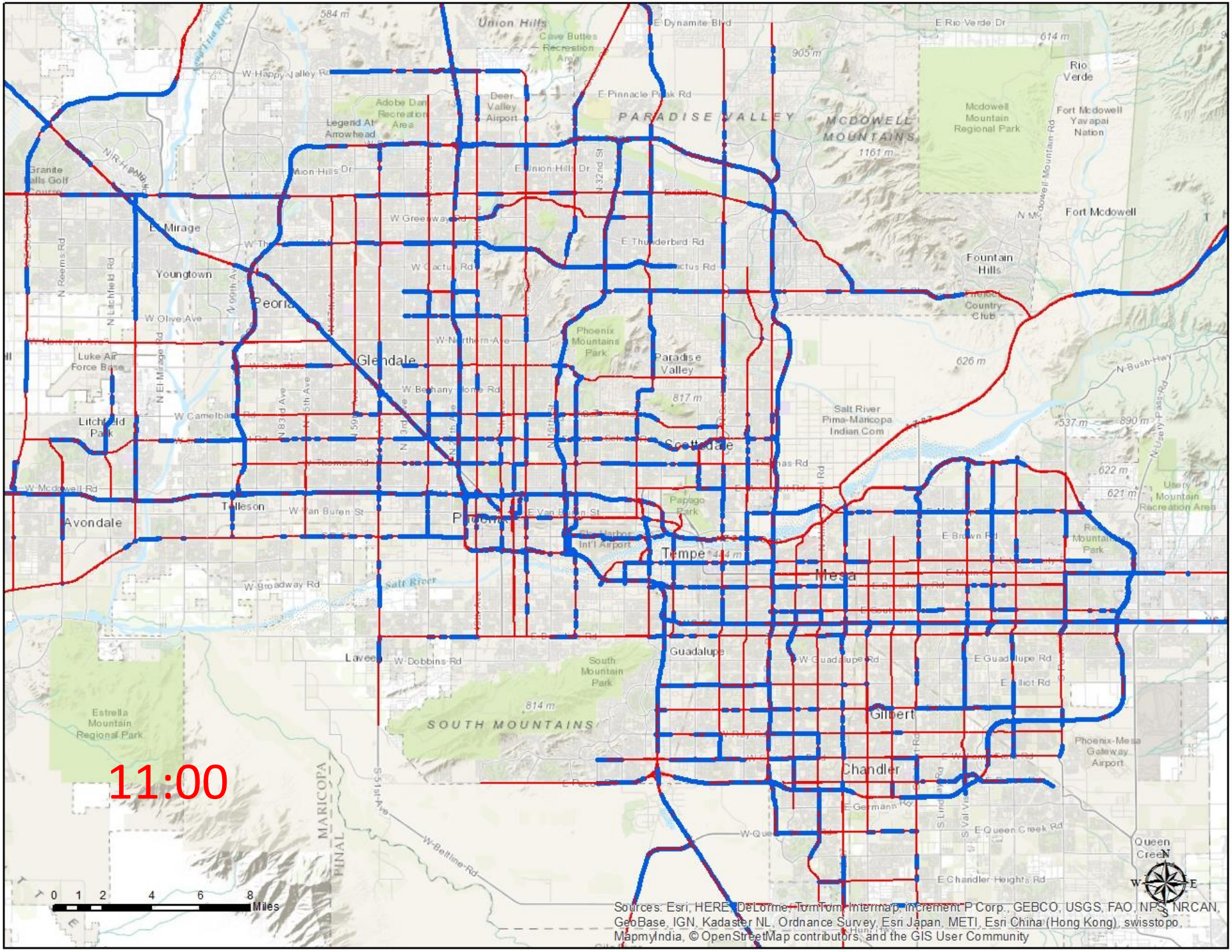
11:00
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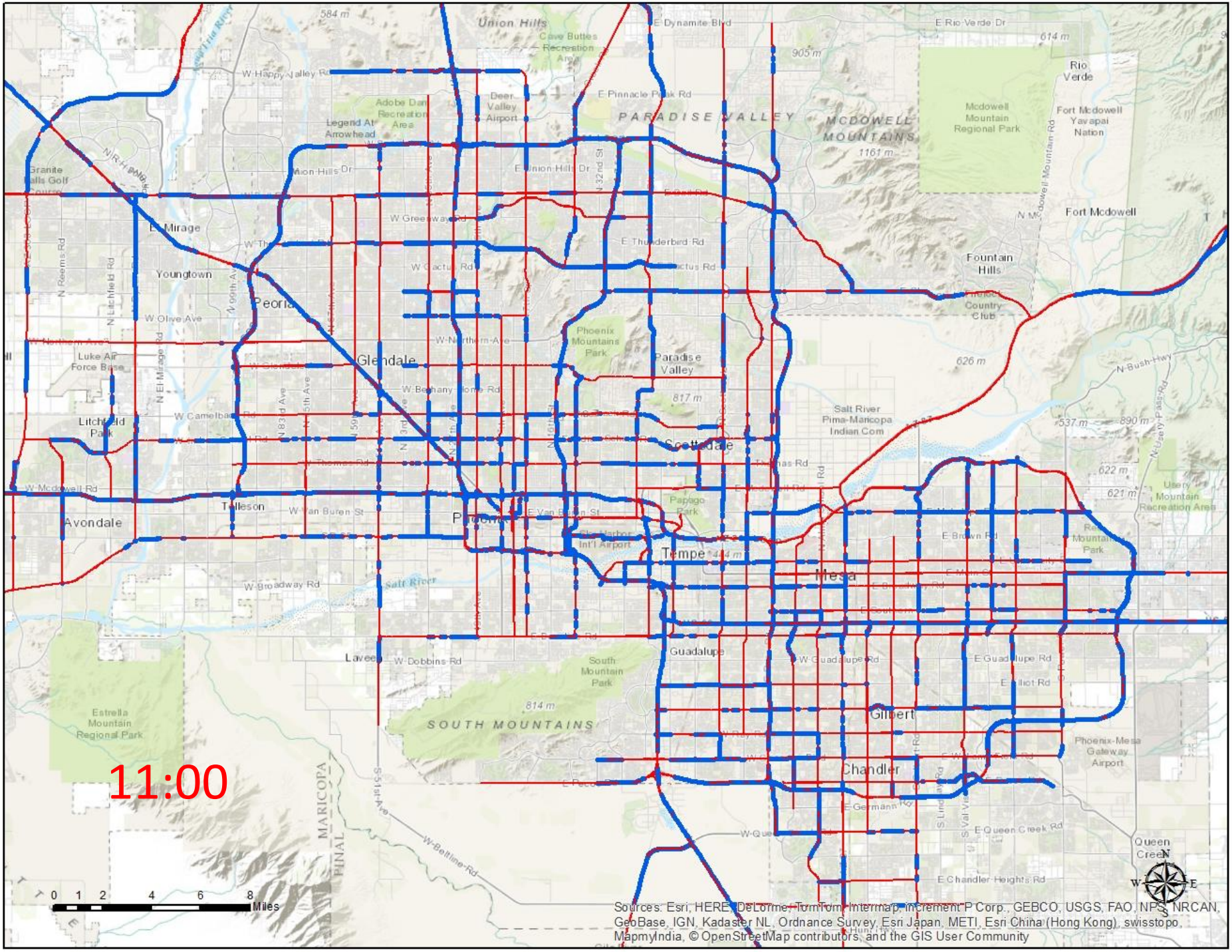
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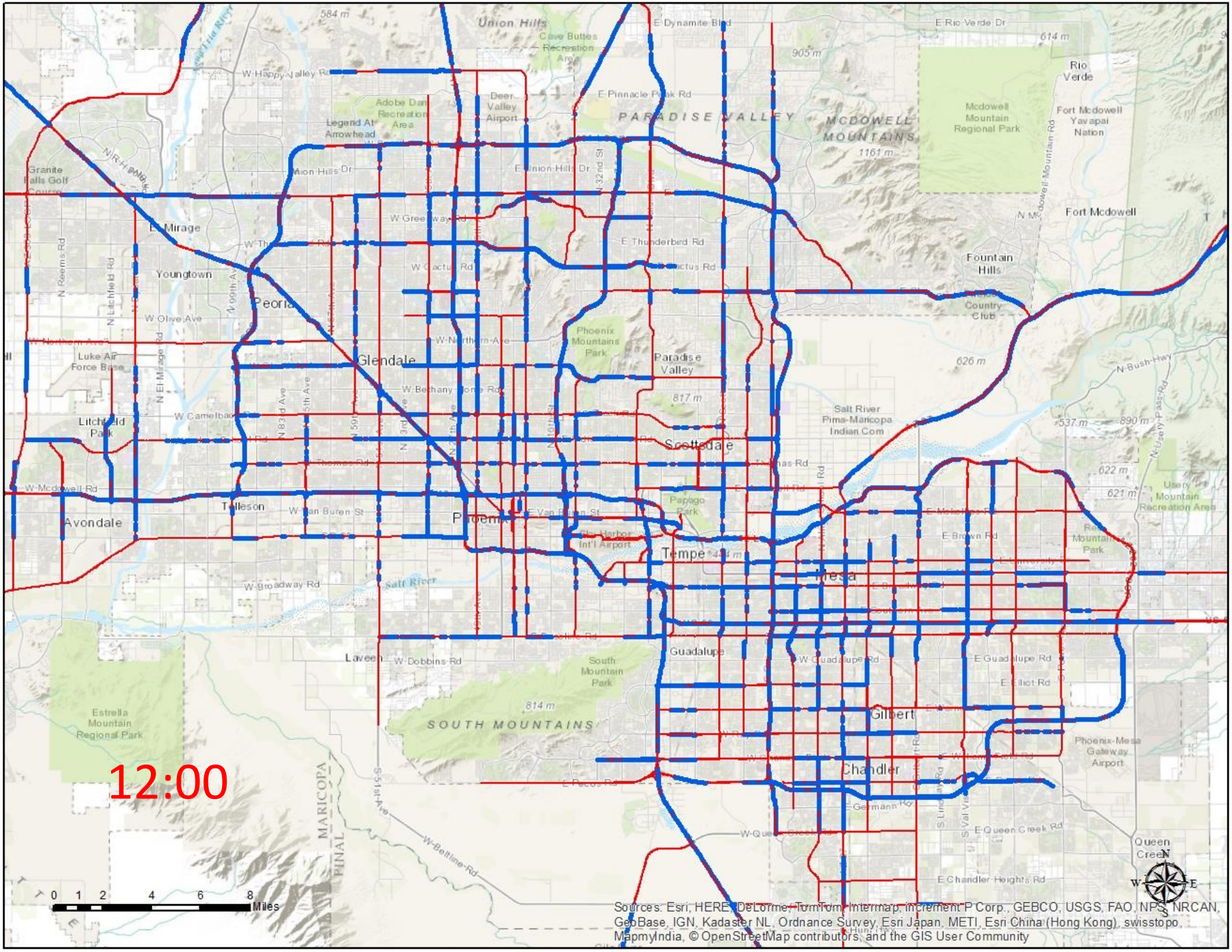
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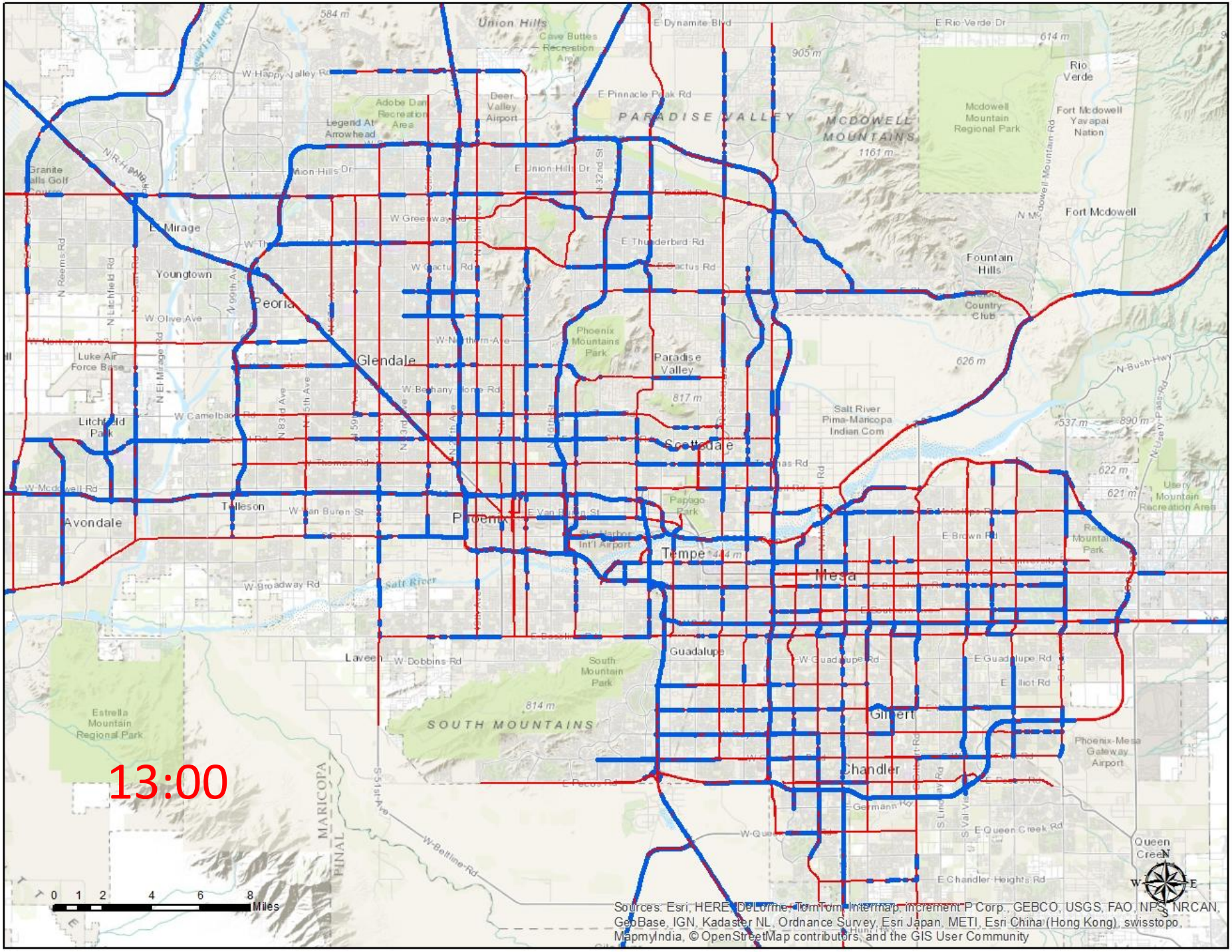
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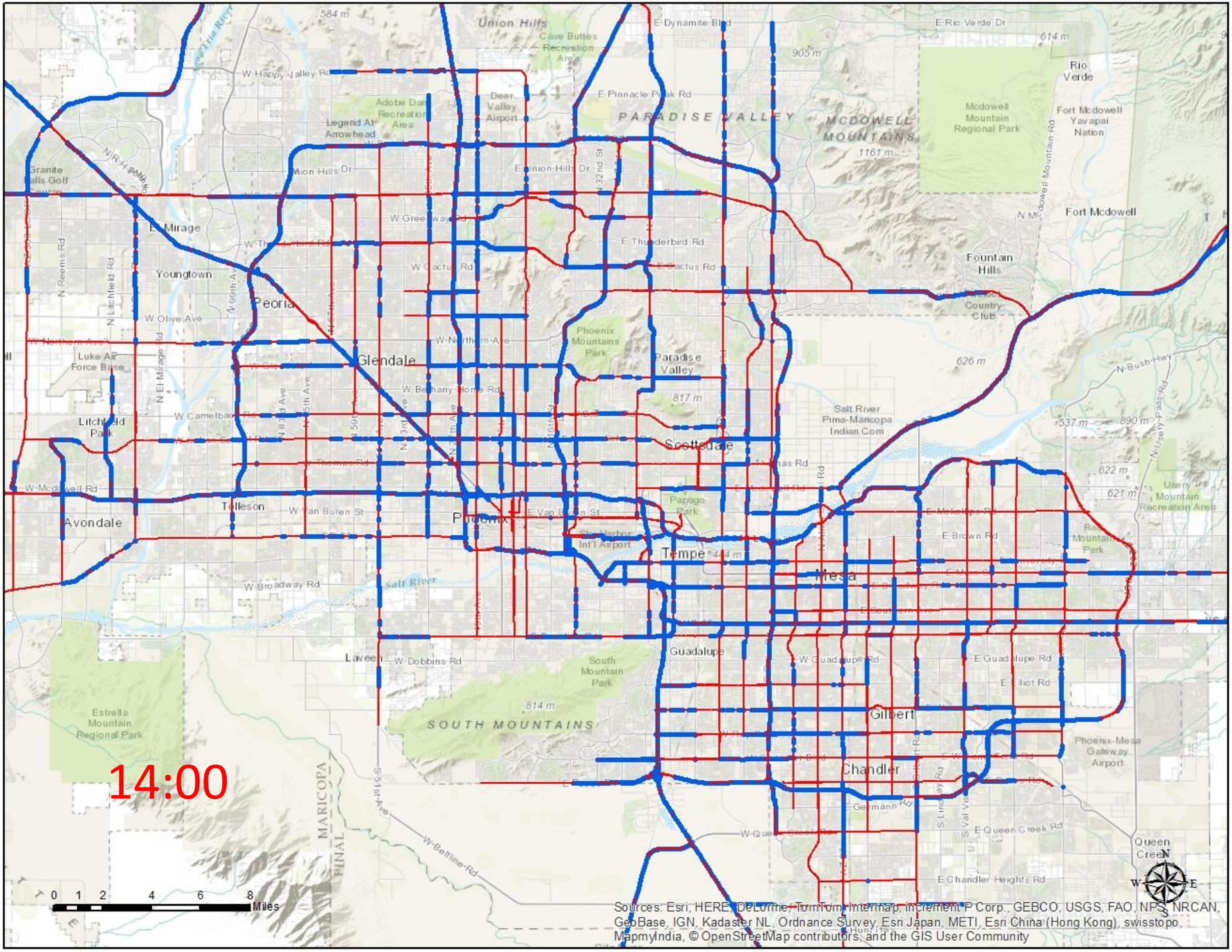
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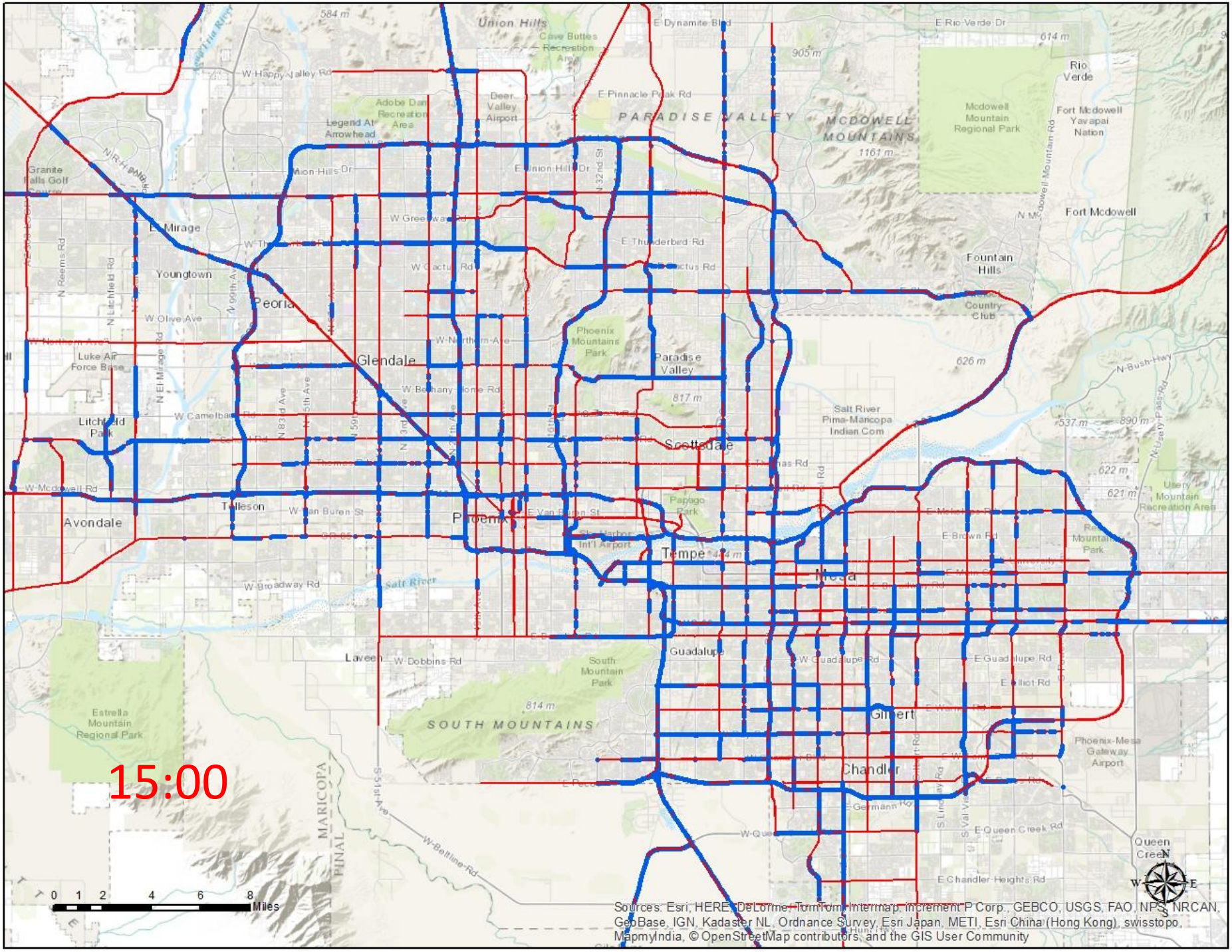
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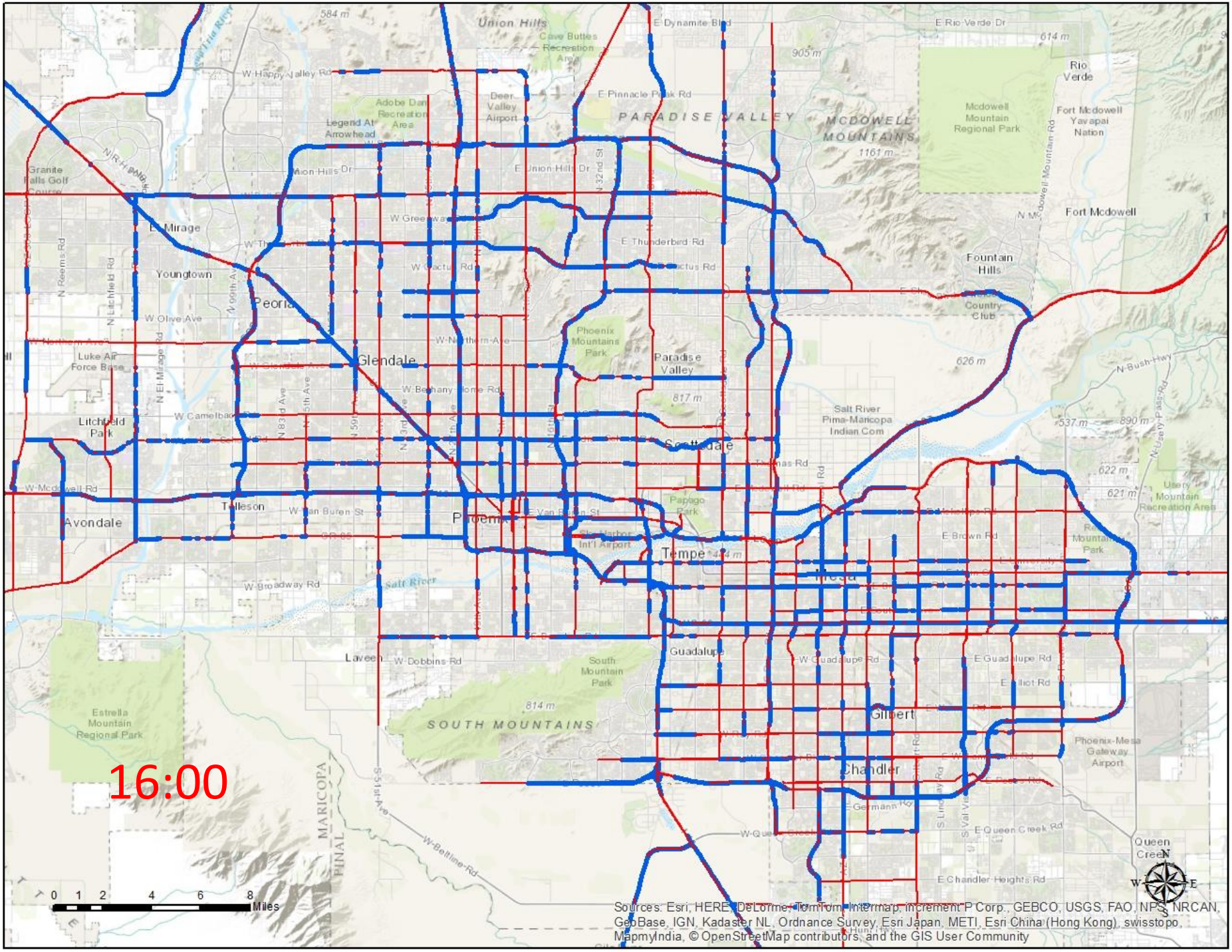
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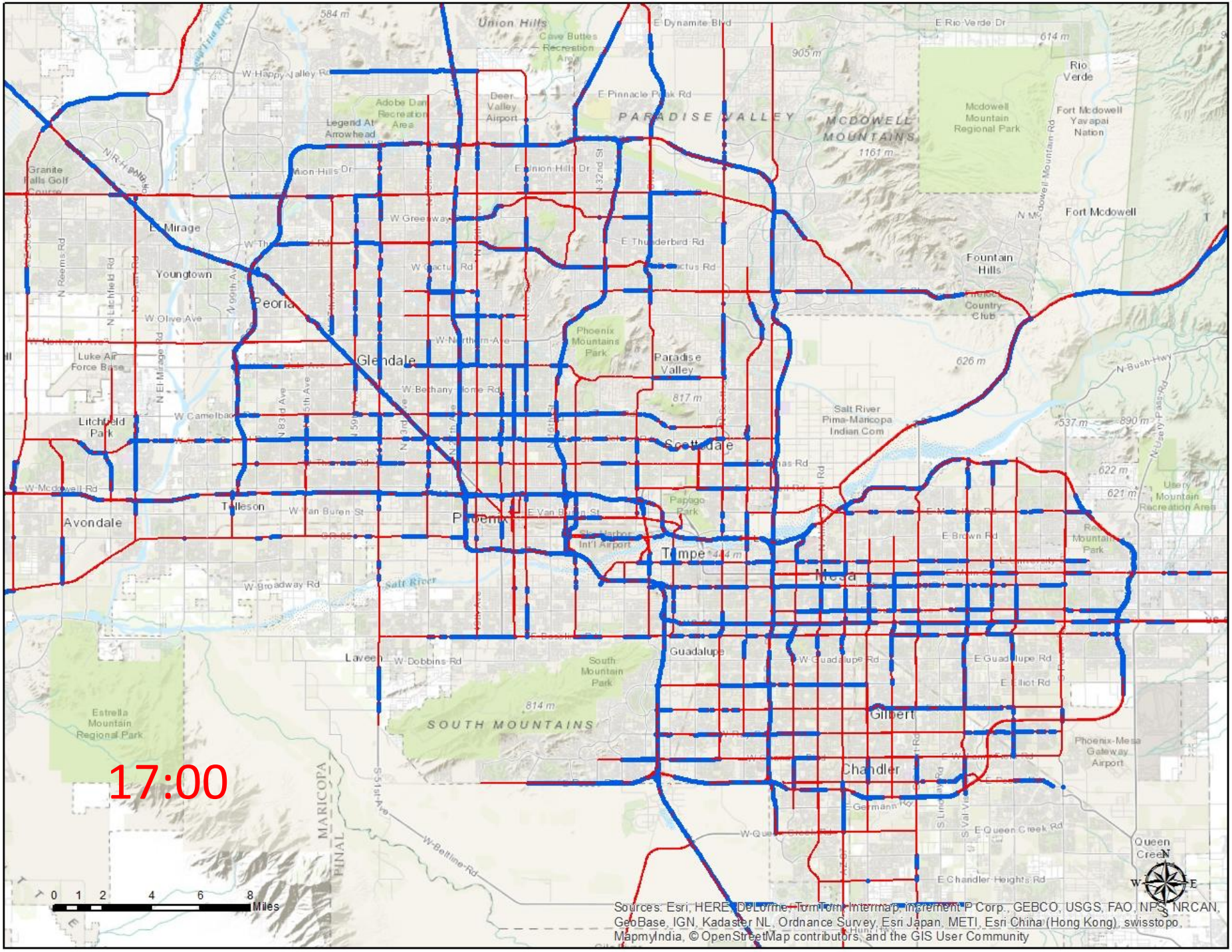
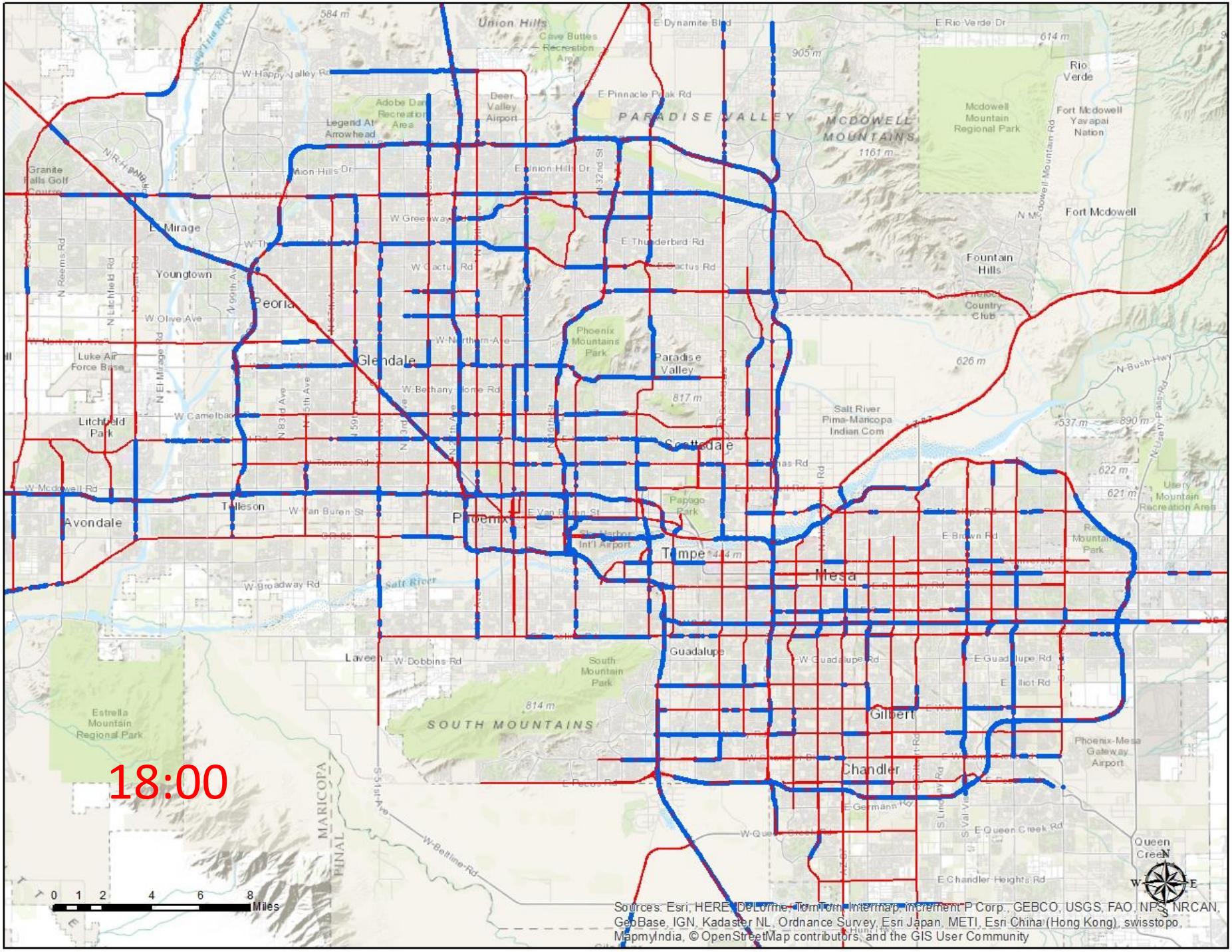
Queen Creek
E Chandler Heights Rd
0 1 2 4 6 8 Miles
Sources: Esri, HERE, DeLorme, TomTom, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community


17:00
Union Hills
Cave Buttes Recreation Area
E Dynamite Blvd
E Rio Verde Dr
584 m
614 m
905 m
W Happy Valley Rd
Adobe Dam Recreation Area
Deer Valley Airport
E Pinnacle Peak Rd
PARADISE VALLEY
McDOWELL MOUNTAINS
Rio Verde
Mcdowell Mountain Regional Park
Fort Mcdowell Yavapai Nation
Legend At Arrowhead
Granite Falls Golf Course
Union Hills Dr
E Union Hills Dr
N 32nd St
1161 m
Fort Mcdowell
W Greenway
E Mirage
W Thunderbird Rd
E Thunderbird Rd
Youngtown
W Cactus Rd
Cactus Rd
Fountain Hills
Peoria
W Olive Ave
Country Club
W Northern Ave
Phoenix Mountains Park
Luke Air Force Base
Glendale
Paradise Valley
626 m
W Bethany Home Rd
817 m
Salt River Pima-Maricopa Indian Com
Litchfield Park
W Camelback
Scottsdale
537 m
890 m
622 m
621 m
W Mcdowell Rd
Tolleson
W Van Buren St
Papago Park
Usery Mountain Recreation Area
Avondale
Phoenix
E Van Buren St
Sky Harbor Int'l Airport
E Brown Rd
Tempe
444 m
Mesa
W Broadway Rd
Salt River
Guadalupe
Laveen
W Dobbins Rd
South Mountain Park
W Guadalupe Rd
E Guadalupe Rd
E Elliot Rd
814 m
SOUTH MOUNTAINS
Gilbert
Estrella Mountain Regional Park
Phoenix-Mesa Gateway Airport
Chandler
MARICOPA
PINAL
S 51st Ave
W Beltline Rd
E Germann Rd
E Queen Creek Rd
Queen Creek
E Chandler Heights Rd
0 1 2 4 6 8 Miles
N
W
E
S
Sources: Esri, HERE, DeLorme, TomTom, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community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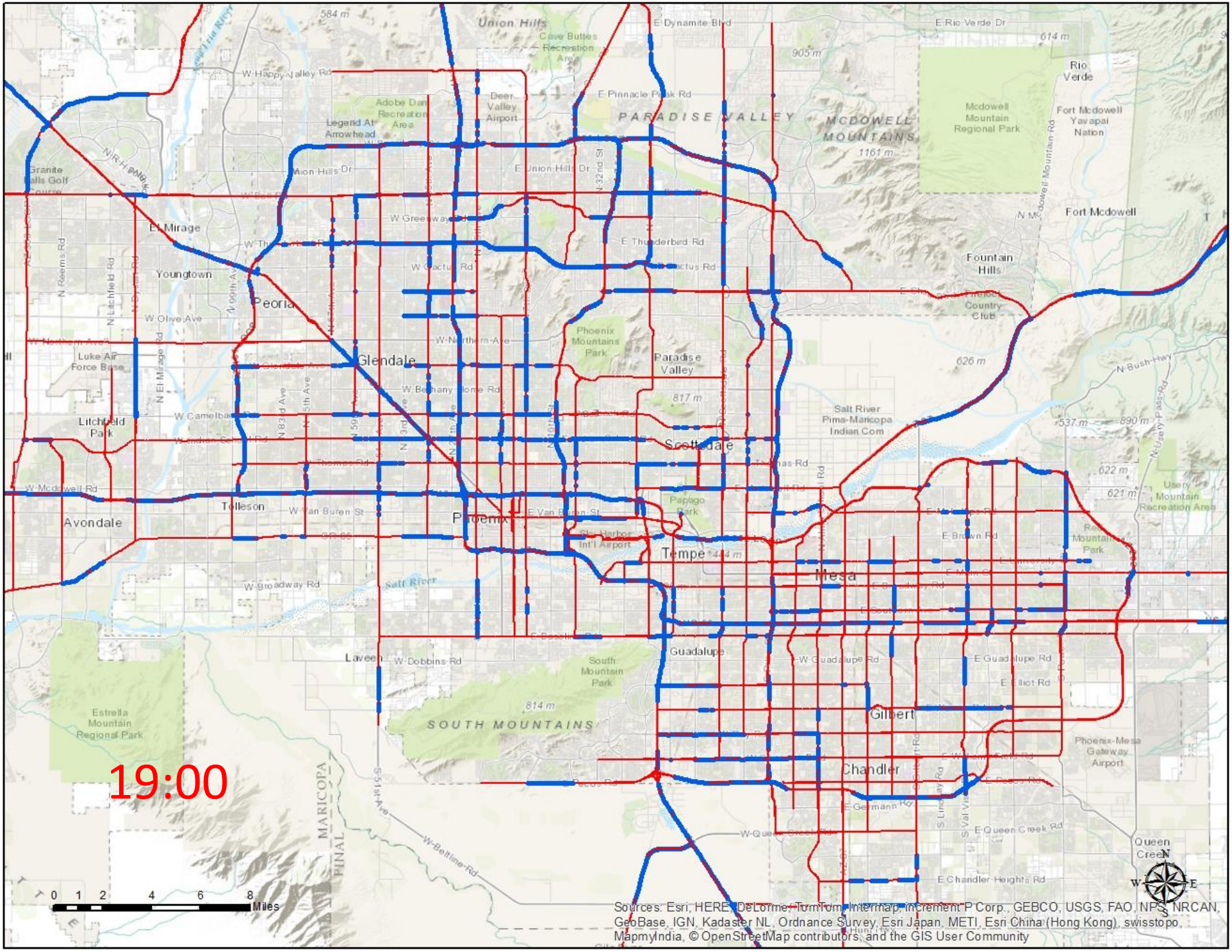
Union Hills
Cave Buttes Recreation Area
E Dynamite Blvd
E Rio Verde Dr
Rio Verde
W Happy Valley Rd
Adobe Dam Recreation Area
Legend At Arrowhead
Deer Valley Airport
E Pinnacle Peak Rd
PARADISE VALLEY
McDOWELL MOUNTAINS
Mcdowell Mountain Regional Park
Fort Mcdowell Yavapai Nation
Union Hills Dr
Granite Falls Golf Course
W Greenway Rd
Fort Mcdowell
El Mirage
E Thunderbird Rd
Fountain Hills
Youngtown
W Cactus Rd
E Cactus Rd
Peoria
W Olive Ave
Phoenix Mountains Park
W Northern Ave
Glendale
Paradise Valley
Luke Air Force Base
W Bethany Home Rd
Litchfield Park
W Camelback
Salt River Pima-Maricopa Indian Com
Scottsdale
W Mcdowell Rd
Tolleson
Avondale
W Van Buren St
Phoenix
E Van Buren St
Papago Park
Sky Harbor Int'l Airport
Tempe
Usery Mountain Recreation Area
E Brown Rd
Mesa
W Broadway Rd
Salt River
Laveen
W Dobbins Rd
South Mountain Park
Guadalupe
W Guadalupe Rd
E Guadalupe Rd
E Elliot Rd
Estrella Mountain Regional Park
SOUTH MOUNTAINS
Gilbert
Phoenix-Mesa Gateway Airport
Chandler
MARICOPA
PINAL
E Germann Rd
E Queen Creek Rd
Queen Creek
E Chandler Heights Rd
W Baseline Rd
0 1 2 4 6 8 Miles
Sources: Esri, HERE, DeLorme, TomTom, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community


19:00
Union Hills
Cave Buttes Recreation Area
E Dynamite Blvd
E Rio Verde Dr
Rio Verde
W Happy Valley Rd
Adobe Dam Recreation Area
Deer Valley Airport
E Pinnacle Peak Rd
PARADISE VALLEY
MCDOWELL MOUNTAINS
Mcdowell Mountain Regional Park
Fort Mcdowell Yavapai Nation
Legend At Arrowhead
Union Hills Dr
E Union Hills Dr
Granite Falls Golf Course
Fort Mcdowell
El Mirage
W Greenway Rd
E Thunderbird Rd
Fountain Hills
Youngtown
W Cactus Rd
Cactus Rd
Peoria
W Olive Ave
Country Club
Phoenix Mountains Park
W Northern Ave
Glendale
Paradise Valley
Luke Air Force Base
W Bethany Home Rd
Litchfield Park
W Camelback
Salt River Pima-Maricopa Indian Com
Scottsdale
W Mcdowell Rd
Tolleson
W Van Buren St
Avondale
Phoenix
E Van Buren St
Papago Park
Sky Harbor Int'l Airport
Tempe
Usery Mountain Recreation Area
E Brown Rd
Mesa
W Broadway Rd
Salt River
Laveen
W Dobbins Rd
South Mountain Park
Guadalupe
W Guadalupe Rd
E Guadalupe Rd
E Elliot Rd
Estrella Mountain Regional Park
SOUTH MOUNTAINS
Gilbert
Phoenix-Mesa Gateway Airport
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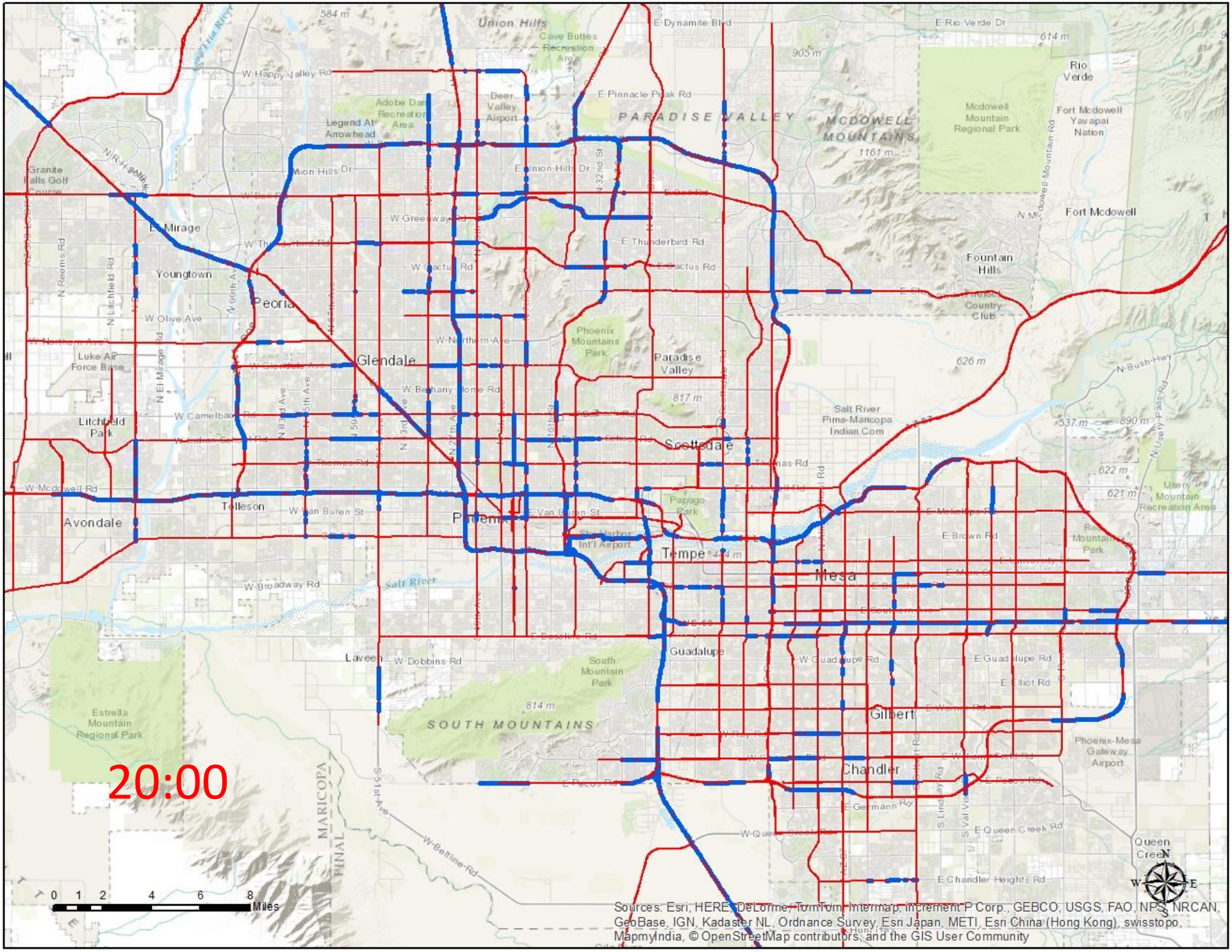
MARICOPA
PINAL
W Beltline Rd
E Germann Rd
E Queen Creek Rd
Queen Creek
E Chandler Heights Rd
0 1 2 4 6 8 Miles
Sources: Esri, HERE, DeLorme, TomTom, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community


20:00
Union Hills
Cave Buttes Recreation Area
E Dynamite Blvd
E Rio Verde Dr
Rio Verde
W Happy Valley Rd
Adobe Dam Recreation Area
Legend At Arrowhead
Deer Valley Airport
E Pinnacle Peak Rd
PARADISE VALLEY
MCDOWELL MOUNTAINS
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Fort Mcdowell Yavapai Nation
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E Mirage
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E Thunderbird Rd
Fort Mcdowell
Fountain Hills
Youngtown
Peoria
W Olive Ave
Phoenix Mountains Park
Paradise Valley
Luke Air Force Base
Glendale
W Bethany Home Rd
Litchfield Park
W Camelback
Salt River Pima-Maricopa Indian Com
Scottsdale
W Mcdowell Rd
Tolleson
Avondale
Phoenix
Papago Park
Sky Harbor Int'l Airport
Tempe
Mesa
W Broadway Rd
Salt River
Laveen
W Dobbins Rd
South Mountain Park
Guadalupe
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NPMRDS Data Processing

1. Convert travel time data to speed data (on TMC level)
2. Establish a reference speed database (by hour by TMC) for weekday and weekend, derived from historical data (6 months in 2013)
3. Impute the NULL speed in NPMRDS with the reference speed
4. Perform filtering algorithm to remove outliers (same procedure used against the 3rd party archived speed database in the past)

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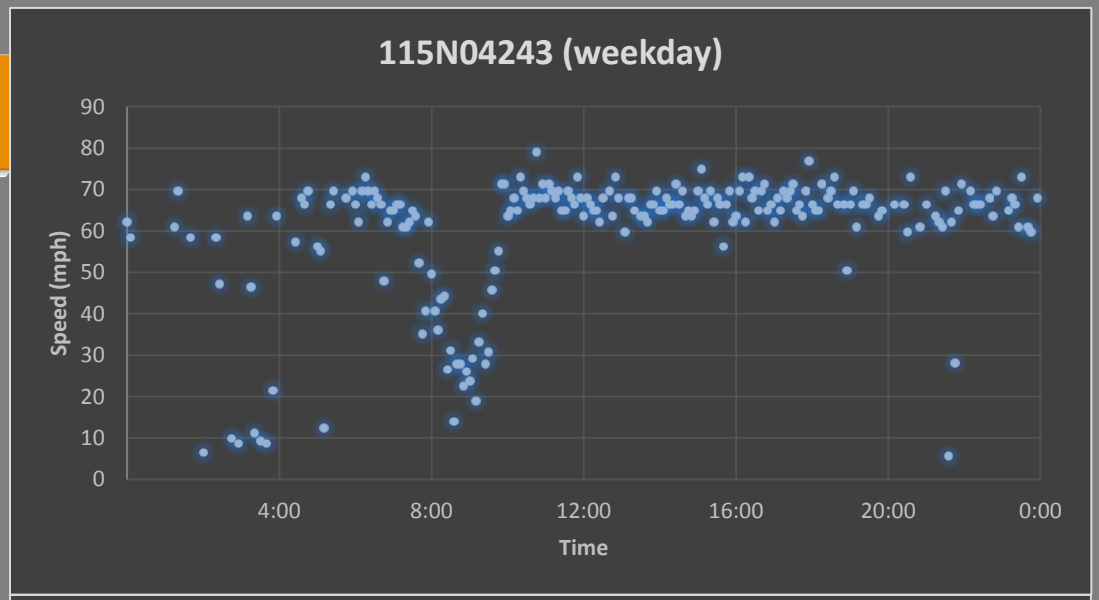
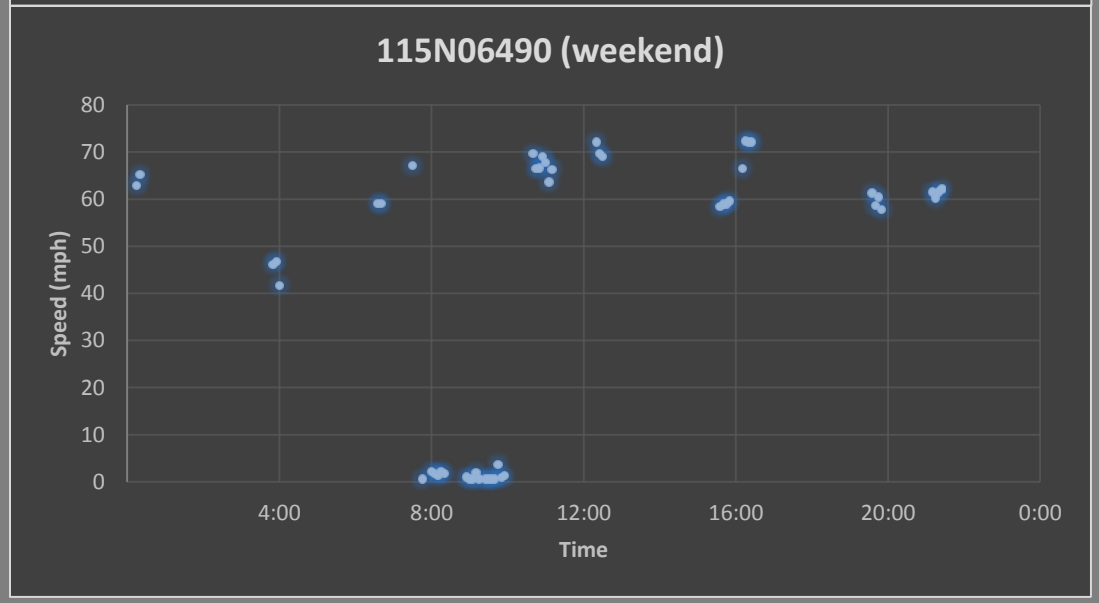
NPMRDS Raw vs. Imputed vs. Filtered

2





NPMRDS Raw

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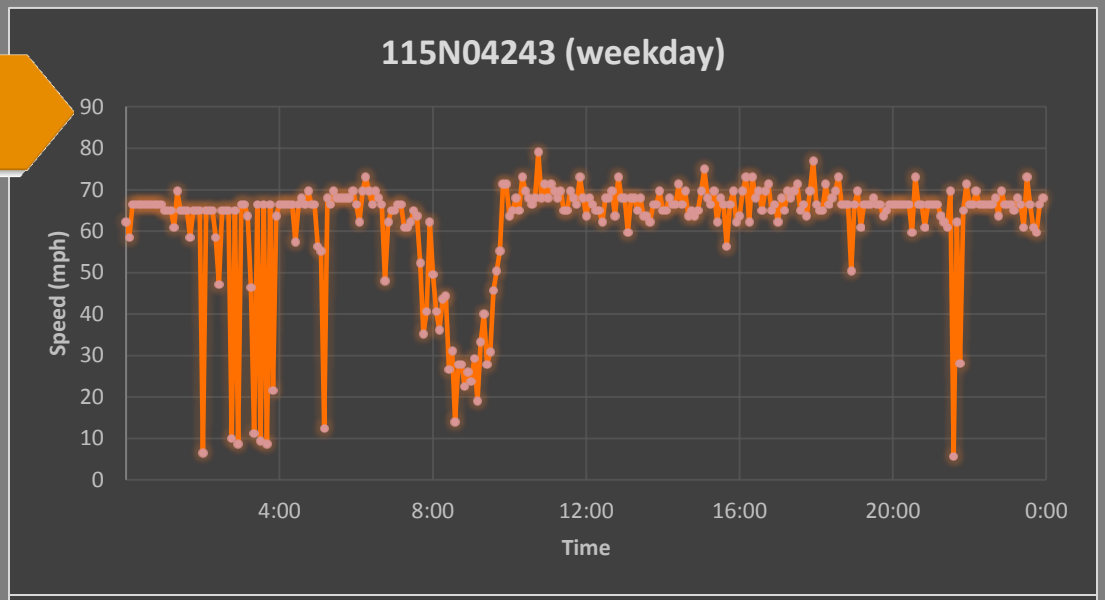
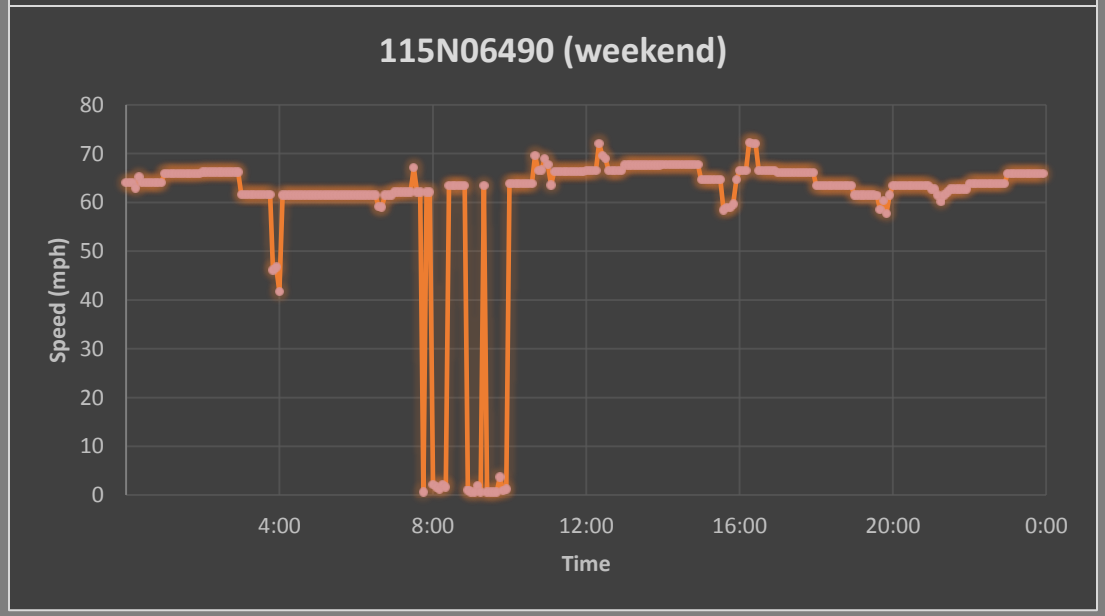
NPMRDS Raw vs. Imputed vs. Filtered

2





Imputed

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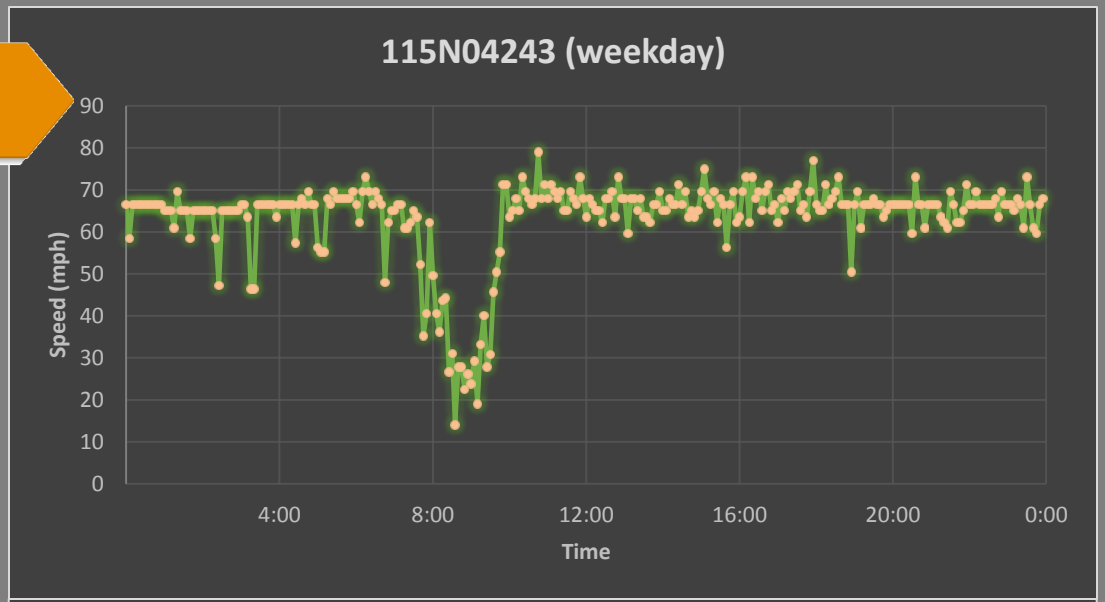
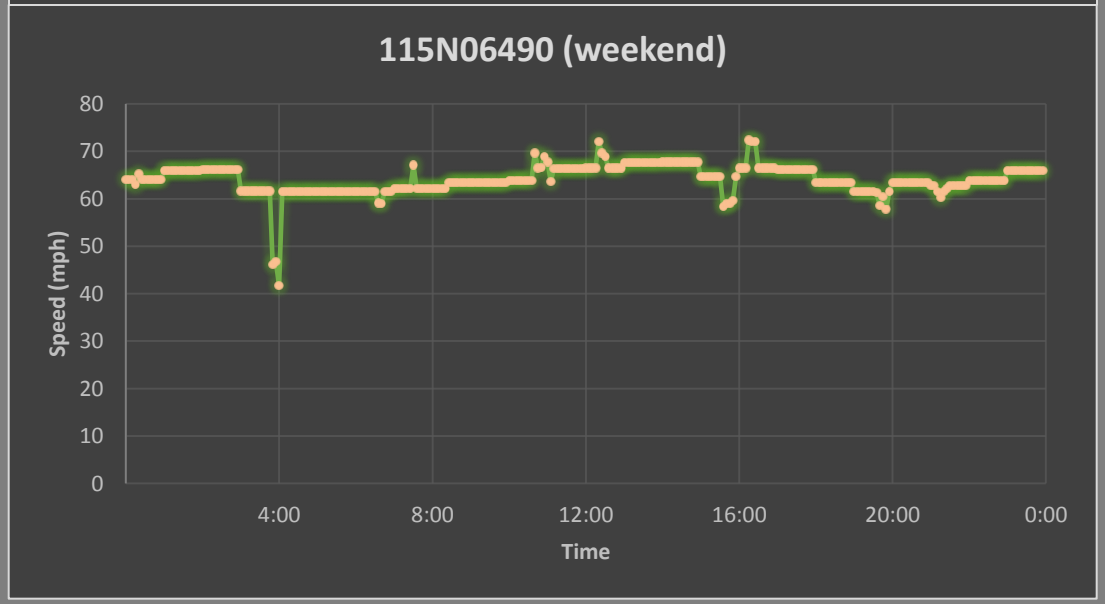
NPMRDS Raw vs. Imputed vs. Filtered

2





Filtered

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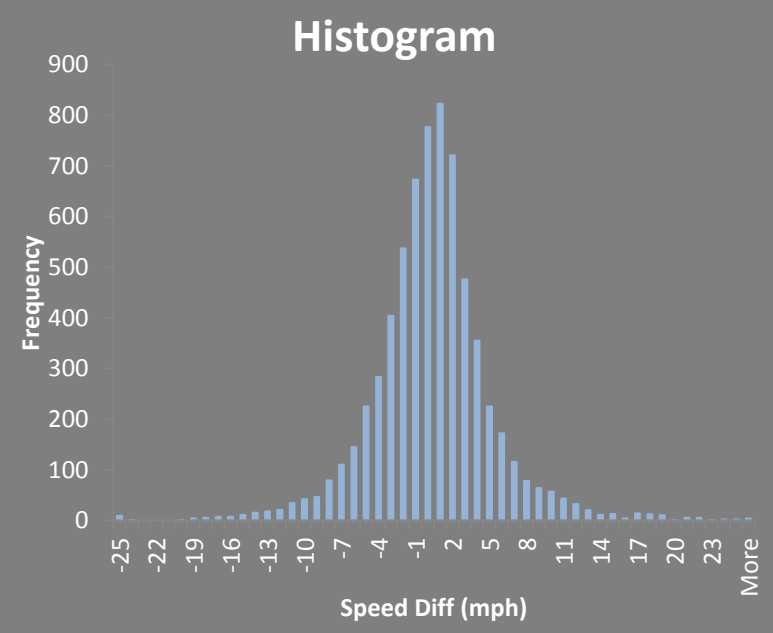
NPMRDS vs. 3rd Party Archived Speed Data

2

- Comparing 2013 NPMRDS October speed (aggregated to 15-min by average weekday) to 2012 Third Party Data October speed on selected TMC.

TMC	Mean Abs Error (mph)	RMSE %
115N04160	3.4	8%
115N04184	2.4	6%
115N04201	2.9	7%
115N05736	4.5	22%
115N07465	3.3	15%
115P04111	2.8	7%
115P04164	3.5	8%
115P04195	2.8	7%
115P04232	4.2	11%
115P04609	4	16%
Average	3.4 (mph)	11%



- Statistically, two datasets are very close.

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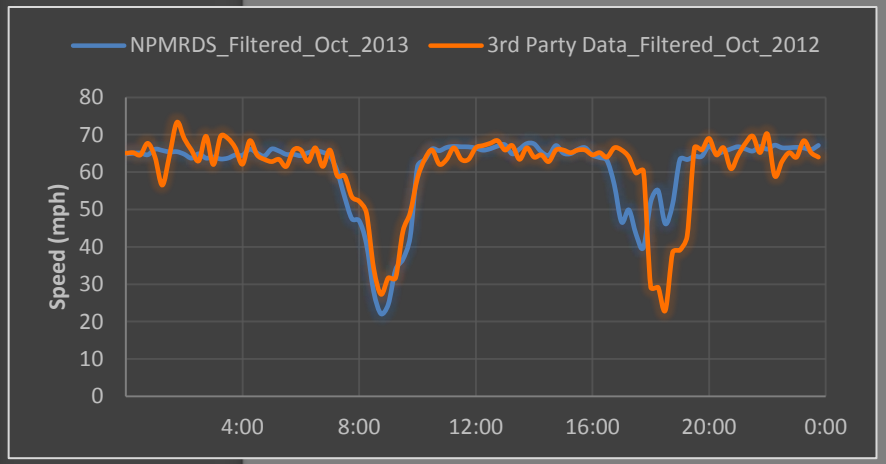
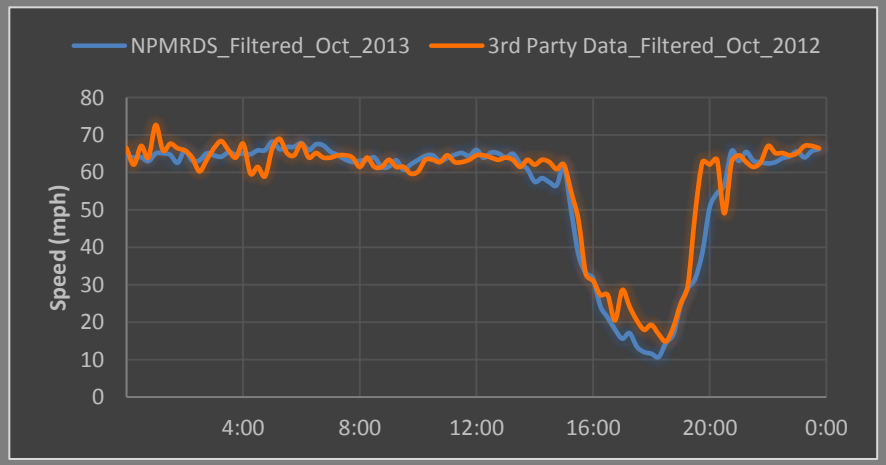
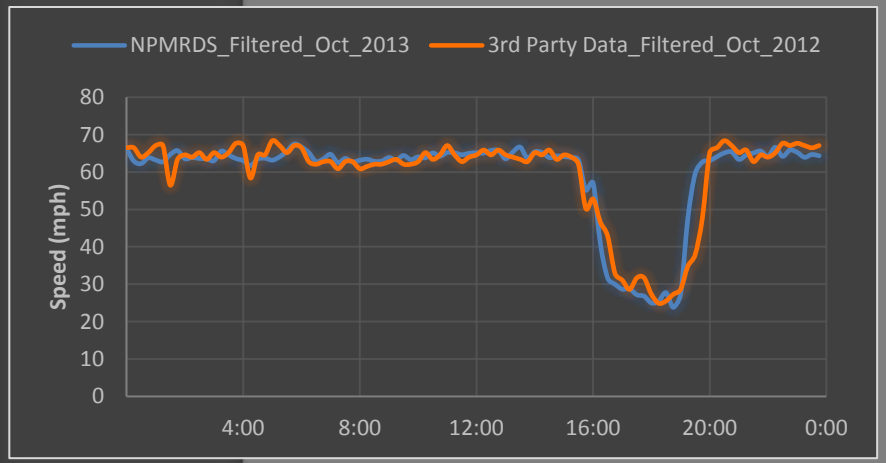
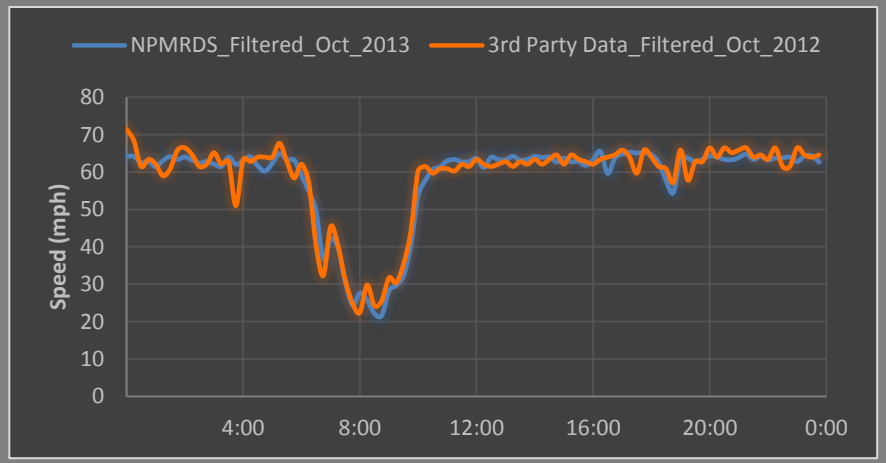
NPMRDS vs. Third Party Data

2









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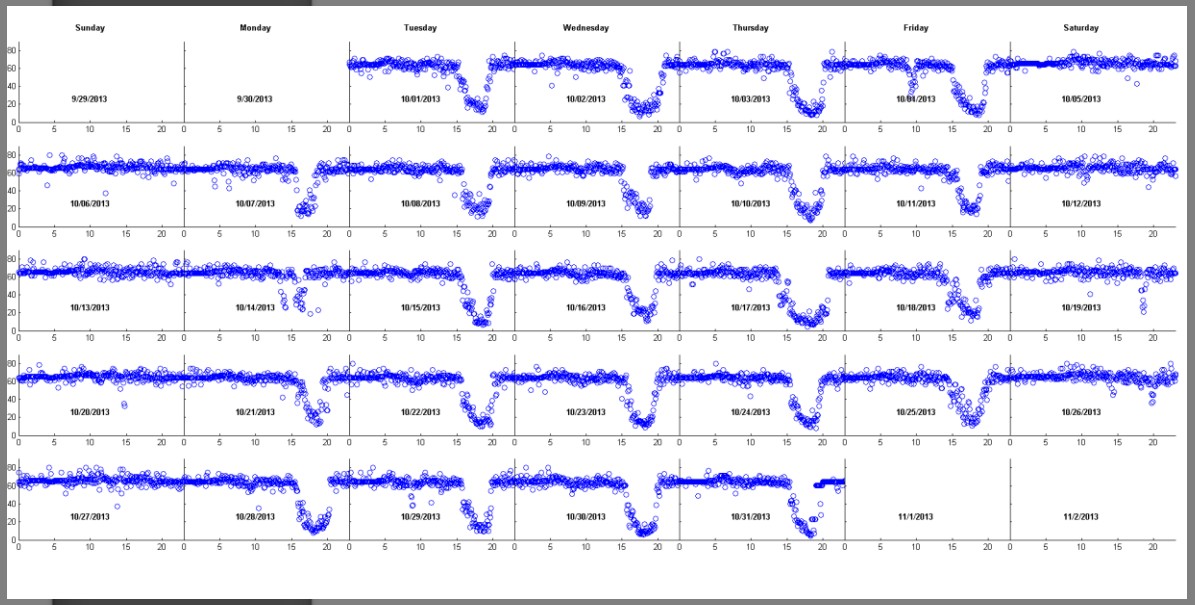
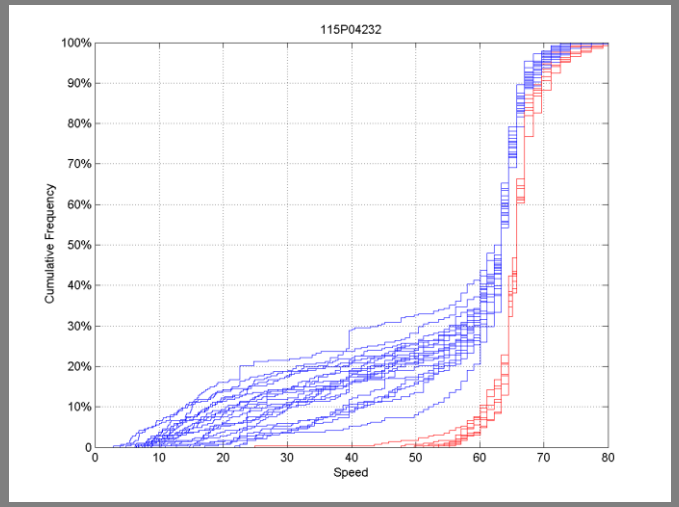
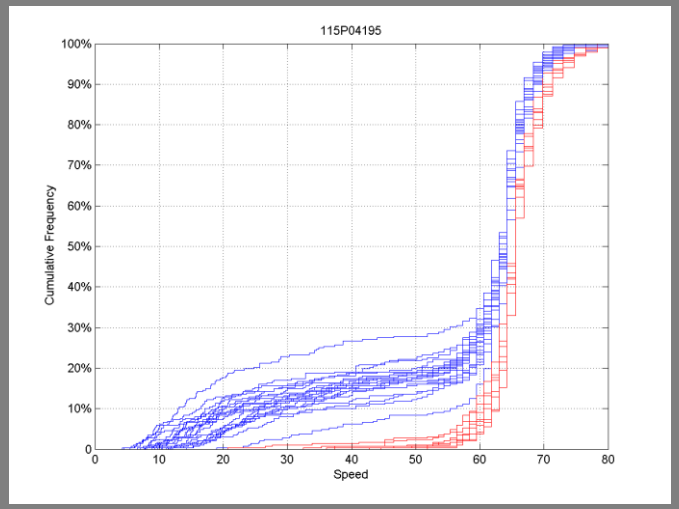
Using NPMRDS on Congestion Monitoring

2

- Detailed congestion profile
- Day-by-day monitoring capability (NHS)
- Reliability measures







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NPMRDS – What is Next?

2

- NPMRDS is a great add-in dataset to MAG, particularly facilitates planning, operation and programming studies
- NPMRDS consistent to the 3rd party archived historical speed data
- Working on incorporating NPMRDS into MAG congestion monitoring routines, it enhances our capability in monitoring/measuring traffic variability and reliability
- Continue to evaluate NPMRDS and tweak data processing algorithm

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Programming - CMP

- Performance-based CMP process for the programming of projects
- Alternative scenarios based on benefit-cost and performance analysis for the rebalancing of the Freeway Life-Cycle program
- Programming process for TA Transportation Alternatives Program

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Programming - CMP

4

Case Study A: RTP Freeway Projects

MAG CMP Screening Tool Summary Rankings

	CRITERIA	Weight	PROJECT NUMBERS: 1	2	3	4	5	6	7	8	9
Quantitative Data	VOLUME/AADT *	25%	7	7	9	4	4	3	4	1	2
	CRASH RATE	5%	1	1	1	1	1	1	1	9	1
	TRUCK VOLUME / AADT	5%	7	7	9	4	4	3	4	2	1
	CONGESTION / LOST PRODUCTIVITY GP	10%	5	5	3	7	7	4	7	2	1
	Total Weighted Score:		2.65	2.65	3.05	1.95	1.95	1.35	1.95	1.00	0.70
	Rank Order:		2	2	1	4	4	7	4	8	9
Qualitative Data	CMP OBJECTIVES	35%	3.33	2.60	2.57	3.29	2.14	3.29	3.57	3.43	3.29
	PROJECT/MODE SPECIFIC ASSESSMENT	20%	4	4	1	4	3	4	3	4	4
	Total Weighted Score:		1.37	1.11	1.70	1.35	1.15	1.35	1.65	1.40	1.35
	Rank Order:		4	9	1	5	8	5	2	3	5

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