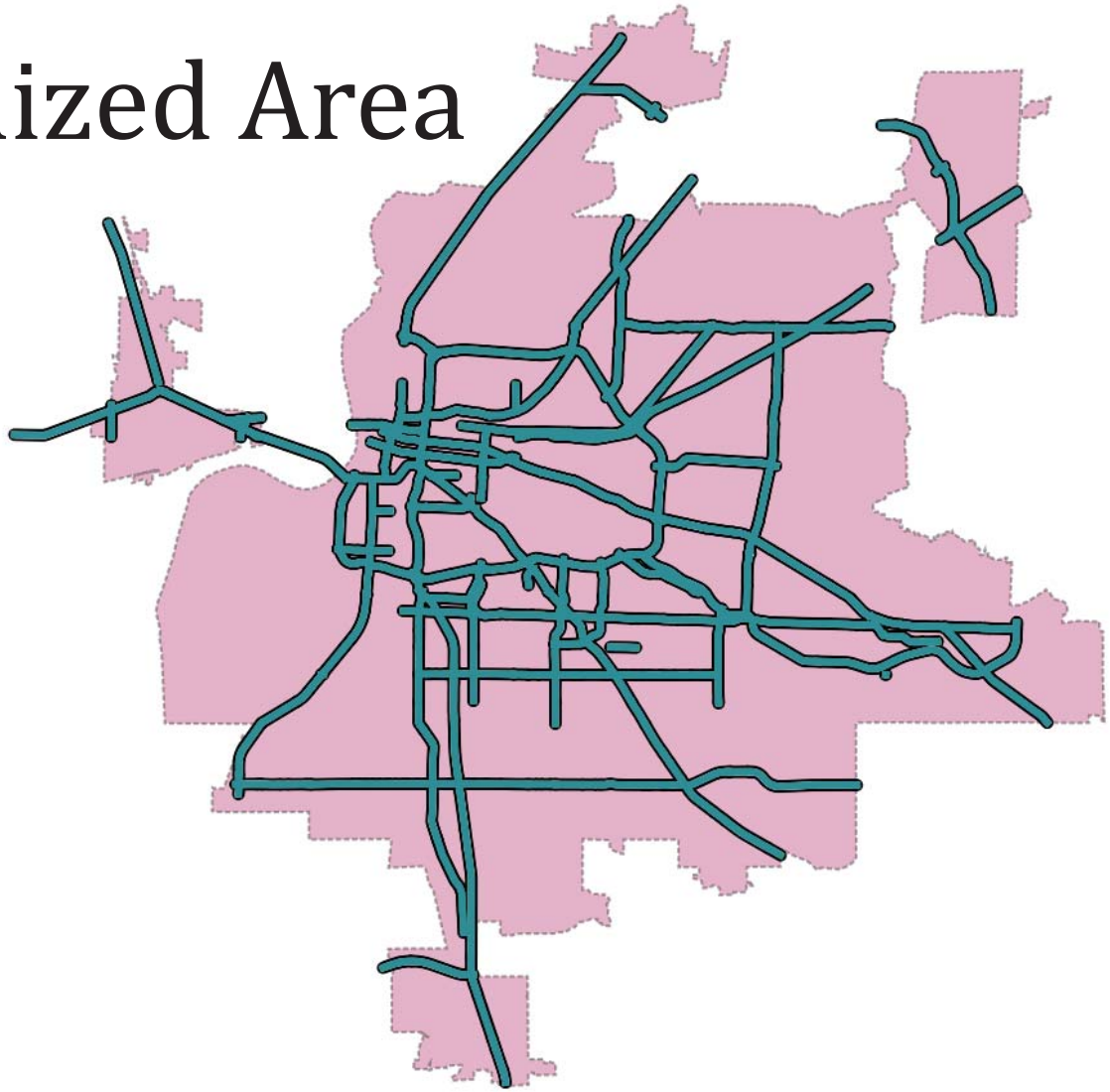
Memphis Urbanized Area (TN-MS-AR) PHED Analysis



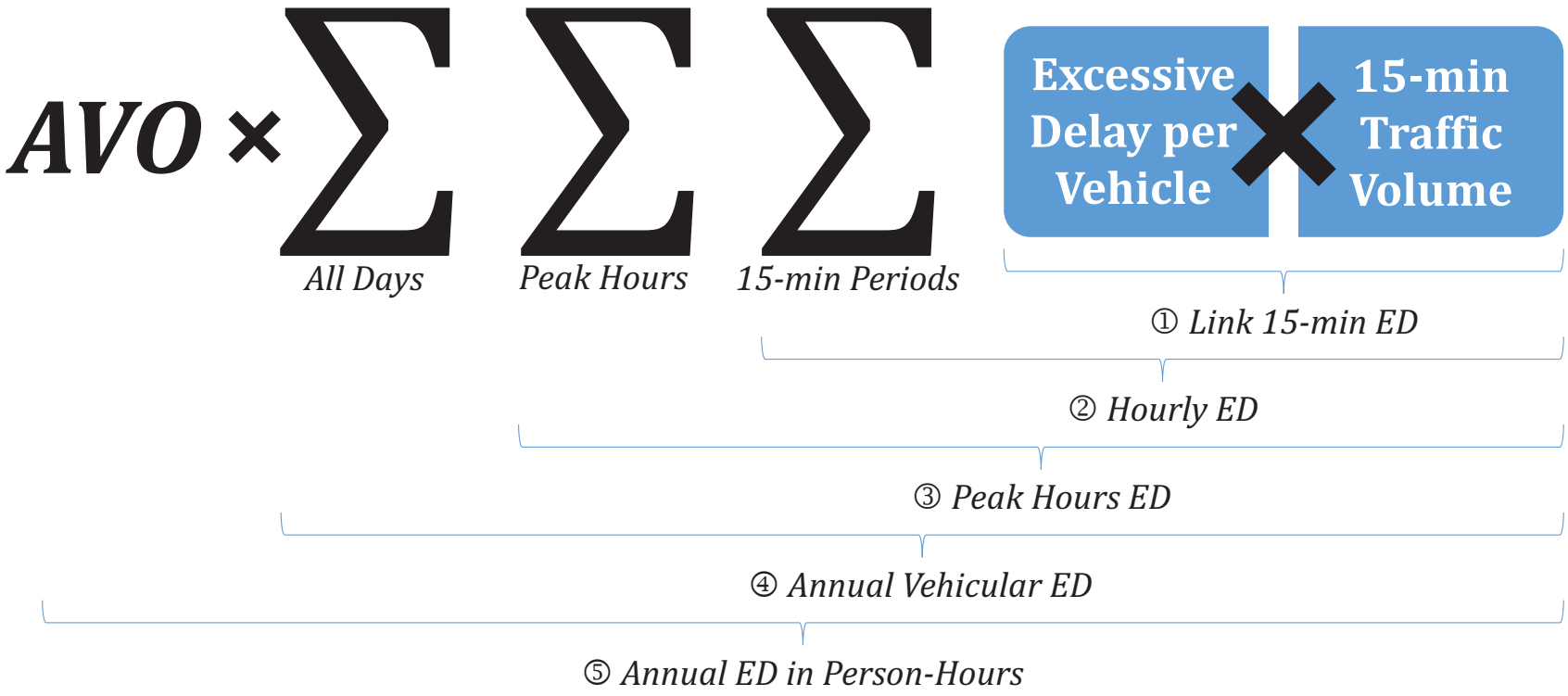
A Working Report

The University of Tennessee

03.27.2018

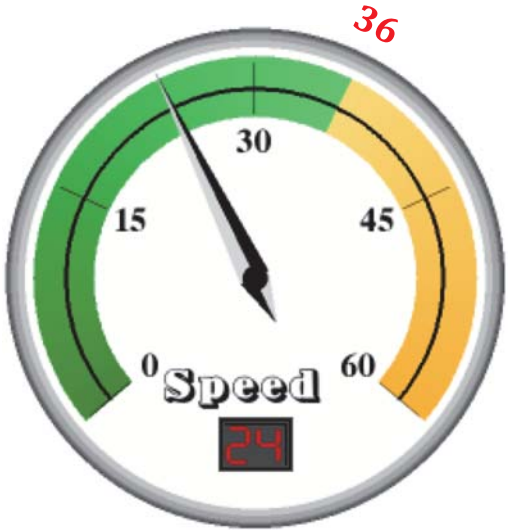
Note: The calculations and PHED results presented herein are work in progress and not final. Additional data and executive assumptions are needed before these can be finalized. Please use these numbers with discretion.

Link Excessive Delay Calculations



$$AVO \times \sum_{\text{All Days}} \sum_{\text{Peak Hours}} \sum_{\text{15-min Periods}} \text{Excessive Delay Per Vehicle} \times \text{15-min Traffic Volume}$$

- Speed Limit: **60 mph**
- Speed Threshold: **36 mph**
- Link Speed: **24 mph**



15-min Excessive Delay per Vehicle

$$= \frac{0.6\ mile}{24\ mph} - \frac{0.6\ mile}{36\ mph}$$

$$= 30\ seconds$$

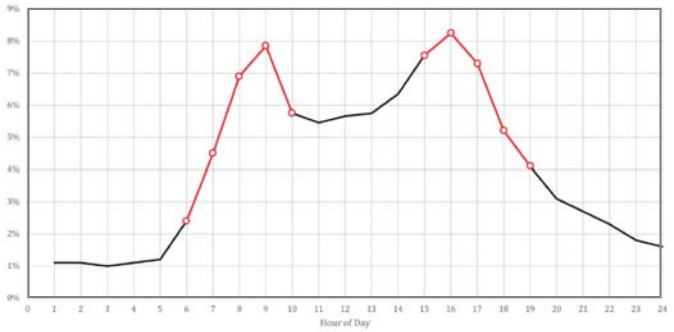
$$AVO \times \sum_{\text{All Days}} \sum_{\text{Peak Hours}} \sum_{\text{15-min Periods}}$$

Excessive Delay Per Vehicle × **15-min Traffic Volume**

$$AADT \div$$

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Sun	1.46	1.40	1.24	1.23	1.24	1.24	1.24	1.26	1.26	1.27	1.32	1.34
Mon	1.08	1.02	1.00	0.98	1.01	0.97	0.99	0.97	1.02	0.98	0.99	1.02
Tue	1.05	0.99	0.97	0.95	0.94	0.96	0.96	0.95	0.95	0.96	0.96	1.00
Wed	1.06	1.00	0.95	0.94	0.93	0.94	0.97	0.94	0.94	0.94	0.96	1.00
Thu	1.03	0.98	0.92	0.91	0.90	0.91	0.94	0.92	0.91	0.91	0.99	0.97
Fri	0.96	0.90	0.92	0.87	0.85	0.86	0.90	0.85	0.84	0.85	0.93	0.93
Sat	1.23	1.14	1.11	1.04	1.04	1.04	1.08	1.04	1.05	1.06	1.10	1.13

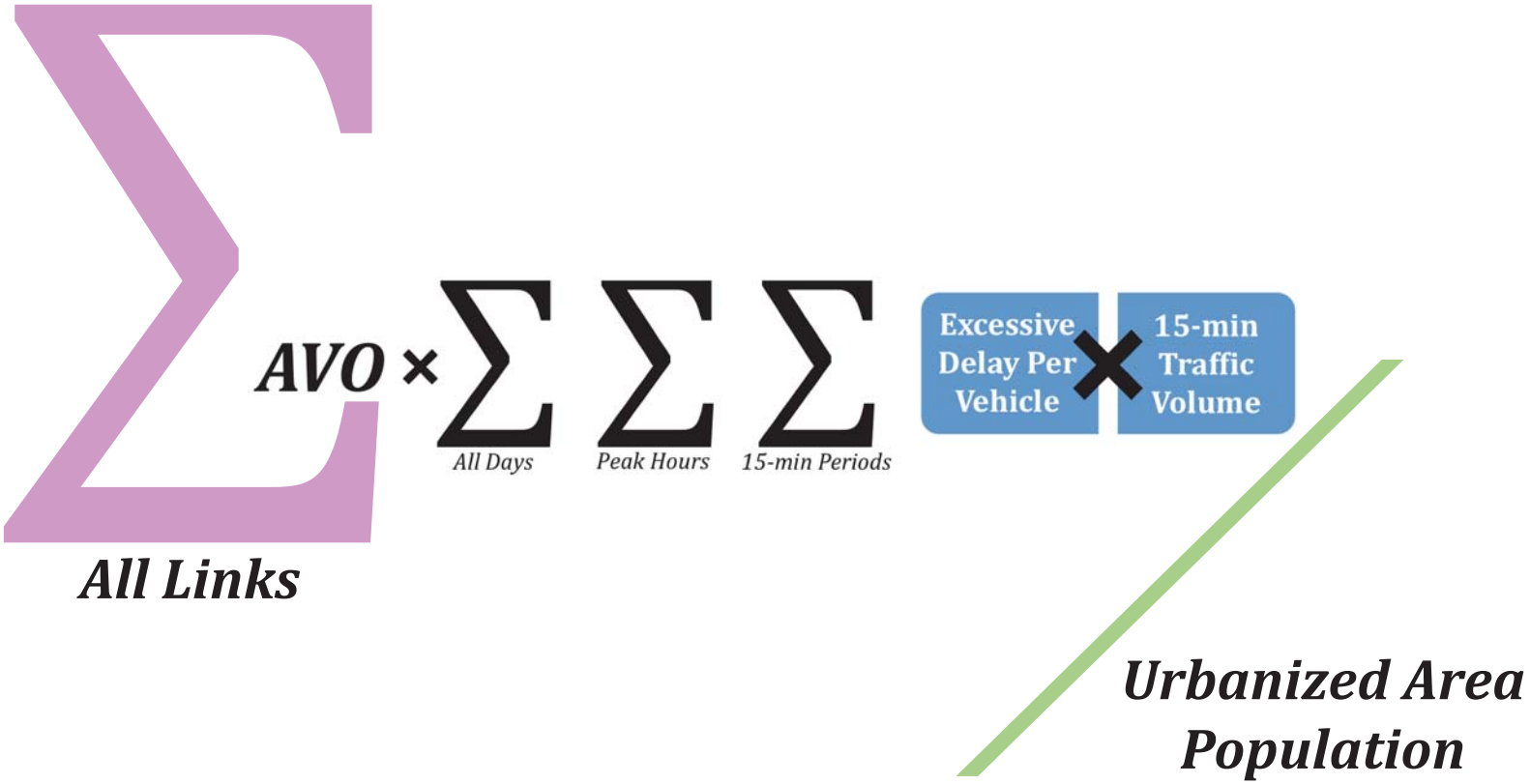
×

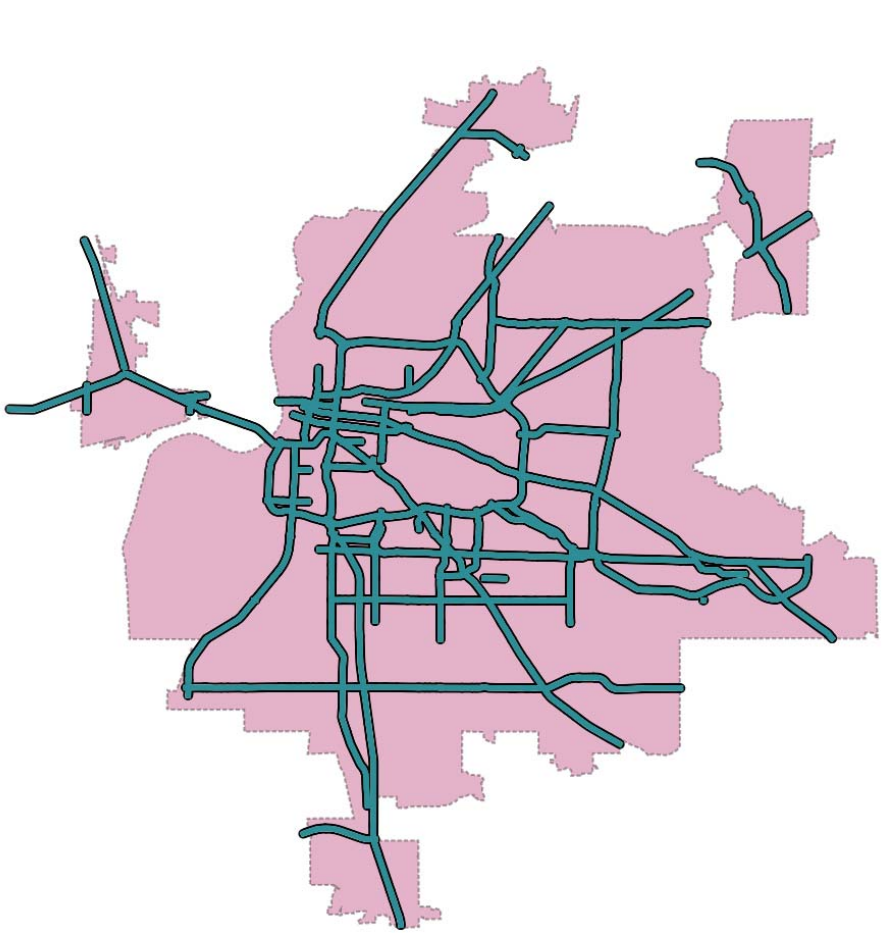


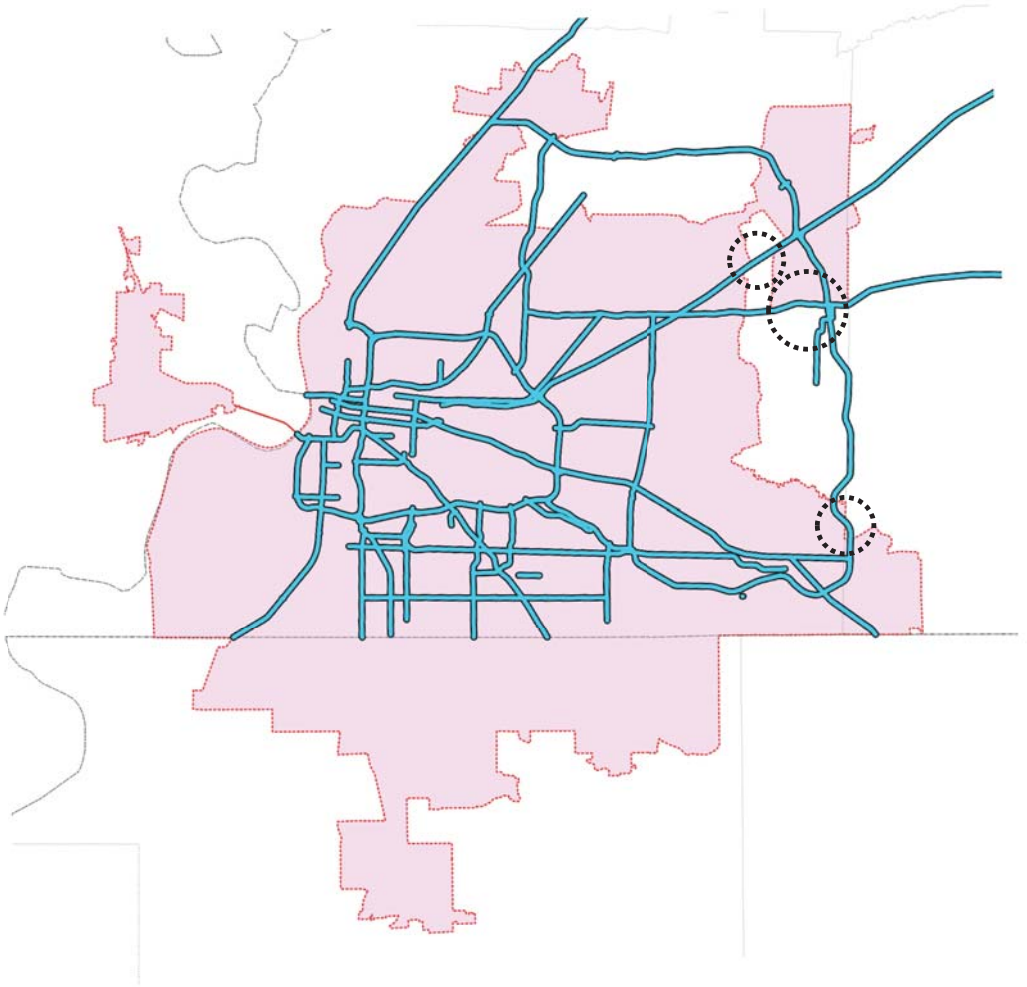
TN-AR-MS Reports
NPMRDS 2.0

TDOT Monthly/Weekly Variation Factors*

FHWA Hourly Distribution Factors


AVO ×
All Days
Peak Hours
15-min Periods
Excessive Delay Per Vehicle
15-min Traffic Volume
All Links
Urbanized Area Population

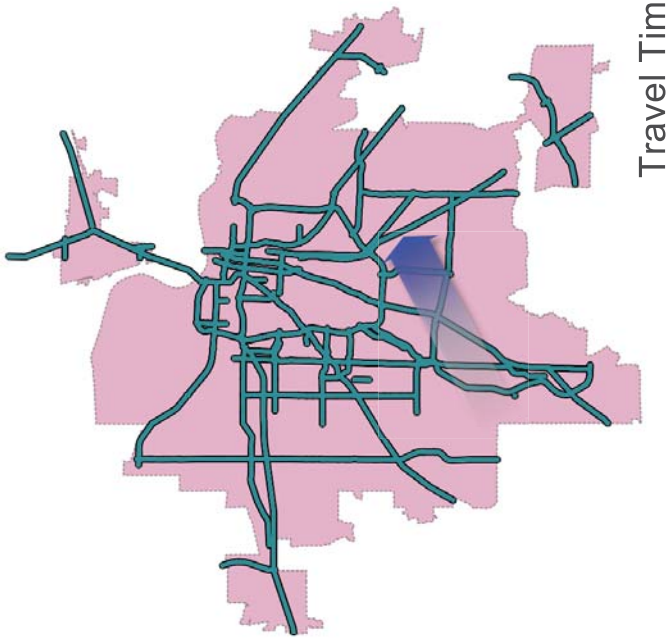


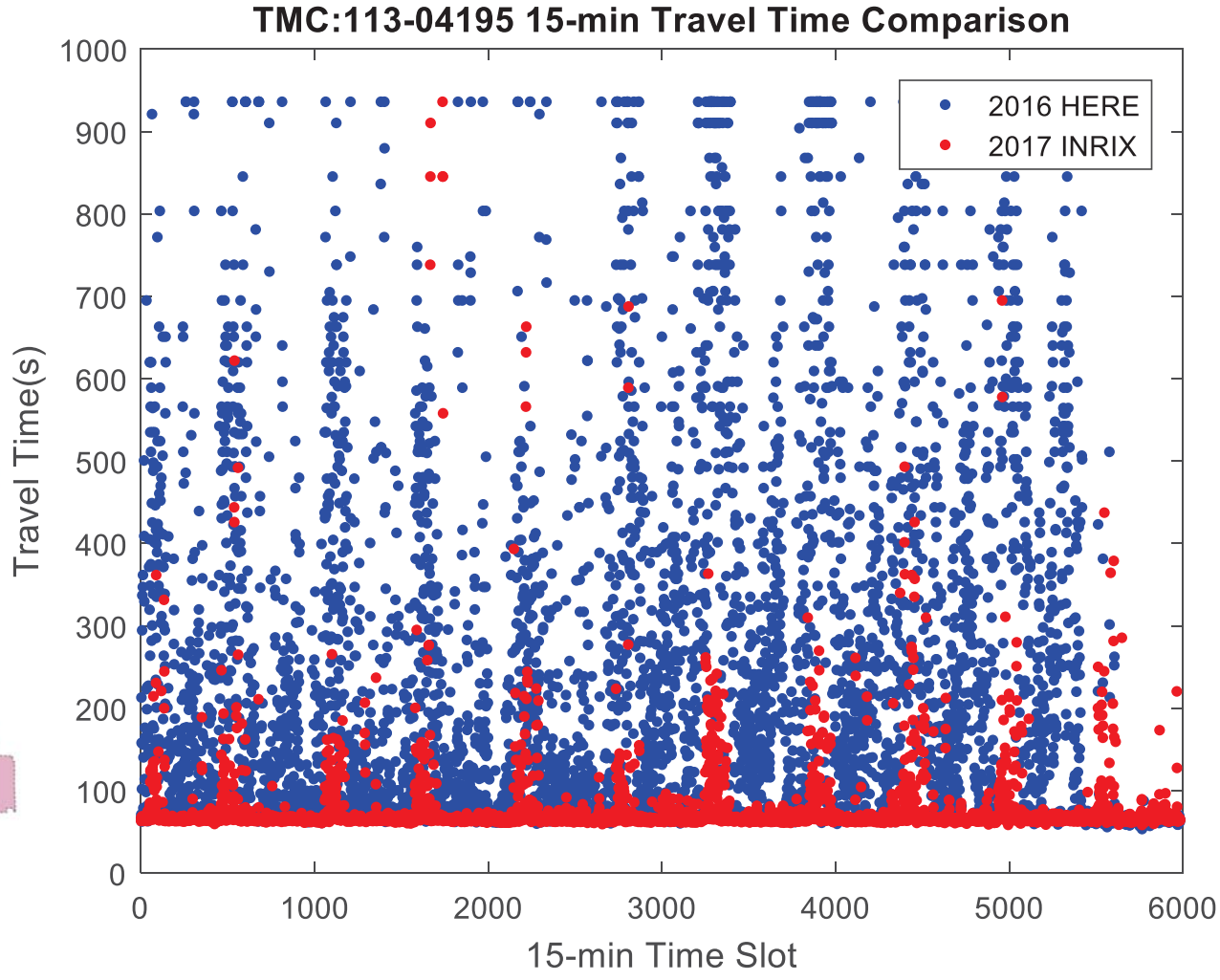


PHED Results

Memphis Urbanized Area PHED Values				
Peak Period	6AM-10AM & 3PM-7PM			
PHED Year	2014	2015	2016	2017
Population (year)	1,071,406 (2014)	1,075,471 (2015)	1,074,615 (2016)	1,074,615 (2016)
NPMRDS Data Sources	HERE	HERE	HERE	INRIX
AADT Year	2015	2015	2015	2015
PHED (AVO 1.2) in Hours	12,108,679	13,442,913	16,001,162	6,727,670
PHED Per Capita	11.30	12.50	14.89	6.26
Data Missing Rate	38%	32%	25%	23%
Missing Rate/Unit Length	26%	20%	14%	16%

INRIX vs HERE



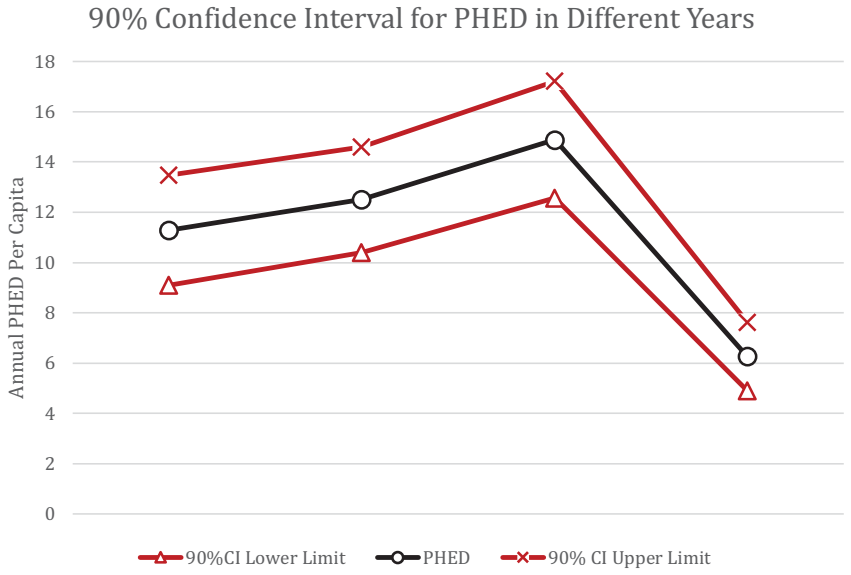


PHED Results (for Comparison)

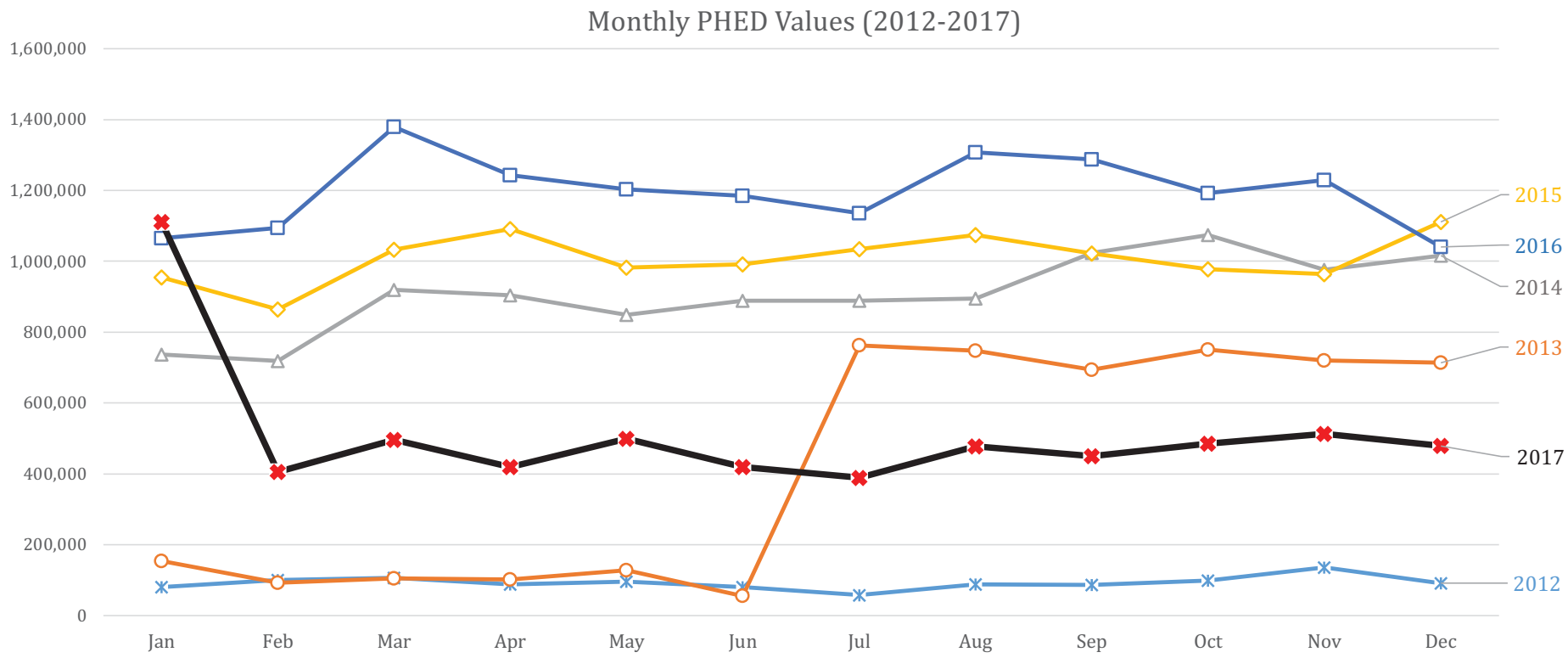
Four Urbanized Area				
Year	2017			
Peak Period	6AM-10AM & 3PM-7PM			
MPO	Knoxville	Chattanooga	Nashville	Memphis
PHED (AVO1.2) in Hours	4,264,178	3,243,384	18,034,805	6,727,670
Population (2016)	581,472	395,824	1,041,575	1,074,615
PHED Per Capita	7.33	8.19	17.32	6.26
Data Missing Rate	31%	37%	19%	23%
Total Length in Miles	653	458	879	787

Confidence Interval for PHED Results

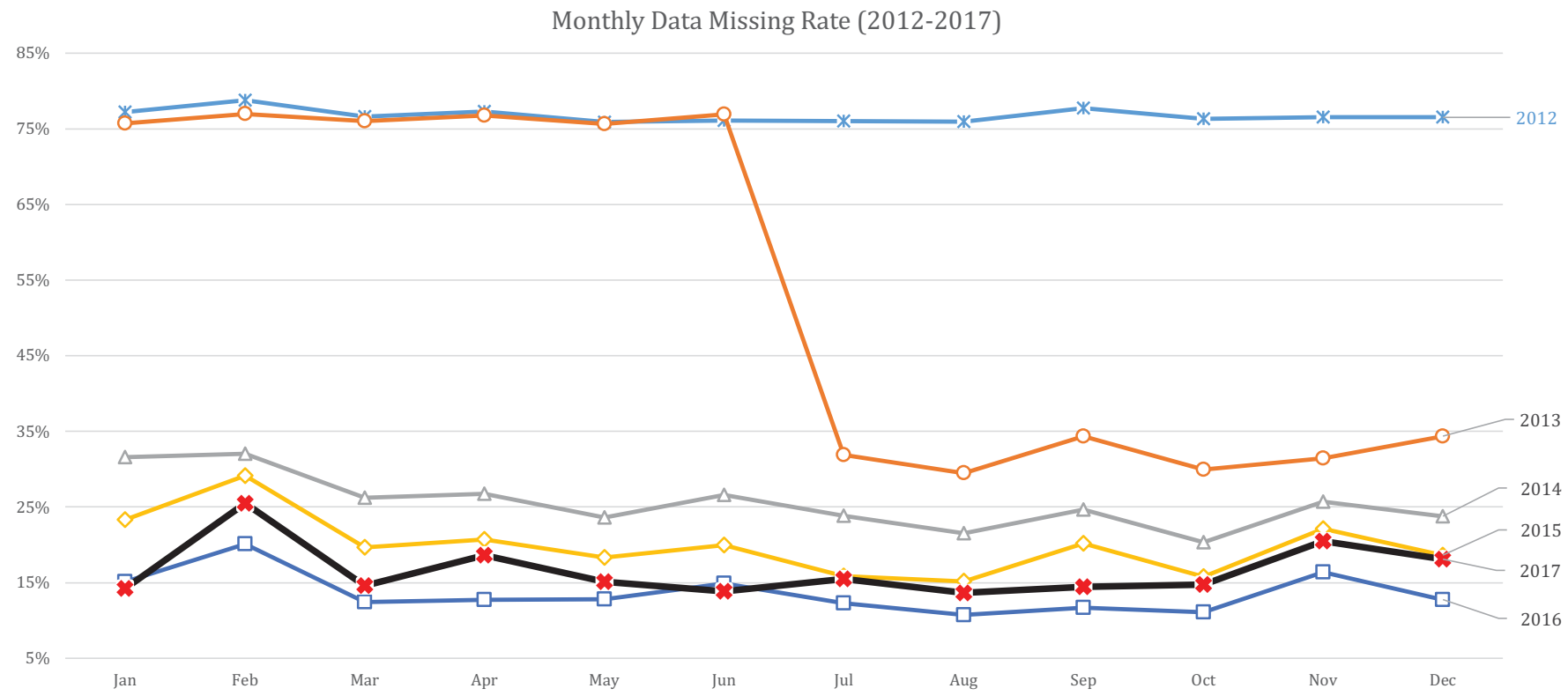
Confidence Interval for PHED Values				
Peak Period	6AM-10AM & 3PM-7PM			
PHED Year	2014	2015	2016	2017
90% CI Lower Limit	9,763,735	11,180,527	13,506,600	5,268,938
PHED per Capita (hr)	9.11	10.40	12.57	4.90
PHED (hours)	12,108,679	13,442,913	16,001,162	6,727,670
PHED per Capita (hr)	11.30	12.50	14.89	6.26
90% CI Upper Limit	14,453,622	15,705,299	18,495,725	8,186,394
PHED per Capita (hr)	13.49	14.60	17.21	7.62

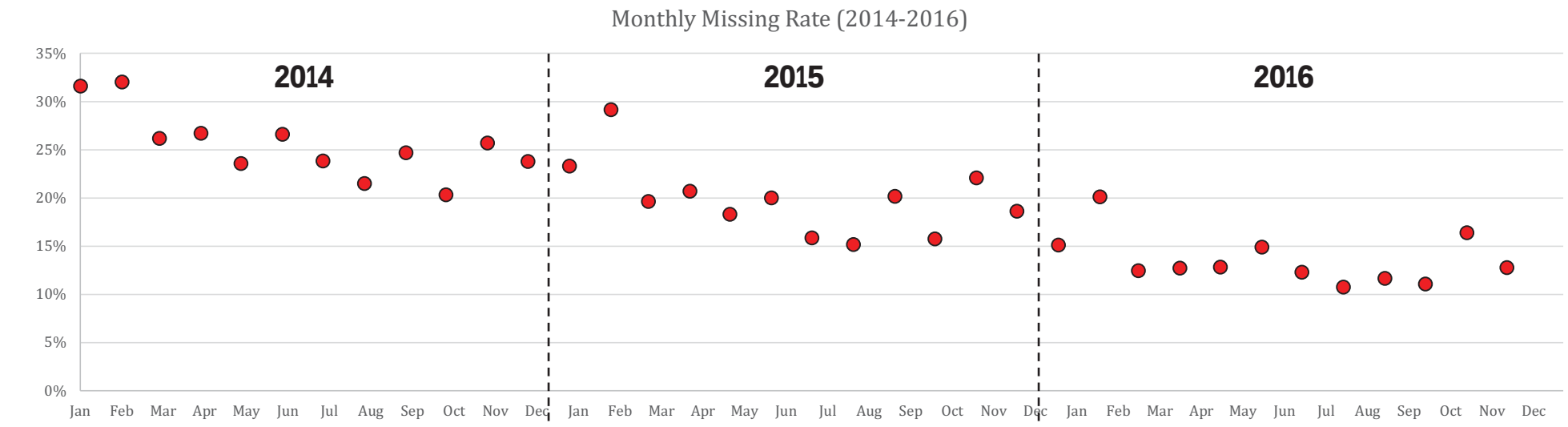


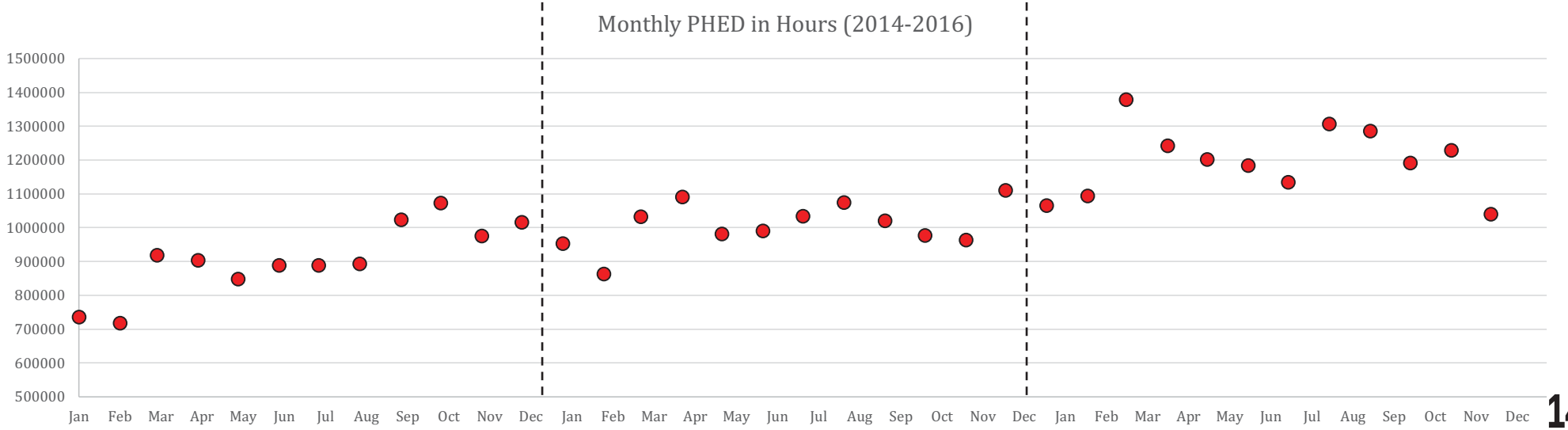
Monthly PHED Trend



Monthly Data Missing Rate Trend




Monthly Missing Rate (2014-2016)
2014
2015
2016
35%
30%
25%
20%
15%
10%
5%
0%
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec

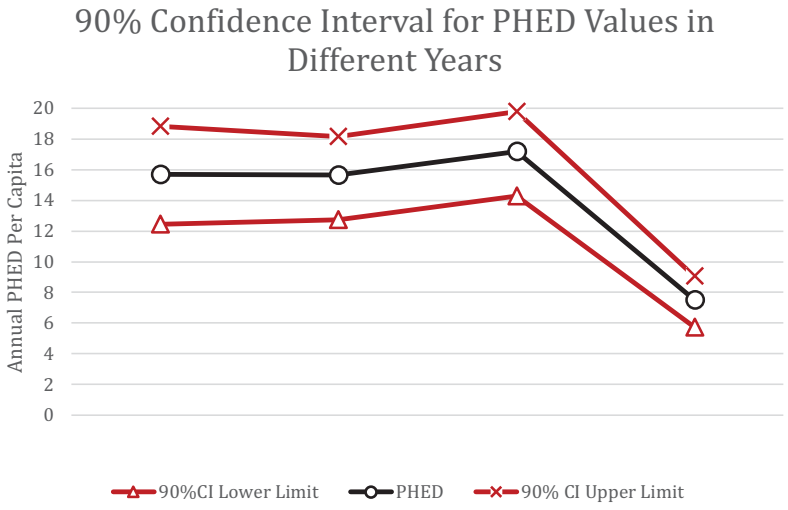

Monthly PHED in Hours (2014-2016)
1500000
1400000
1300000
1200000
1100000
1000000
900000
800000
700000
600000
500000
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec

Replacing Missing Data

Memphis Smoothed Urbanized Area PHED Values after Replacing Missing Data					
Peak Period	6AM-10AM & 3PM-7PM				
PHED Year	2014	2015	2016	Average Increase/year (2014-2016)	2017
Population (year)	1,071,406 (2014)	1,075,471 (2015)	1,074,615 (2016)	-	1,074,615 (2016)
AADT Year	2015	2015	2015	-	2015
PHED	16,788,110	16,870,290	18,462,411	5.0%	8,084,471
Per Capita (hours)	15.67	15.69	17.18	4.8%	7.52

Replacing Missing Data

Confidence Interval for PHED Values w/ with Missing Data Replaced				
Peak Period	6AM-10AM & 3PM-7PM			
PHED Year	2014	2015	2016	2017
90% CI Lower Limit	13,333,023	13,716,122	15,350,010	6,170,635
PHED per Capita (hr)	12.44	12.75	14.28	5.74
PHED (hours)	16,788,110	16,870,290	18,462,411	8,084,472
PHED per Capita (hr)	15.67	15.69	17.18	7.52
90% CI Upper Limit	20,153,285	19,534,623	21,259,140	9,723,596
PHED per Capita (hr)	18.81	18.16	19.78	9.05



PHED Predictions

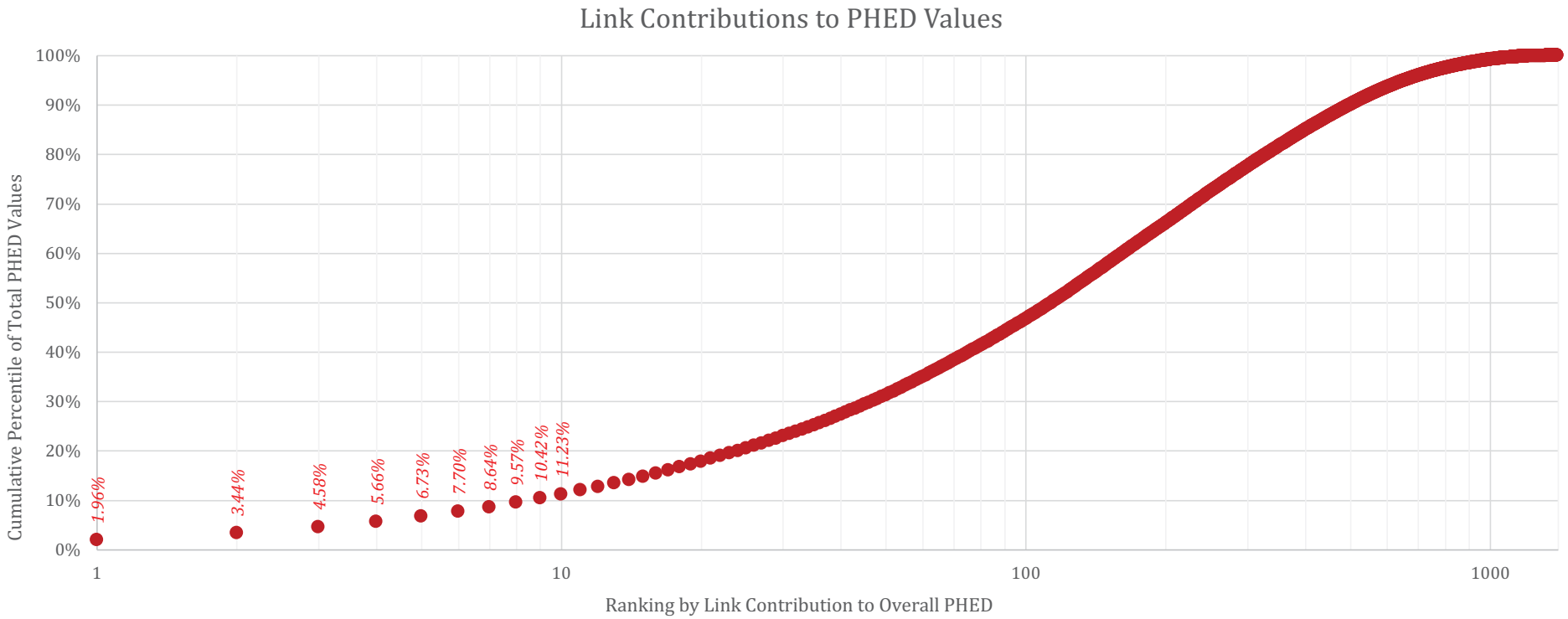
For 2018~2021 using Exponential Smoothing based on HERE data trend

Prediction Results					
PHED Year	2017	2018	2019	2020	2021
PHED (HERE Trend)	6,727,670	7,590,506	8,453,343	9,316,180	10,179,016
per Capita	6.26	7.06	7.87	8.67	9.47
PHED (5% Exp. Growth)	6,727,670	7,064,054	7,417,256	7,788,119	8,177,525
per Capita	6.26	6.57	6.90	7.25	7.61
PHED (5% Linear Growth)	6,727,670	7,064,054	7,400,437	7,736,821	8,073,204
per Capita	6.26	6.57	6.89	7.20	7.51

Targeting

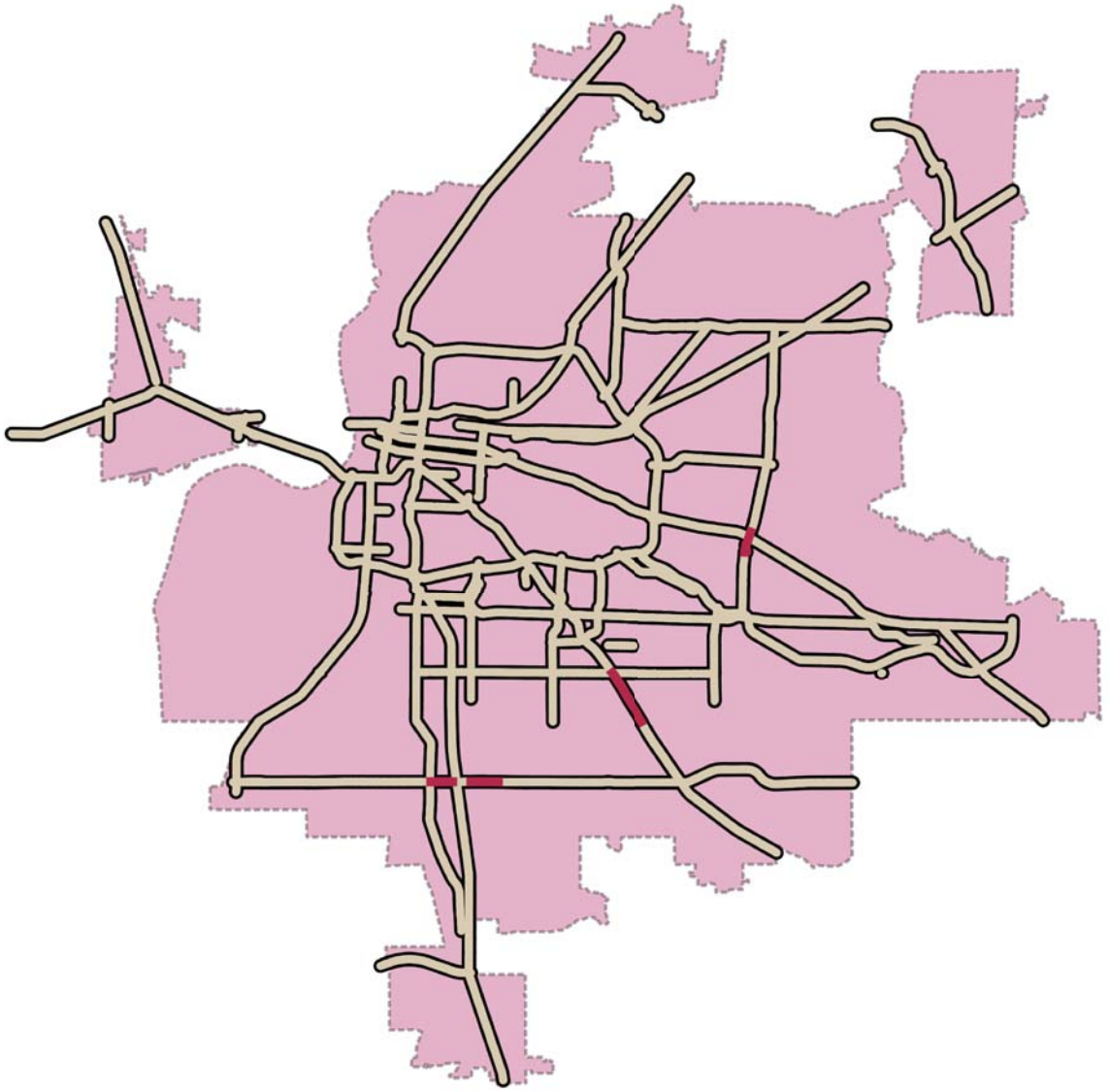
- AVO, traffic volume, link speed, and data quality are main drivers of future PHED values.
- To improve PHED, it is important to identify links where impactful improvements could be made.
- Segments in Memphis Urbanized Area were ranked based on their contributions to PHED values. Links with higher PHED values are identified.

Link Contributions



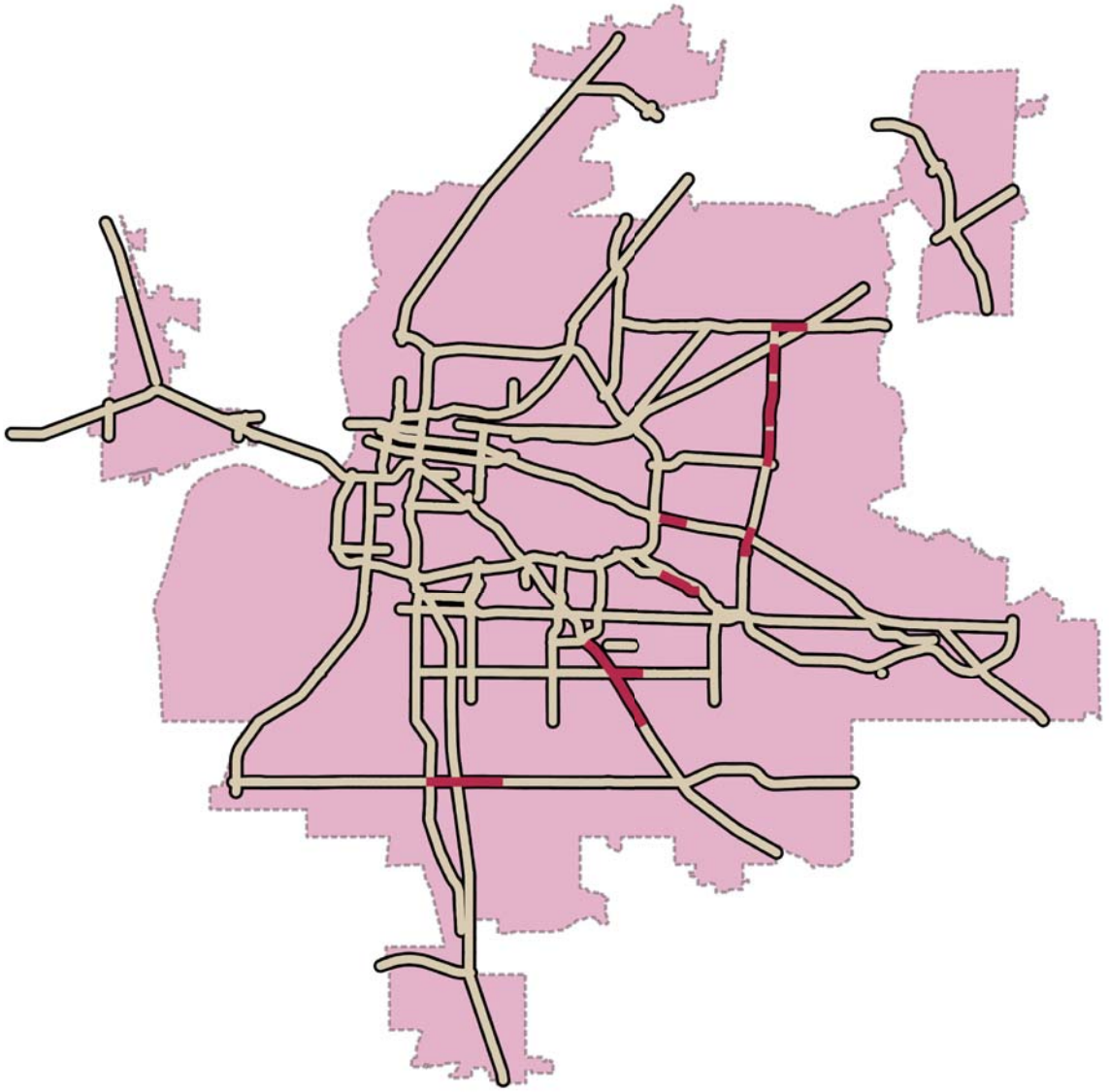
Link Contributions

of Links: 8/1394
Percent of PHED Values: 10%



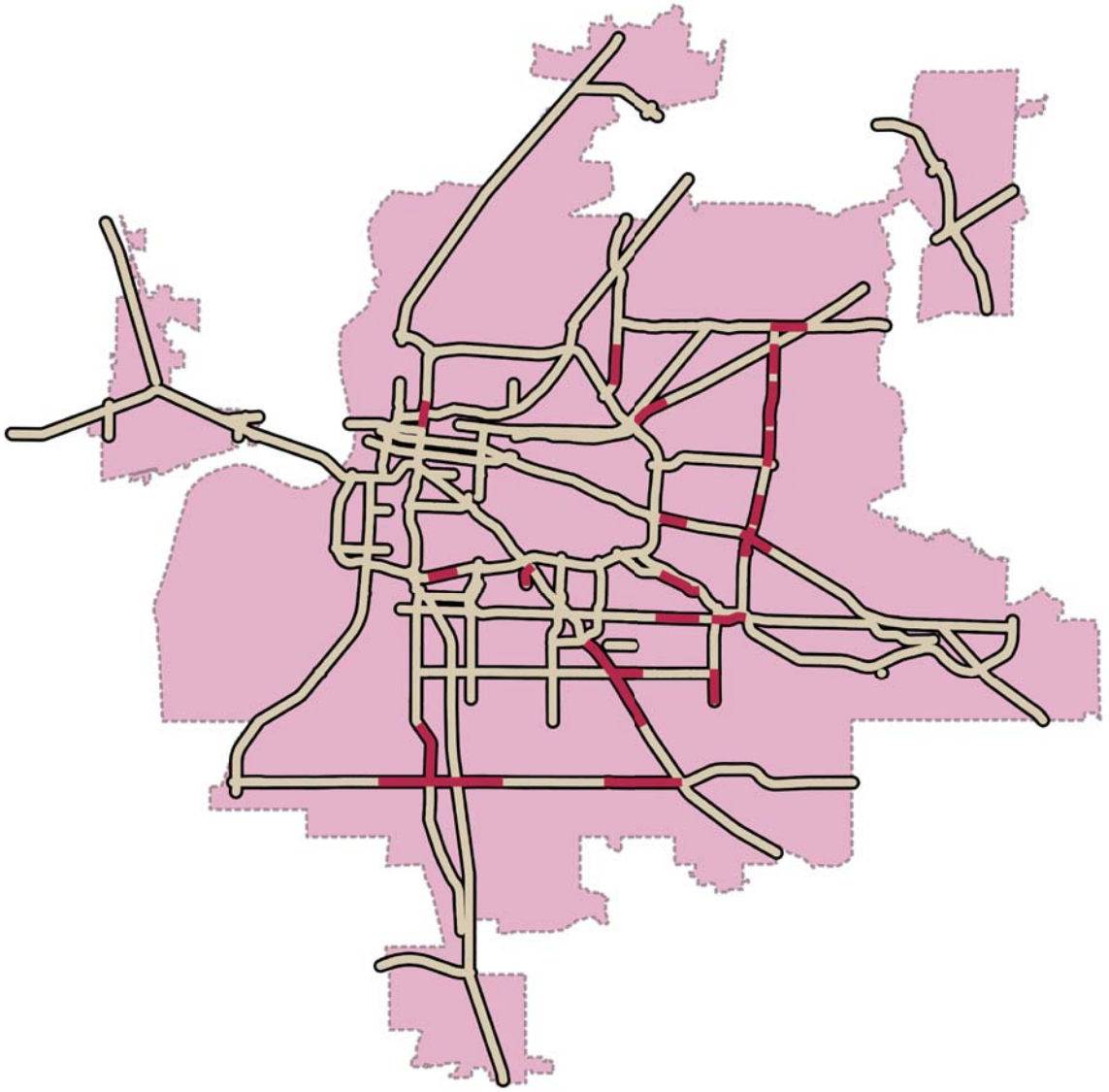
Link Contributions

of Links: 23/1394
Percent of PHED Values: 20%



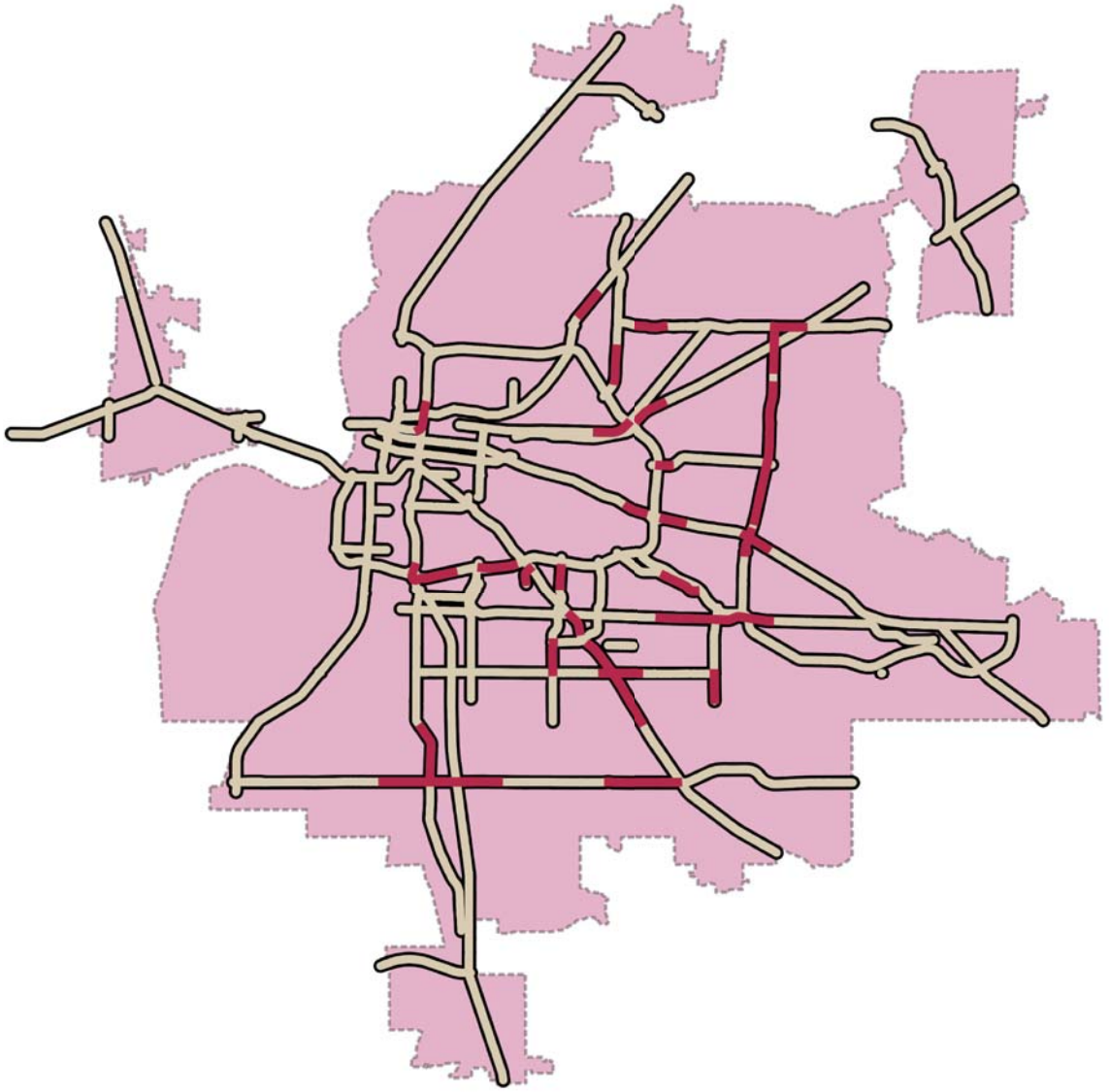
Link Contributions

of Links: 46/1394
Percent of PHED Values: 30%



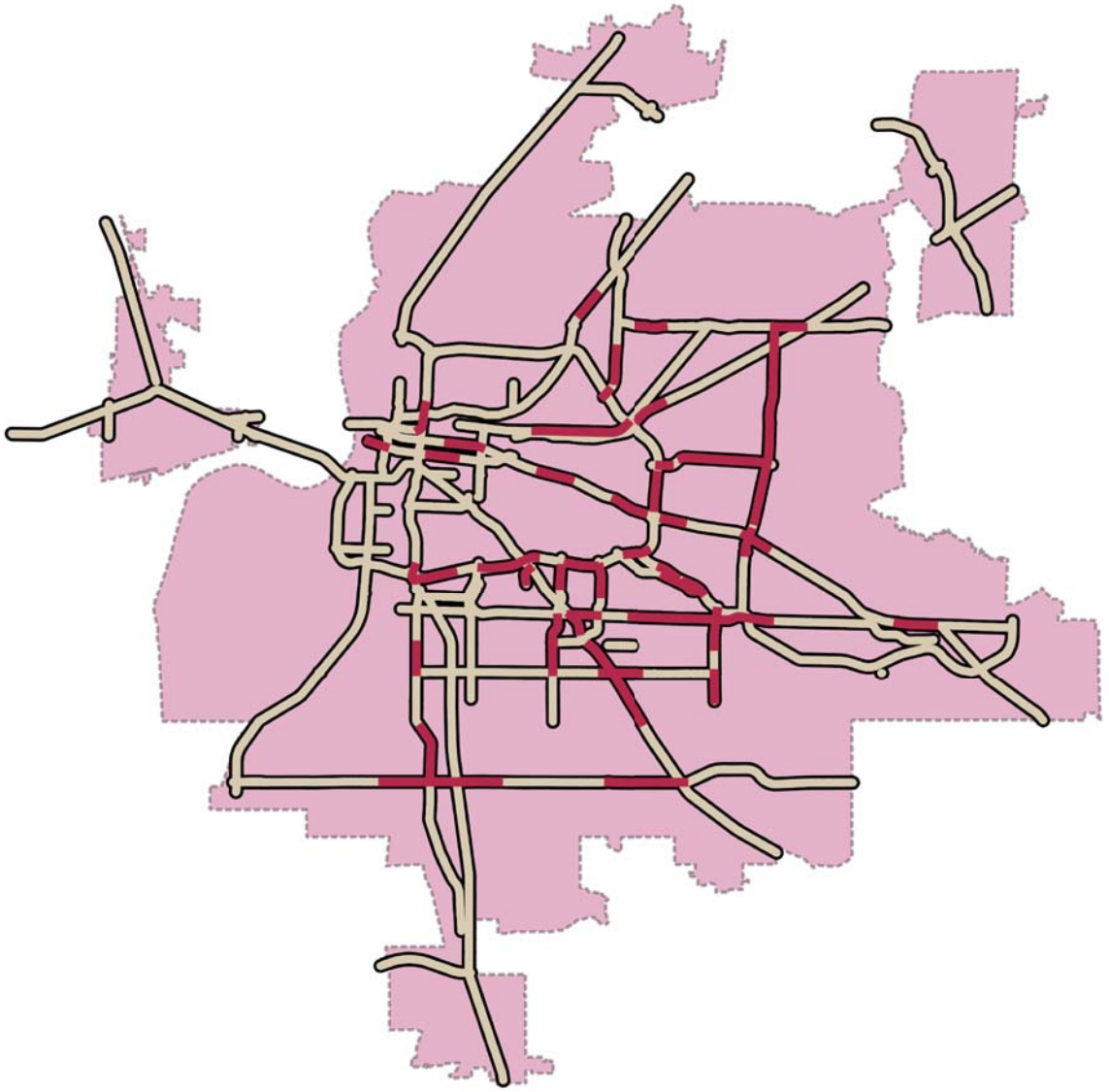
Link Contributions

of Links: 75/1394
Percent of PHED Values: 40%



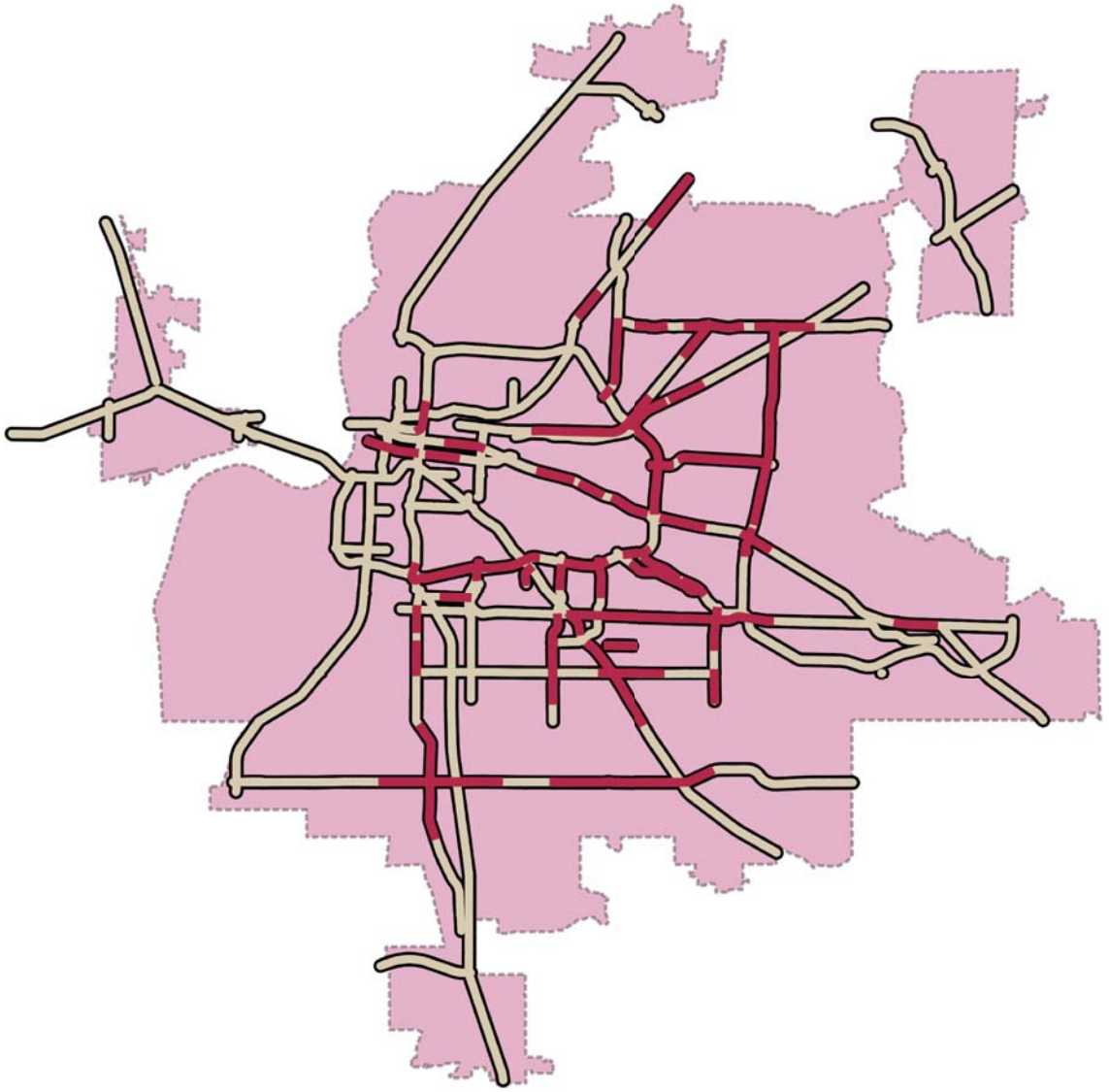
Link Contributions

of Links: 113/1394
Percent of PHED Values: 50%



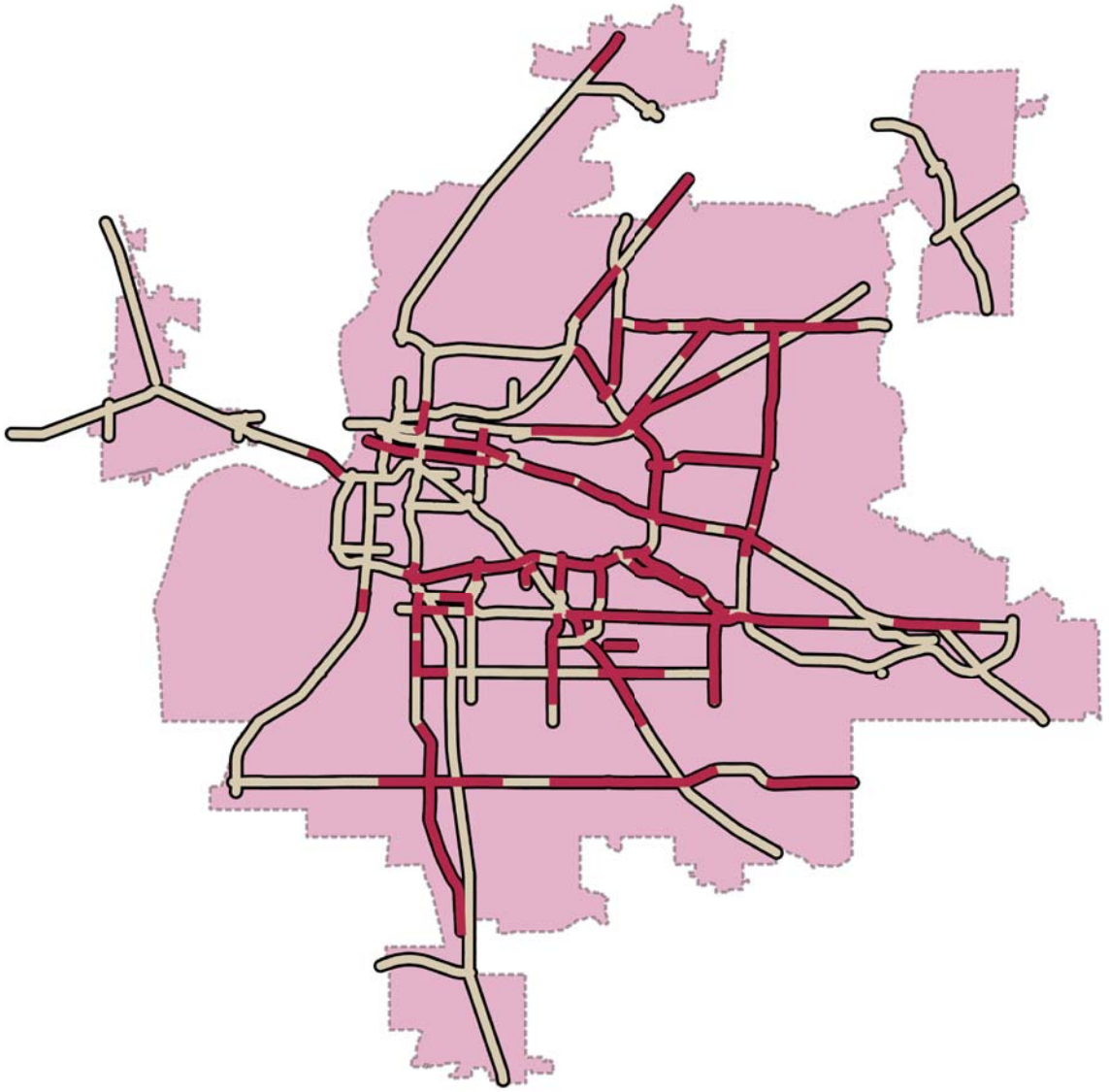
Link Contributions

of Links: 161/1394
Percent of PHED Values: 60%



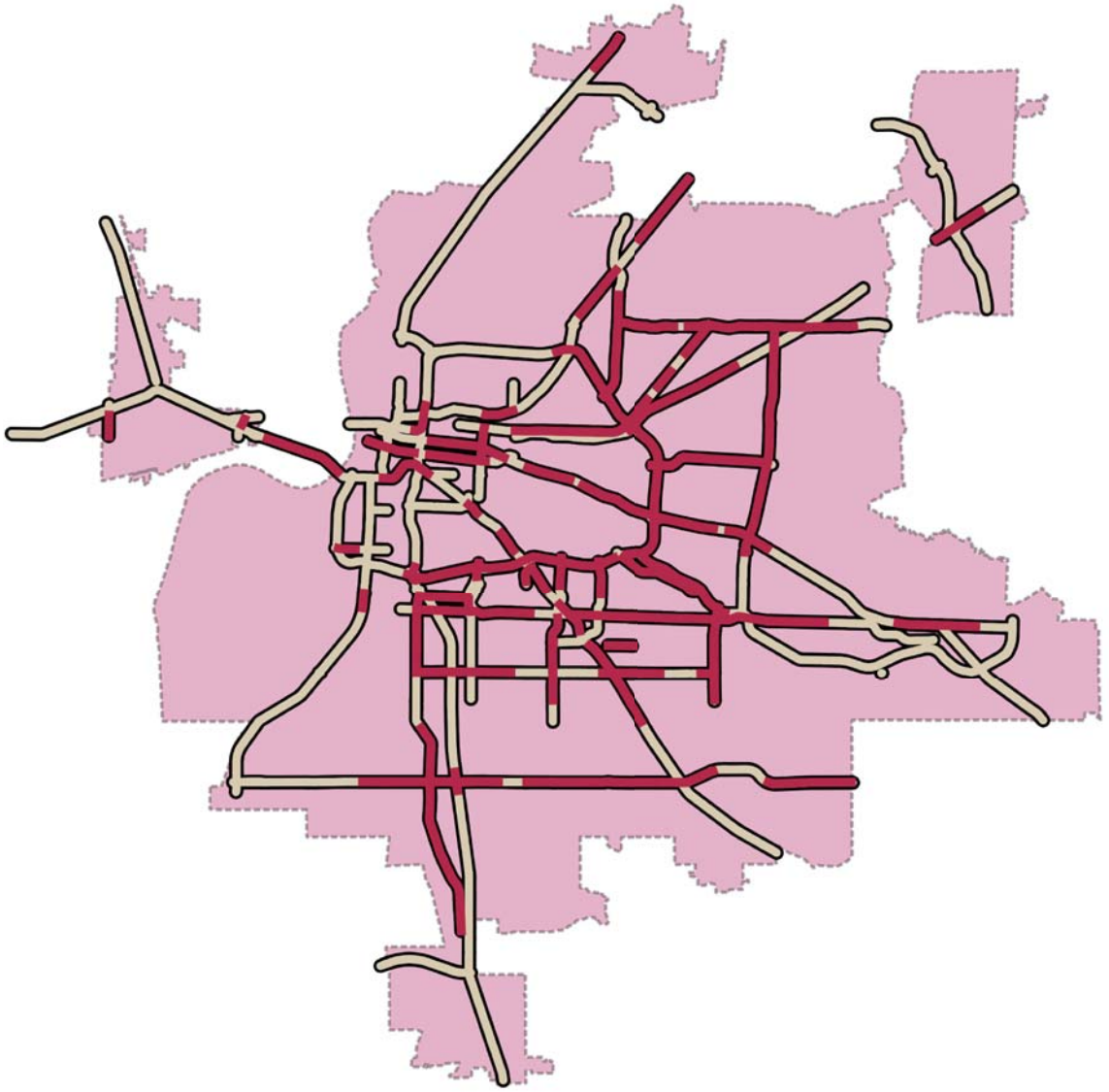
Link Contributions

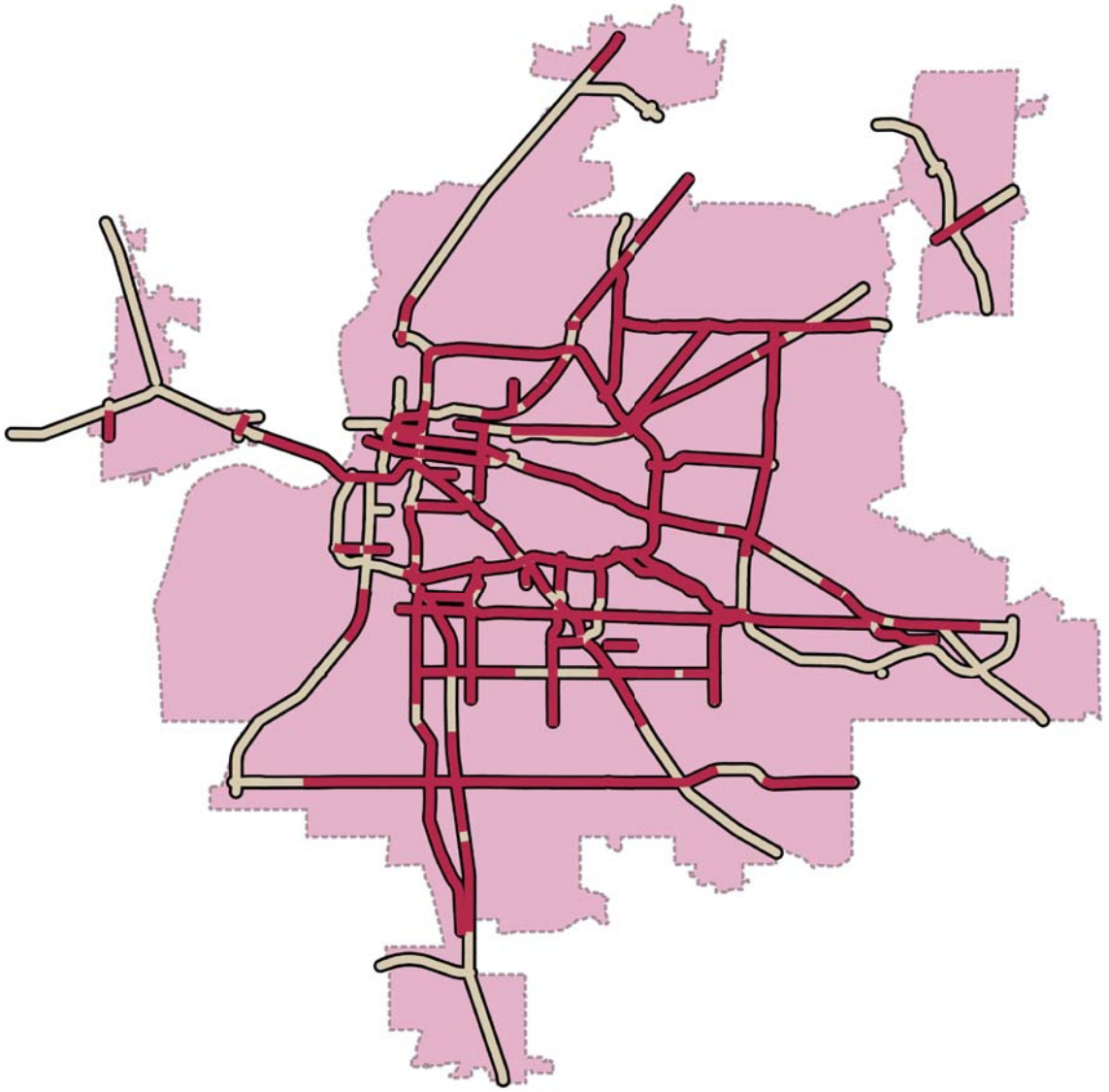
of Links: 229/1394
Percent of PHED Values: 70%



Link Contributions

of Links: 329/1394
Percent of PHED Values: 80%



Link Contributions

of Links: 498/1394
Percent of PHED Values: 90%