MIXED-USE TRIP GENERATION TOOLS

FEHR & PEERS | DC

TPB Travel Forecasting Subcommittee
November 15, 2019

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AGENDA

1. Mixed-Use Trip Generation Tools Overview
2. Montgomery County Site-Level Analysis
3. Insights from Arlington and Alexandria
4. Conclusions
5. Discussion

TRIP GENERATION: 7 LEVELS OF SOPHISTICATION

1. ITE Standard Trip Generation Rates
2. ITE Standard Trip Generation Rates + Regression Formulas
3. ITE Standard Trip Generation Rates + ITE Handbook (Mixed-Use Reductions)
4. EPA MXD Model Application
5. MXD+ Model Application
6. MainStreet Web App, powered by MXD+
7. Custom Trip Generation Model and Tool (e.g., TripsDC)

ITE TRIP GEN MANUAL

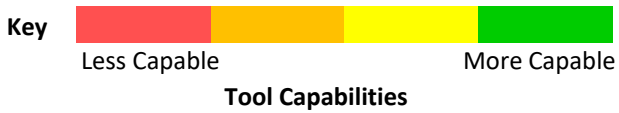
9TH EDITION

- Peak hour vehicle trips by land use
- Uses average rate or regression
- Reduction for internal capture in multi-use developments

10TH EDITION

- Peak hour trips by mode (total person, auto-driver, auto-passenger, transit, non-motorized)
- Calculated using mode splits applied to vehicle trip generation

		ITE 9th Edition	ITE 10th Edition
Applicable Land Use Types		Most	Most
Tool Sensitivity to…	Parking	No	No
	Land Use Mix	No	Yes
	Demographic & Built Env. Context Variables	No	General
Estimates Provided	Vehicle Trips	Direct	Direct
	Person Trips	No	General
	Transit Trips	No	General
	Walk Trips	No	General; combined
	Bike Trips	No	



M-NCPPC LATR

- Adjustment to vehicle trips calculated from the ITE 10th Edition
- Vehicle trip generation rate adjustment factors by policy area and land use type
- Transit proximity and parking management adjustments

		LATR
Applicable Land Use Types		Most
Tool Sensitivity to…	Parking	No*
	Land Use Mix	No
	Demographic & Built Env. Context Variables	Policy Area
Estimates Provided	Vehicle Trips	Direct
	Person Trips	Policy Area
	Transit Trips	Policy Area
	Walk Trips	Policy Area
	Bike Trips	Policy Area

M-NCPPC LATR ADJUSTMENTS

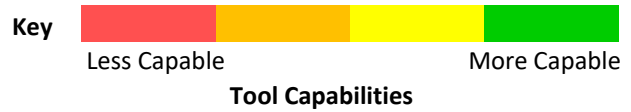
Appendix 1a: Institute of Transportation Engineers Vehicle-Trip Generation Rate Adjustment Factors

Appendix Table 1a: ITE Vehicle-Trip Generation Rate Adjustment Factors					
	Policy Area #	Residential	Office	Retail	Other
1	Aspen Hill	97%	98%	99%	97%
2	Bethesda CBD	79%	63%	61%	62%
3	Bethesda/Chevy Chase	87%	81%	85%	79%
4	Burtonsville Town Center	96%	96%	99%	97%
5	Chevy Chase Lake	87%	81%	85%	79%
6	Clarksburg	100%	101%	100%	100%
7	Clarksburg Town Center	100%	101%	100%	100%
8	Cloverly	99%	101%	100%	101%
9	Damascus	101%	100%	100%	100%
10	Derwood	94%	94%	87%	94%
11	Fairland/Colesville	96%	96%	99%	97%
12	Friendship Heights	78%	70%	73%	70%
13	Gaithersburg City	88%	86%	76%	85%
14	Germantown East	95%	95%	97%	91%
15	Germantown Town Center	89%	91%	89%	90%
16	Germantown West	93%	90%	92%	88%
17	Glenmont	90%	91%	96%	91%
18	Grosvenor	81%	84%	75%	80%
19	Kensington/Wheaton	91%	92%	96%	92%
20	Long Branch	91%	92%	96%	92%
21	Montgomery Village/Airpark	93%	102%	93%	102%
22	North Bethesda	83%	87%	71%	82%
23	North Potomac	97%	100%	100%	100%

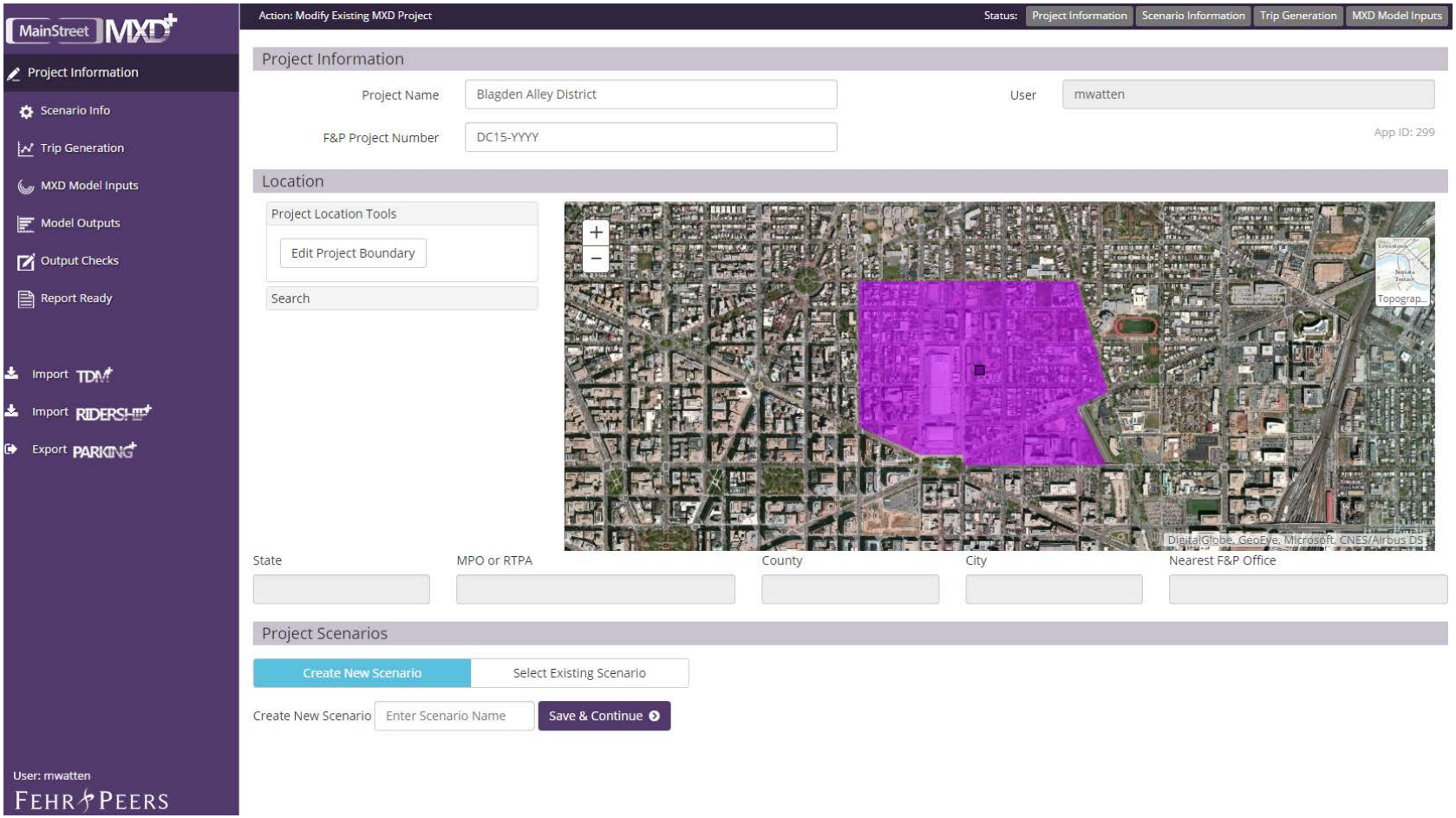
MXD+ (9TH & 10TH EDITIONS)

- Adjustments to ITE Trip Generation (9th & 10th Editions)
- Estimated from national data (~240 sites) with a wide range of characteristics
- Introduces sensitivity to site-level built environment and demographic factors, such as…
  - Developed area
  - Intersection density
  - Vehicle ownership
  - Employment within one mile
  - Employment within 30 minutes transit
  - Employment and population density

		MXD + 9th	MXD+ 10th
Applicable Land Use Types		Most	Most
Tool Sensitivity to…	Parking	No	No
	Land Use Mix	Yes	Yes
	Demographic & Built Env. Context Variables	Site Specific	Site Specific
Estimates Provided	Vehicle Trips	Direct	Direct
	Person Trips	Indirect	Indirect
	Transit Trips	Indirect; Combined	Indirect; Combined
	Walk Trips		
	Bike Trips		



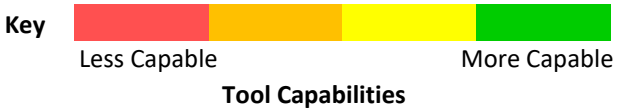
MXD+ MAINSTREET APP



TRIPSDC

- Estimated from 55 Residential + Retail sites in D.C.
- Independent, two-stage estimate of person trips and trips by auto, transit, walk, and bike as distinct modes
- **Person Trip Generation** is a linear model based on magnitude of residential units and commercial square footage
- **Mode Choice** is a multinomial logistic regression with seven independent context variables…

		TripsDC (DC)
Applicable Land Use Types		Res/Retail
Tool Sensitivity to…	Parking	Yes
	Land Use Mix	Yes
	Demographic & Built Env. Context Variables	Site Specific
Estimates Provided	Vehicle Trips	Direct
	Person Trips	Direct
	Transit Trips	Direct
	Walk Trips	Direct
	Bike Trips	Direct



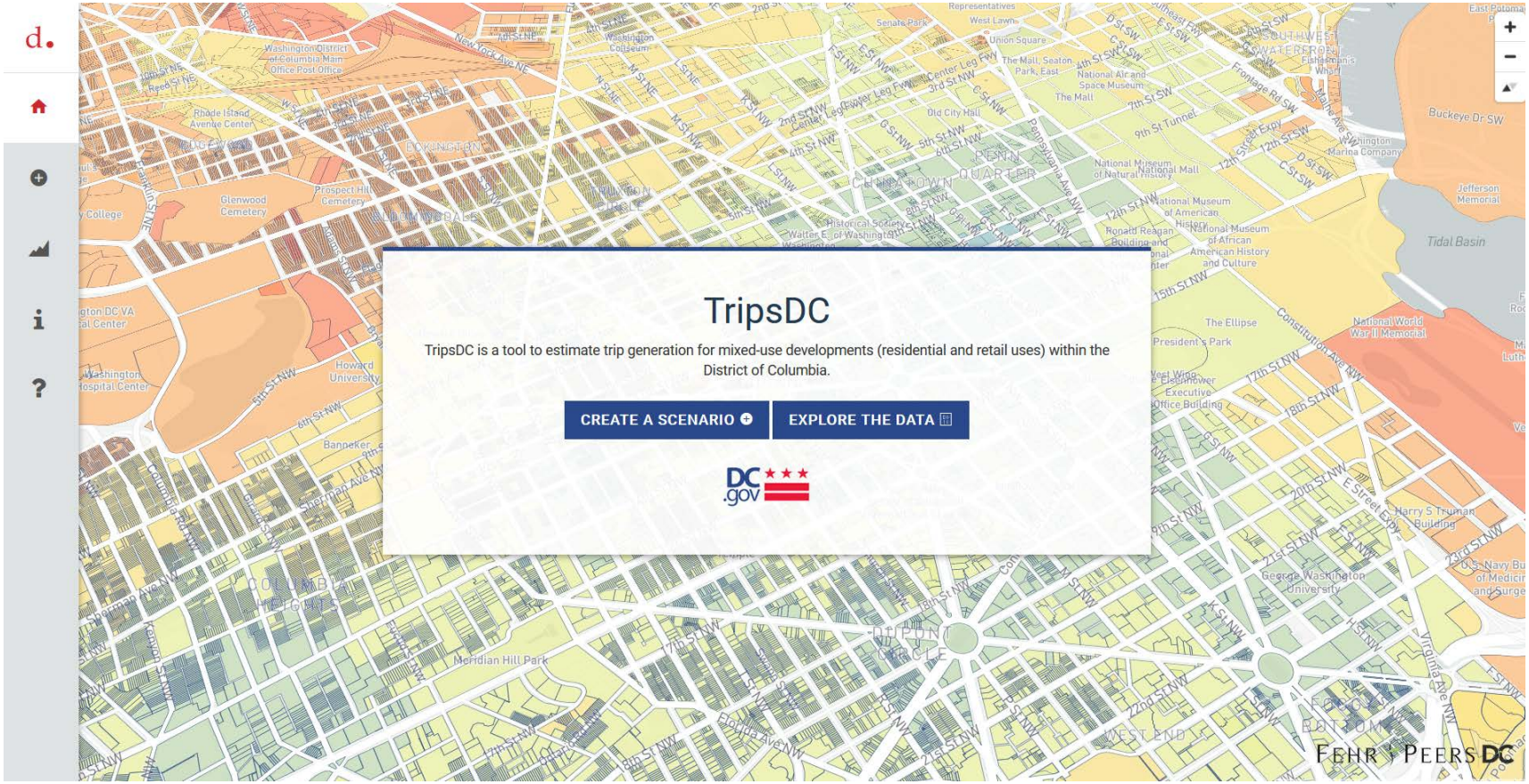
TRIPSDC MODE CHOICE VARS.

- Employment within one mile
- Neighborhood population density
- Parking provided per service population
- Distance to transit <0.25 miles
- Transit/auto competitiveness (45 minutes)
- Transit service intensity

		TripsDC (DC)
Applicable Land Use Types		Res/Retail
Tool Sensitivity to...	Parking	Yes
	Land Use Mix	Yes
	Demographic & Built Env. Context Variables	Site Specific
Estimates Provided	Vehicle Trips	Direct
	Person Trips	Direct
	Transit Trips	Direct
	Walk Trips	Direct
	Bike Trips	Direct

Tool Capabilities

TRIPSDC WEB APP: TripsDC.org



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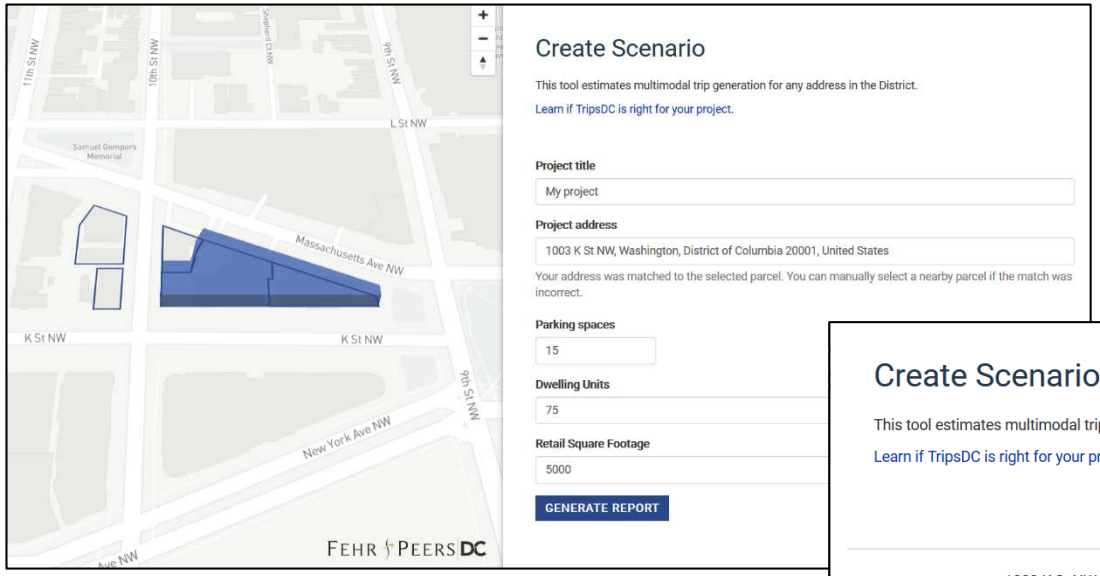
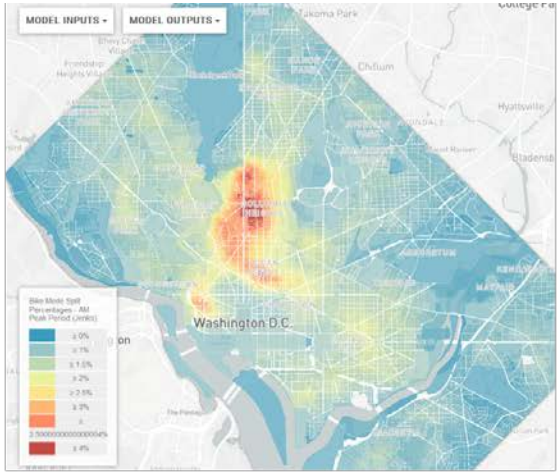
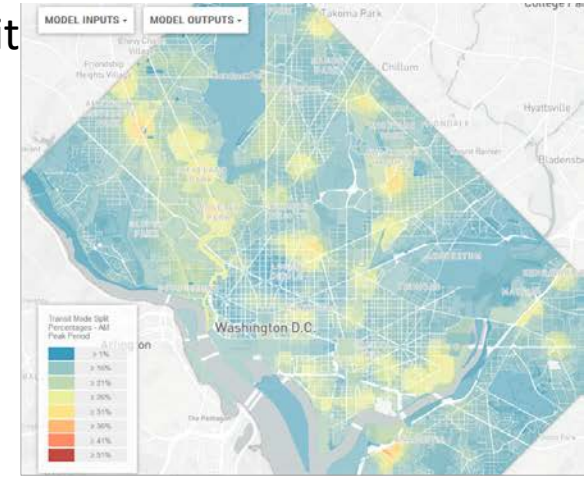


TRIPSDC WEB APP: TripsDC.org

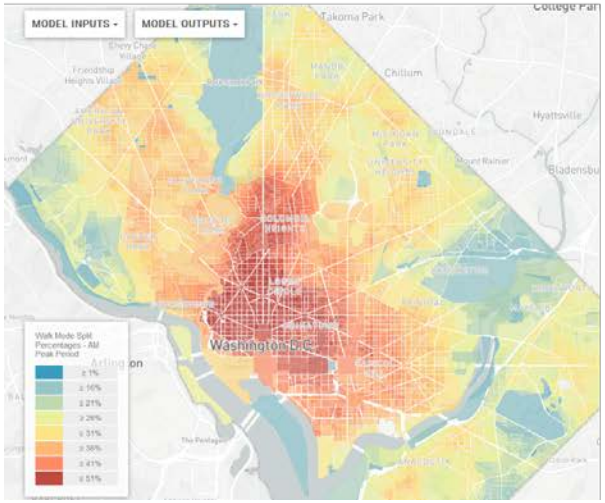
Bike



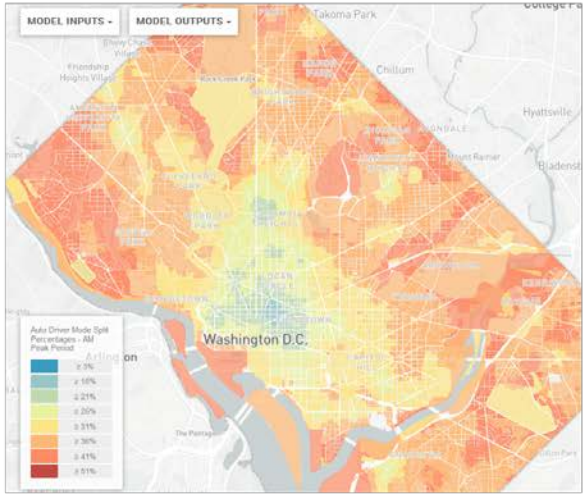
Transit



Walk



Auto



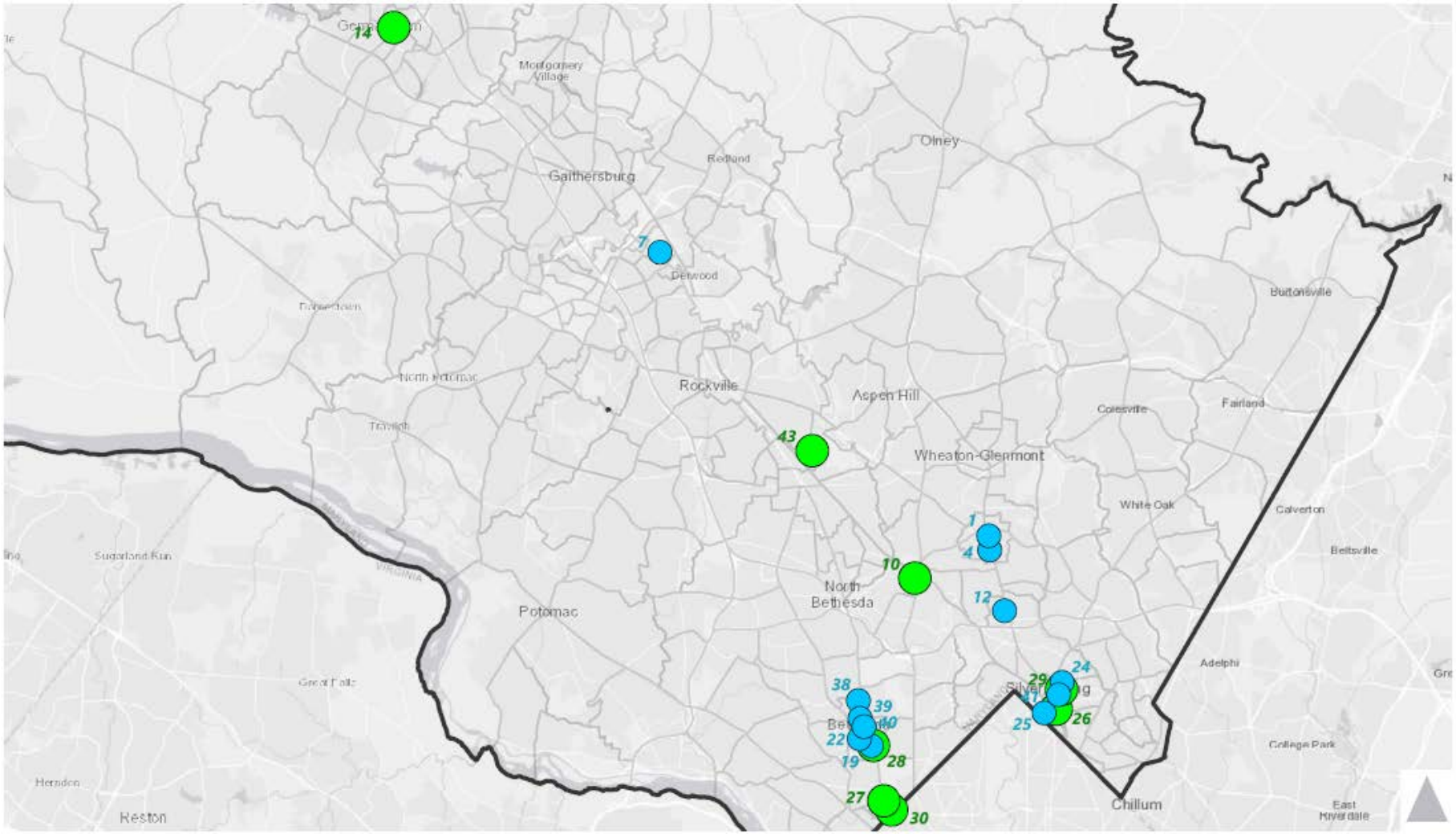
TOOLS SUMMARY

		LATR	ITE 9th Edition	ITE 10th Edition	MXD + 9th	MXD+ 10th	TripsDC (DC)
Applicable Land Use Types		Most	Most	Most	Most	Most	Res/Retail
Tool Sensitivity to…	Parking	No	No	No	No	No	Yes
	Land Use Mix	No	No	Yes	Yes	Yes	Yes
	Demographic & Built Env. Context Variables	Policy Area	No	General	Site Specific	Site Specific	Site Specific
Estimates Provided	Vehicle Trips	Direct	Direct	Direct	Direct	Direct	Direct
	Person Trips	Policy Area	No	General	Indirect	Indirect	Direct
	Transit Trips	Policy Area	No	General	Indirect; Combined	Indirect; Combined	Direct
	Walk Trips	Policy Area	No	General; combined			Direct
	Bike Trips	Policy Area	No				Direct

Key

Less Capable — More Capable

Tool Capabilities



Residential with Retail

Office with Retail

M-NCPPC: ANALYSIS SITES

M-NCPPC: COMPARISON METRIC

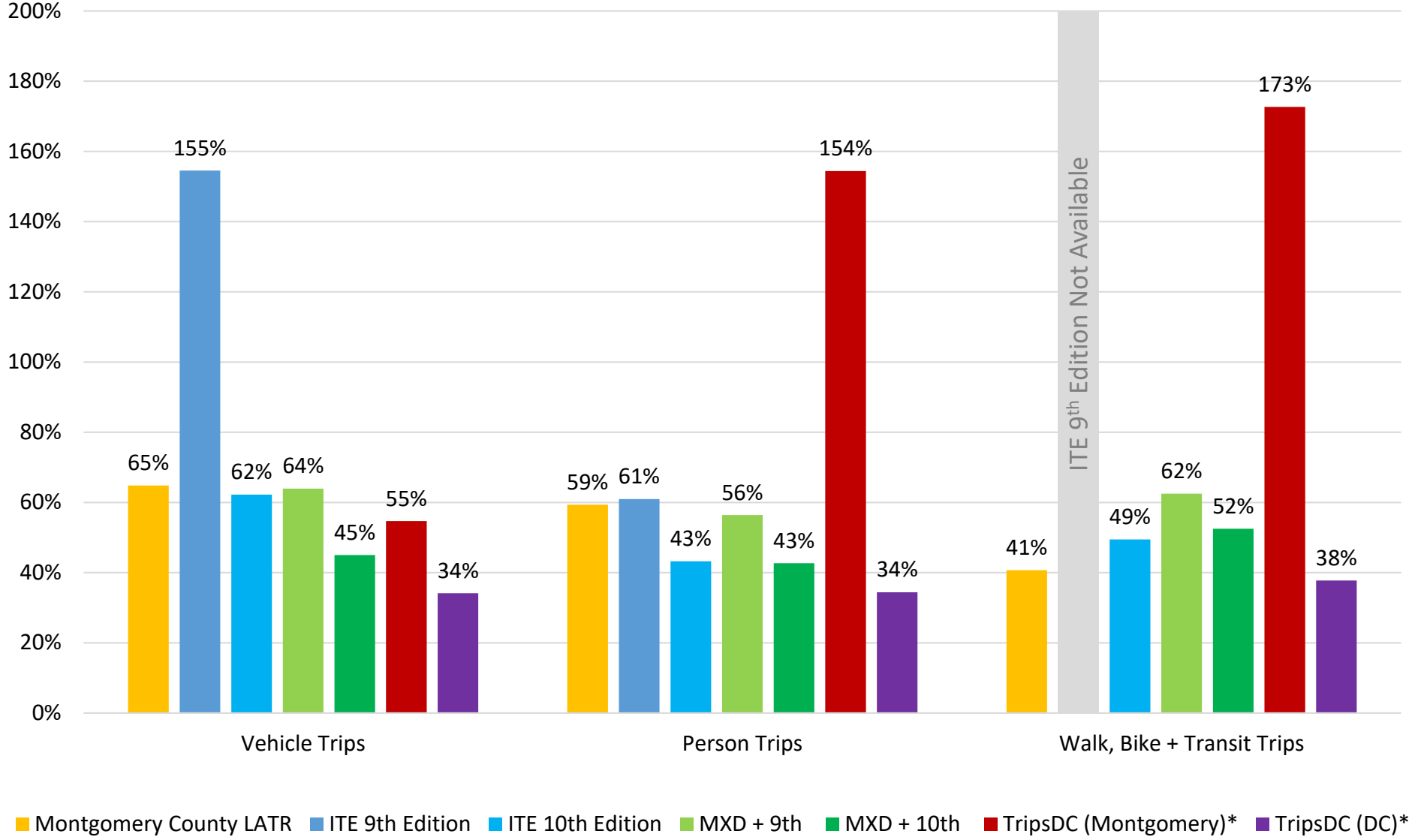
- Weighted Mean Absolute Percent Error (WMAPE)

$$\left|\frac{Estimate\ -Observed}{Observed}\right|$$

- Average across all sites and both peak hours, weighted by observed count

*For person trip comparison for ITE 9th Edition, all vehicle trips are counted as person trips.

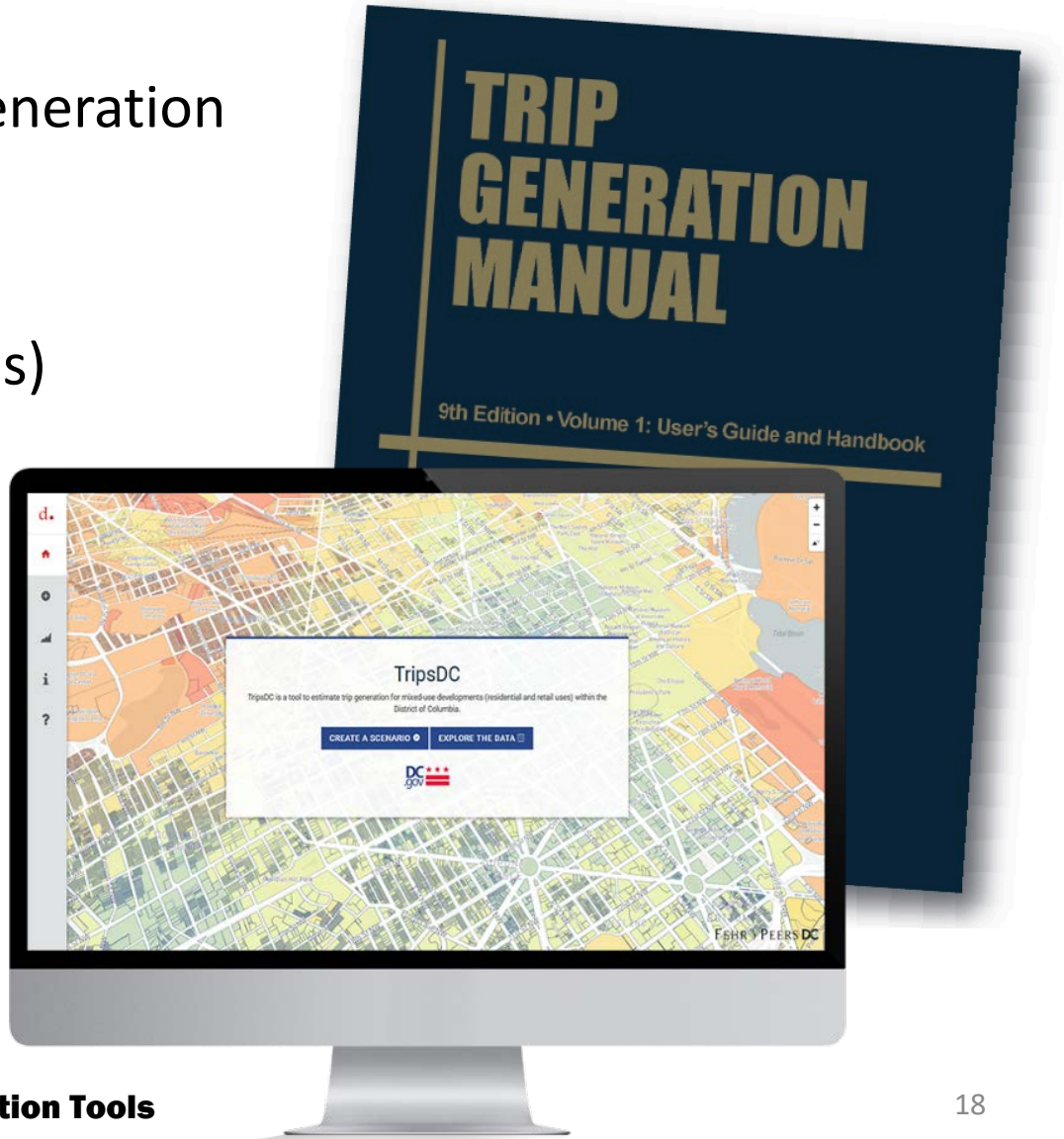
Overall Weighted Mean Absolute Percent Error (WMAPE)



*Residential over Retail Sites Only

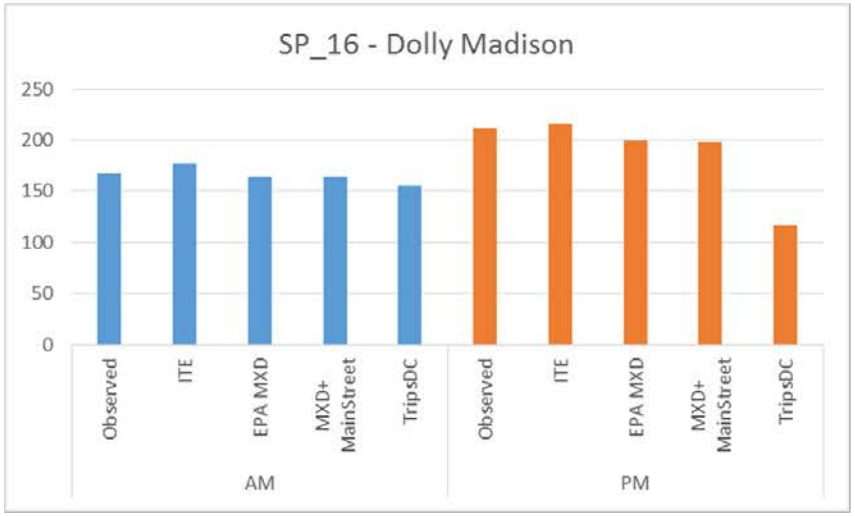
ARLINGTON: TOOLS TESTED

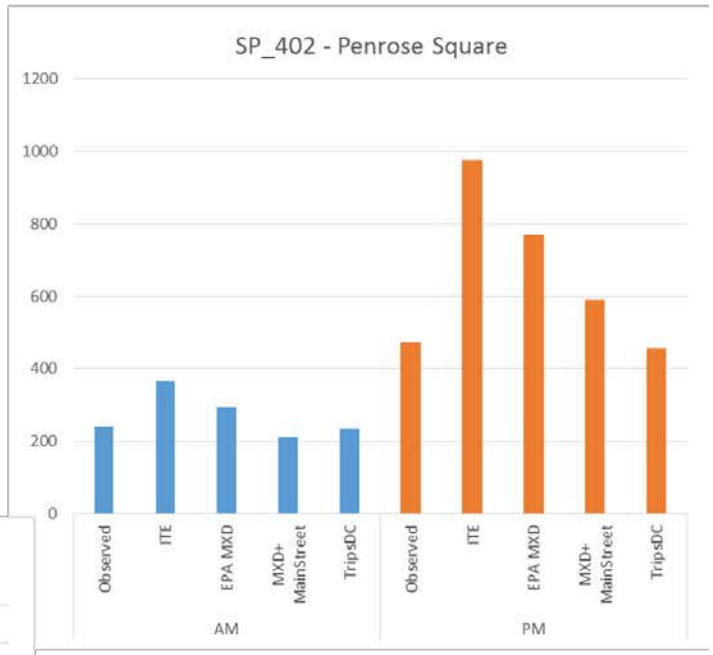
- ITE 9th Edition Trip Generation
- EPA MXD
- MXD+ (ITE 9th Editions)
- TripsDC

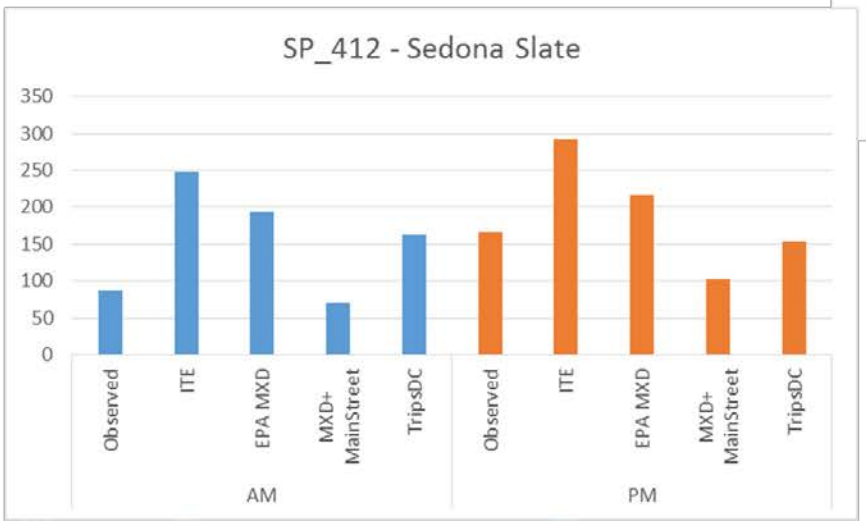


5 Mixed-Use Sites

ARLINGTON: RESULTS





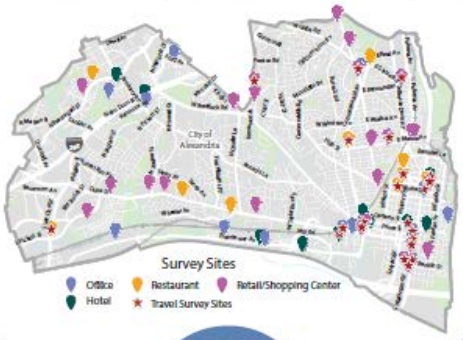


ALEXANDRIA COMMERCIAL PARKING STANDARDS STUDY

Figure 6

Alexandria Commercial Parking Standards Study

This study collected travel and parking data throughout Alexandria to inform recommendations for updated commercial parking standards. Data collection was conducted in spring 2017 and included observed peak hour parking occupancy at 60 commercial sites, travel surveys at 22 sites, and cell phone data about vehicle trips made to/from these sites. Travel surveys asked travelers what business they were visiting, how they got to the site, and where they parked (if traveling in a car).



150 commercial projects were reviewed in the last 5 years

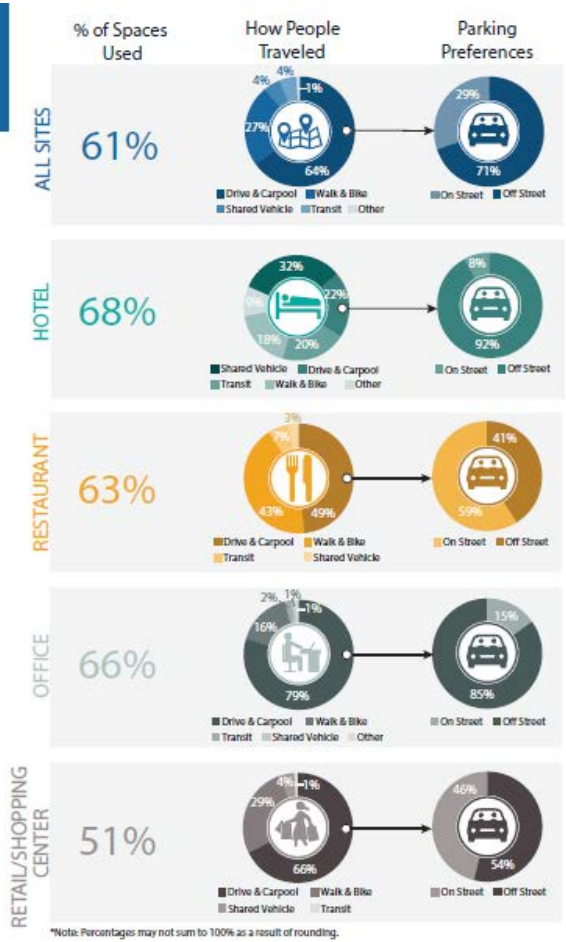
88% of surveyed parking lots were less than 85% full

98% of surveyed sites had lower parking demand than required by the existing ordinance

40% requested parking reductions. ALL reductions were approved

39% of spaces empty during peak hour

45% of trips required used on site parking



REGIONAL DATA SUMMARY

	Washington, D.C	Alexandria, VA	Arlington County*	Montgomery County
Vehicle Trips	Yes	Yes	Yes	Yes
Person Trips	Yes	Yes	No	Yes
Multi-modal Trips	Yes	Yes	No	Yes
Daily / AM / PM	AM / PM	PM Only	Daily / AM / PM	AM / PM
Parking Supply	Yes	Yes	Yes	Yes
Number of Sites by Land Use Type				
Residential Only	**8**	—	**2**	**6**
Residential / Retail	**48**	**7**	**2**	**6**
Residential / Retail / Hotel	**1**	**1**	—	—
Residential / Retail / Office	**1**	—	**1**	—
Office / Retail	**3**	**6**	—	**8**
Hotel / Retail	**2**	**2**	—	—
Hotel Only	**1**	—	—	—
Retail Only	—	**6**	—	—
Total	**64**	**22**	**5**	**20**

*Site-level data are likely available for additional sites.

CONCLUSIONS

1. MXD+ provides improved vehicle and person trip accuracy.
2. Custom tools can provide:
   a) Sensitivity to key policy variables (e.g. parking supply)
   b) Significantly better and individually estimated person, vehicle, walk, bike, and transit trip estimates...
3. …but need key variables and local calibration.
4. Regional data are available.

QUESTION

Could multiple jurisdictions collaborate to:

a) Leverage locally collected data; and

b) Pool resources for custom trip generation tool development?

Discussion

FEHR PEERS DC

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