



**Quick Ways to Use NHTS Data to Support Regional Travel Demand Model Calibration: A Focus on Pedestrian Trips**

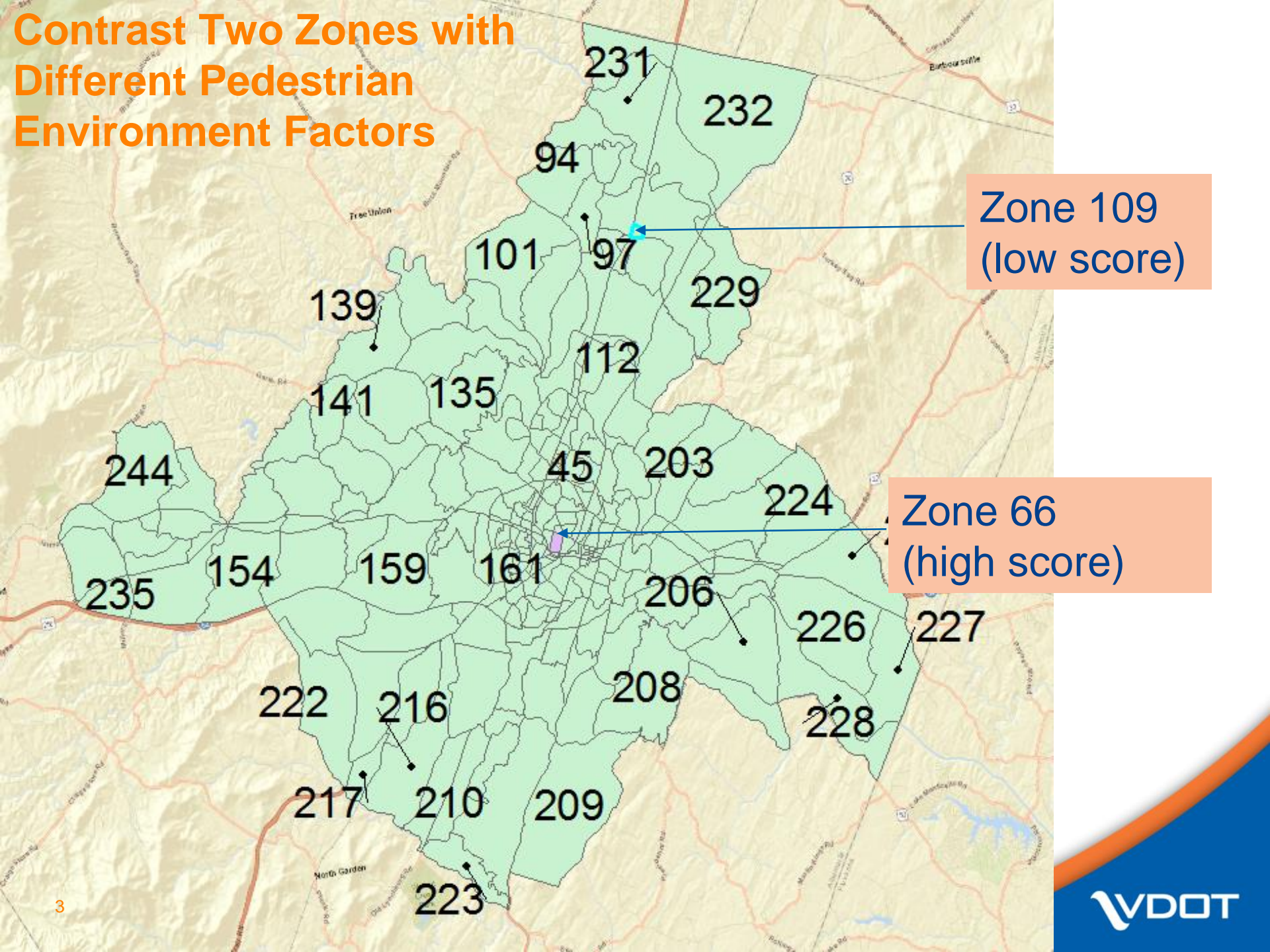
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**August 9, 2018**

# Five Major Questions

1. **Is there an association between population density and either pedestrian environment factors or pedestrian trips in our model?**
2. **What relationship, if any, exists between pedestrian trips and density according to the NHTS?**
3. **How can we quickly update the regional model based on the NHTS findings from step 2?**
4. **How do forecast pedestrian trips compare to observed ground counts?**
5. **How does an updated model affect investment decisions?**

# Contrast Two Zones with Different Pedestrian Environment Factors



Zone 109  
(low score)

Zone 66  
(high score)

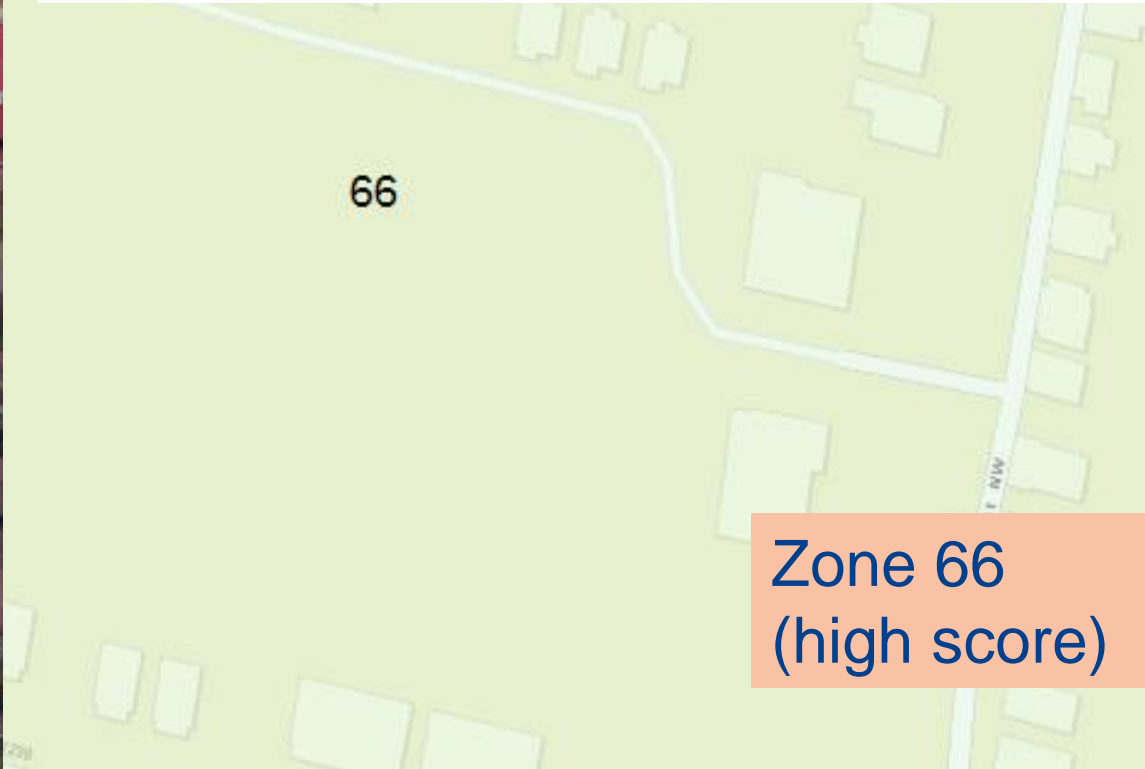
Sidewalk availability:	0%	(0)
Easy street crossings	<10%	(1)
Nonmotorized connections	<10%	(1)
Minimum setbacks	<10%	(1)

Zone 109  
(low score)





Sidewalk availability:	100% (3)
Easy street crossings	>90% (3)
Nonmotorized connections	>90% (3)
Minimum setbacks	>90% (3)



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Map data © 2018 Google

DOT

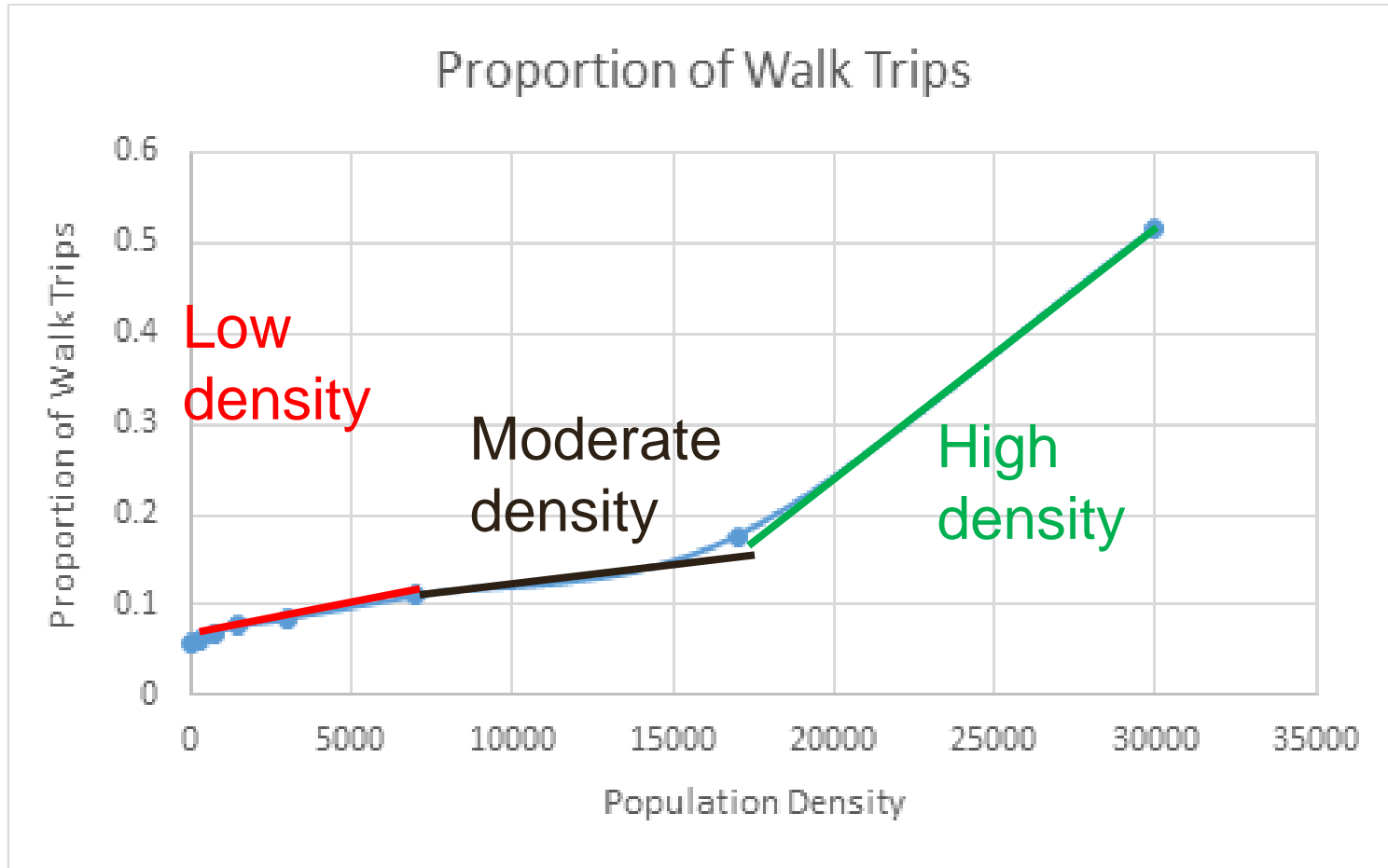
## Results of Step 1 With the Base Year 2010 Model

- ❑ **Surprise: Very weak correlation between population density (people/mile<sup>2</sup>) and the pedestrian environment (0.30)**
- ❑ **Good news: Stronger correlation between population density and proportion of trips in the model that are pedestrian (0.74)**
- ❑ **Promising equation from the 2010 model:**
  - ❑ **Density explains 55% of the variation in proportion of pedestrian trips**
  - ❑ **Density is significant ( $p < 0.01$ )**

$$\text{Percent of Trips that are Pedestrian} = 0.00001227 * (\text{Population Density}) + 0.00736896$$

- ❑ **Suggestion: Let's use NHTS data to relate density with proportion of trips that are pedestrian for year 2017.**

## Step 2. Notice Proportion of Trips that are Pedestrian Does Not Follow a Smooth Curve!



However, a concern is that one might overfit models to data, so linear models were used.

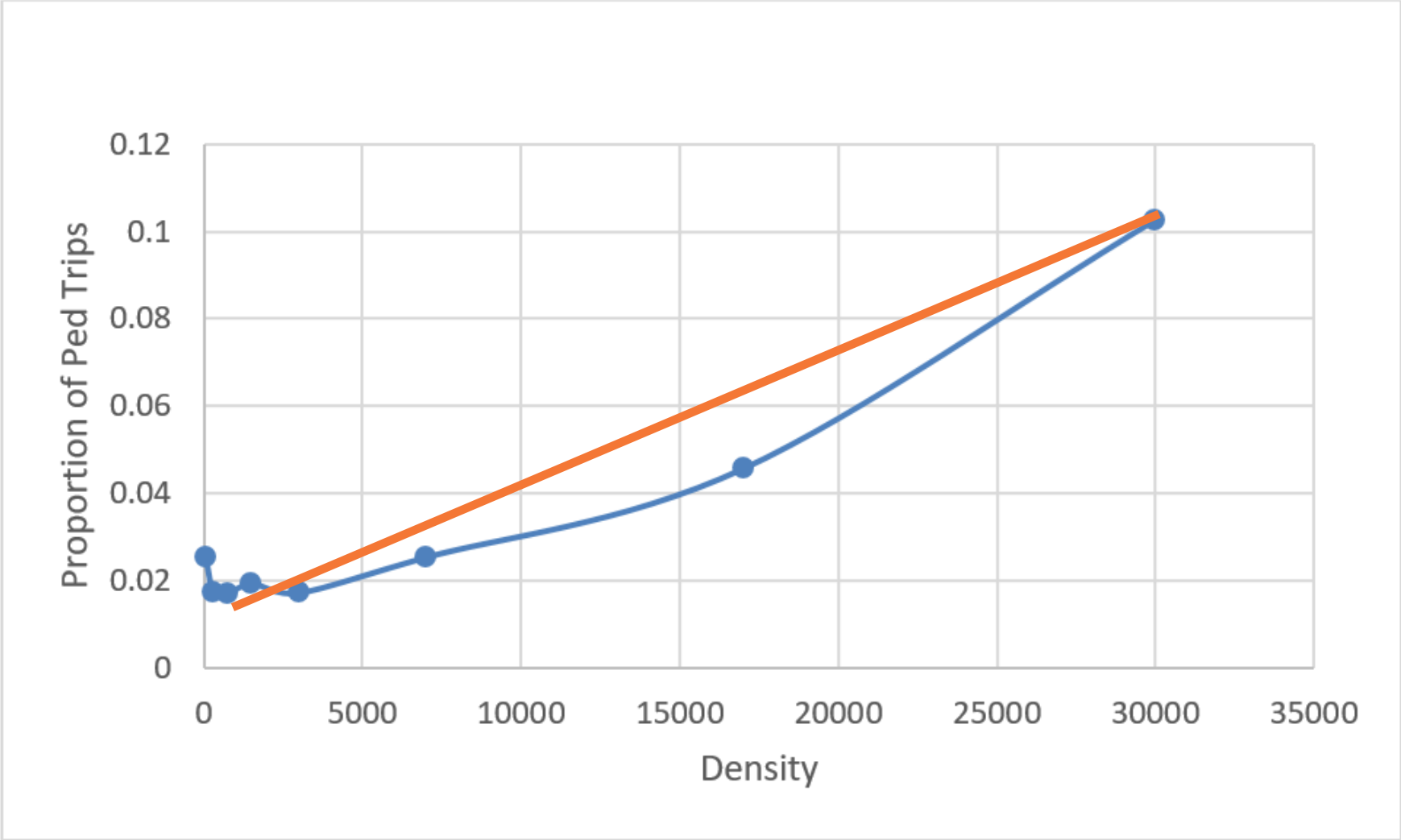
## Proportion of Pedestrian Trips is Equal to:

Vehicle Available?	Trip Purpose	Equation (R <sup>2</sup> , p-value of density)
Yes	HBW	$0.01435 + 0.000003 * \text{density}$
	HBO	$0.09030 + 0.000006 * \text{density}$
No	HBW	$0.2056 + 0.000002 * \text{density}$
	HBO	$0.3144 + 0.000007 * \text{density}$
Yes or No	NHB	$0.0398 + 0.000011 * \text{density}$

These models forecast proportion of pedestrian trips as a function of density



# Example: Proportion of Pedestrian Trips for Home-Based Work (if a vehicle is available)



## Step 3. Modify the Regional Model to Update the Proportion of Pedestrian Trips by Zone

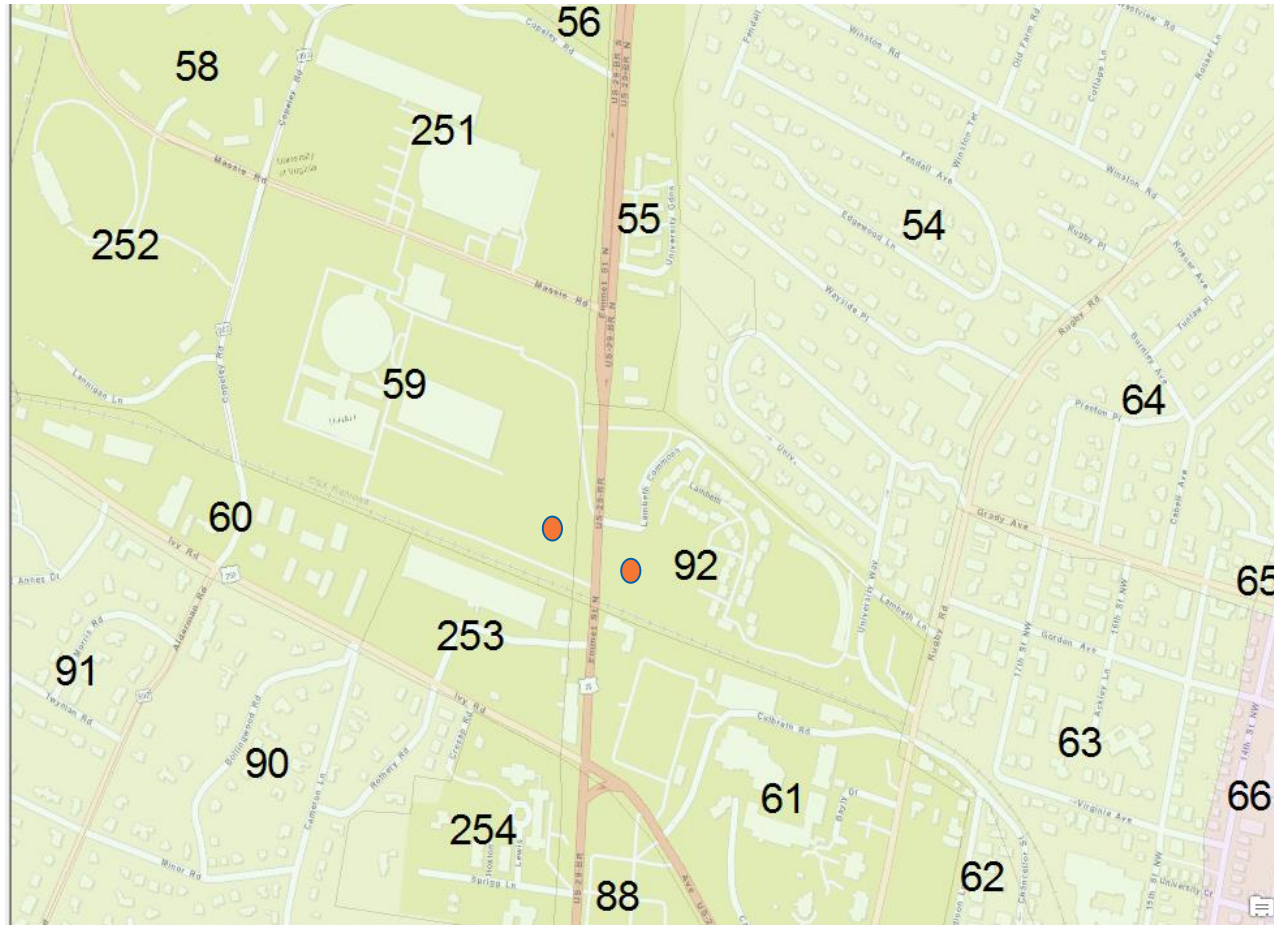
- ❑ Model has two sets of results: 2010 (base year) and 2025 (near-term forecasts)
- ❑ Used 2025 densities with equations on the previous slide to obtain proportion of pedestrian trips for each zone
- ❑ Used population of each zone to weight these pedestrian proportions

## Step 3 Results: Proportion of Pedestrian Trips for the Entire Region

Household Type	Trip purpose	2025 (original)	2025 (revised)
With a vehicle	Home-based work	1.83%	3.076%
	Home-based other	3.273%	12.312%
Without a vehicle	Home-based work	3.66%	no change
	Home-based other	6.546%	39.798%
All	Non-home based	2.661%	9.997%

*Note: the model mode shares did not change this dramatically, but pedestrian trips increased by about 5%*

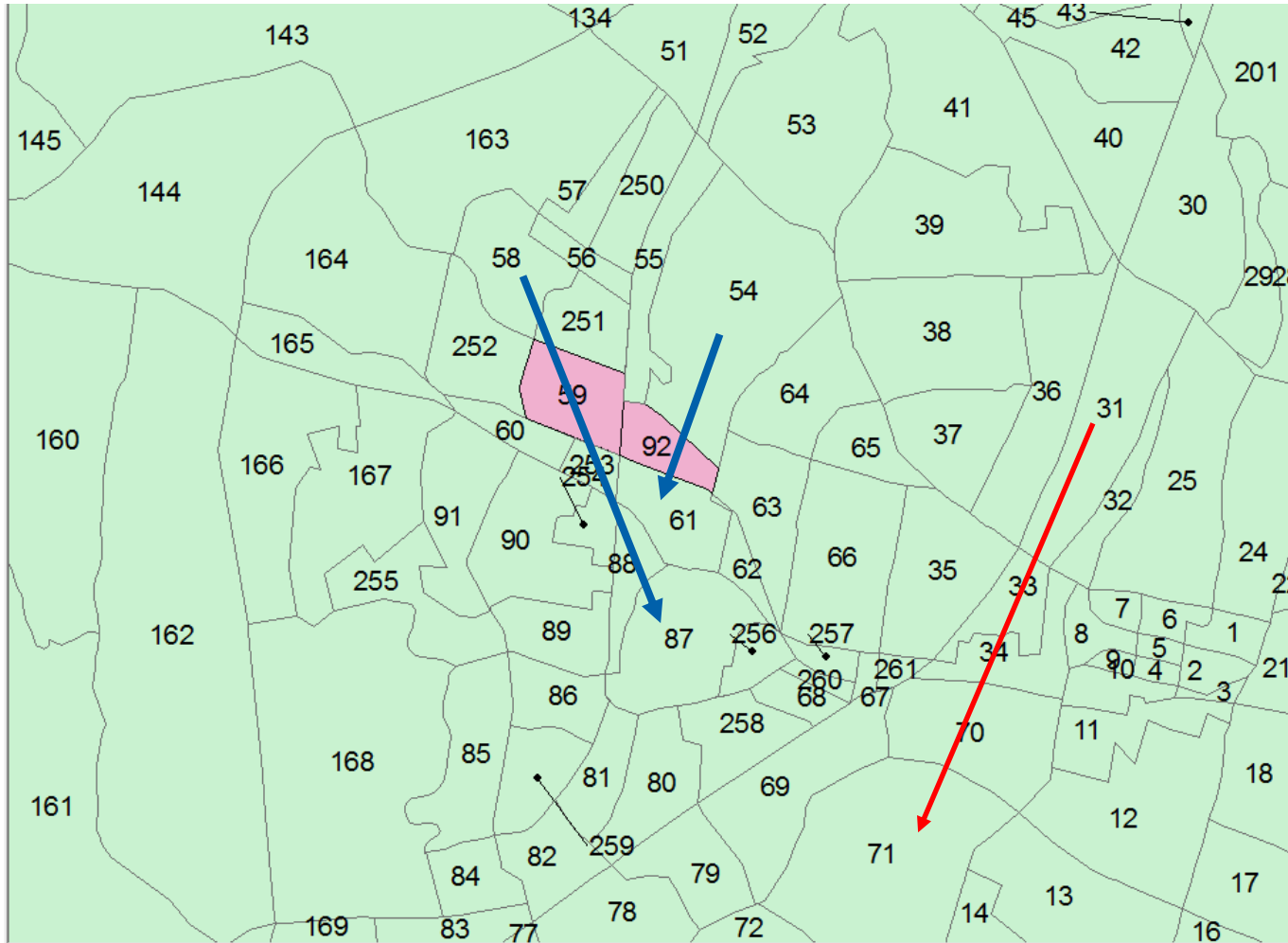
## Step 4. Compare Forecast and Observed Values



Pedestrian counter is located on Emmet Street in Zones 92 & 59

Let's compare the trips from the model that use this counter to the counted values

# Which Pedestrians Might Use these Zones?



Examples

Peds from Zone 54 to 61 (**likely**)

Peds within zone 92 (**maybe**)

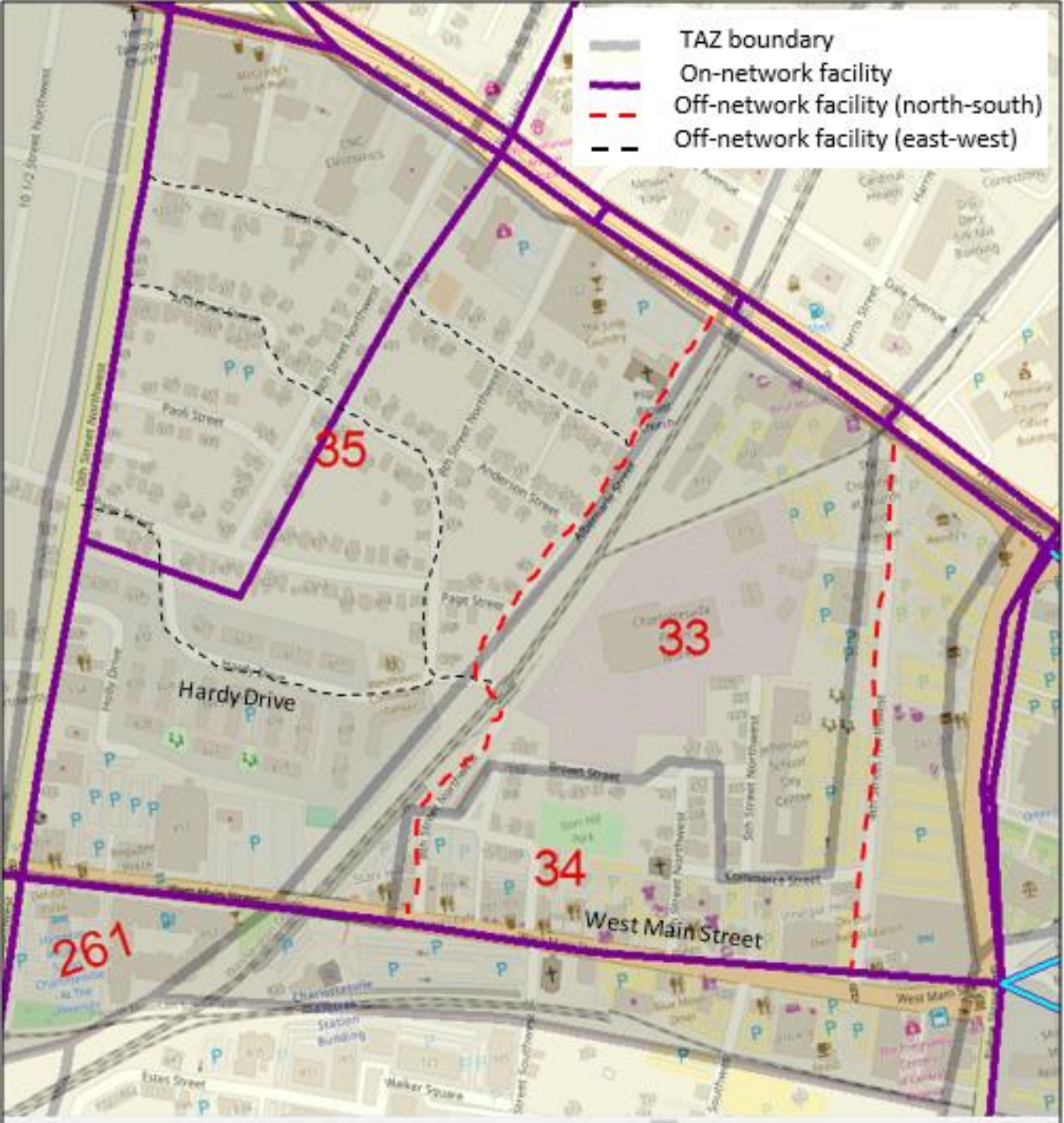
Peds from Zone 31 to 71 (**no**)

*With 262X262 desire lines, we don't want to do a manual tabulation!*

# A Limitation of Regional Models

Streets of use to pedestrians...

may not be on the network



## How Do We Automatically Determine Which of these Pedestrian Trips Will Likely Traverse Zones 59 and 92?

### Limitations

- ❑ Some pedestrian facilities are not on the network (previous slide)
- ❑ Regional models don't typically represent pedestrian link flows (below) but rather have a single OD table

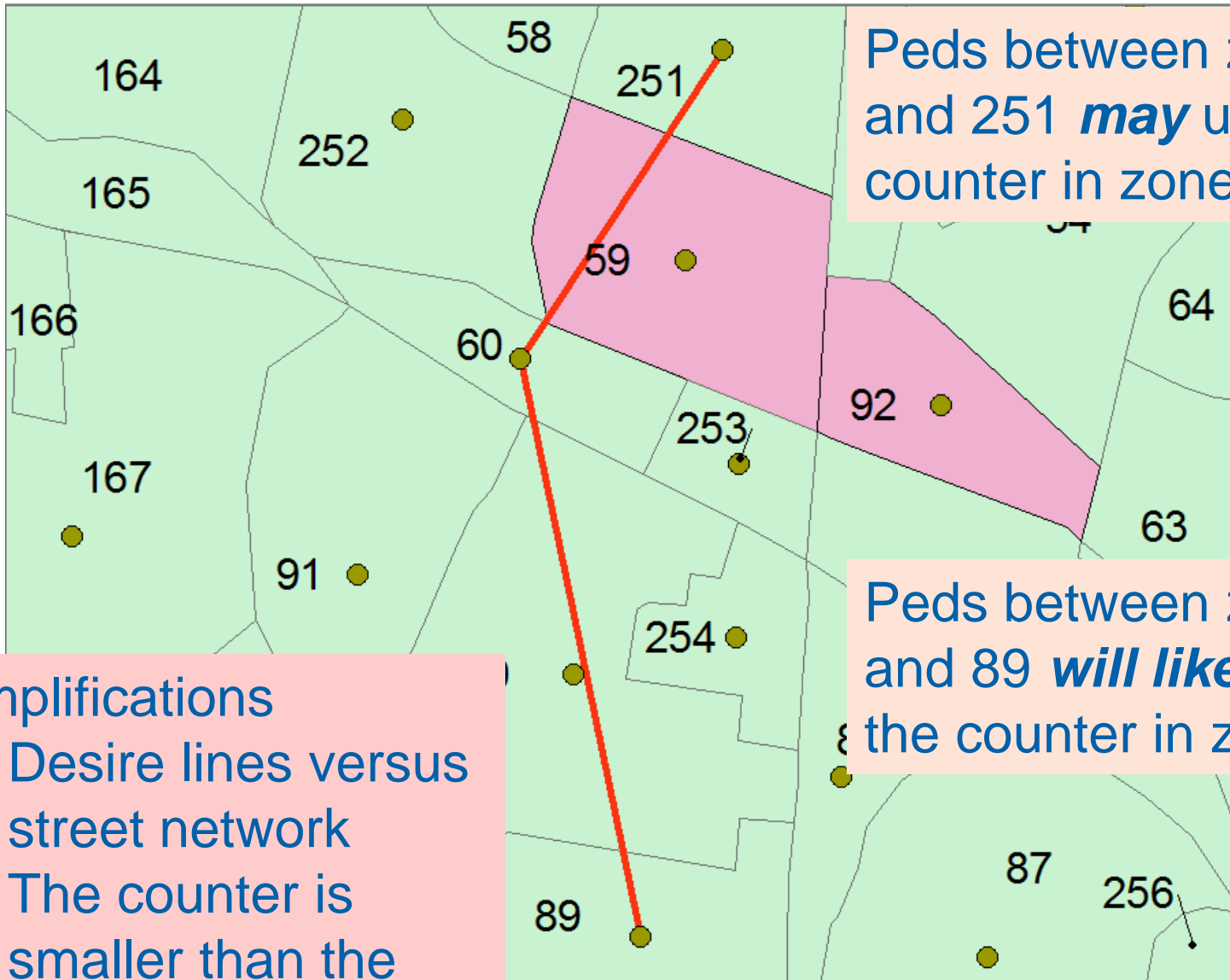
Zone	59	60	61	62	63
59	0.00	7.06	3.22	10.39	13.10
60	7.06	0.63	15.82	0.43	1.80
61	3.22	15.82	6.95	11.64	26.29
62	10.39	0.43	11.64	0.68	4.83
63	13.10	1.80	26.29	4.83	12.45

## Step 4. Approach with GIS Tools

- A. Generate a centroid for each zone
- B. Generate a “Near Table” with each possible centroid pair
- C. Create desire lines connecting each pair of centroids
- D. Overlay desire lines with pedestrian counters



## Example of Two Contrasting Desire Lines (Step 4c)



Peds between zones 60 and 251 **may** use the counter in zone 59

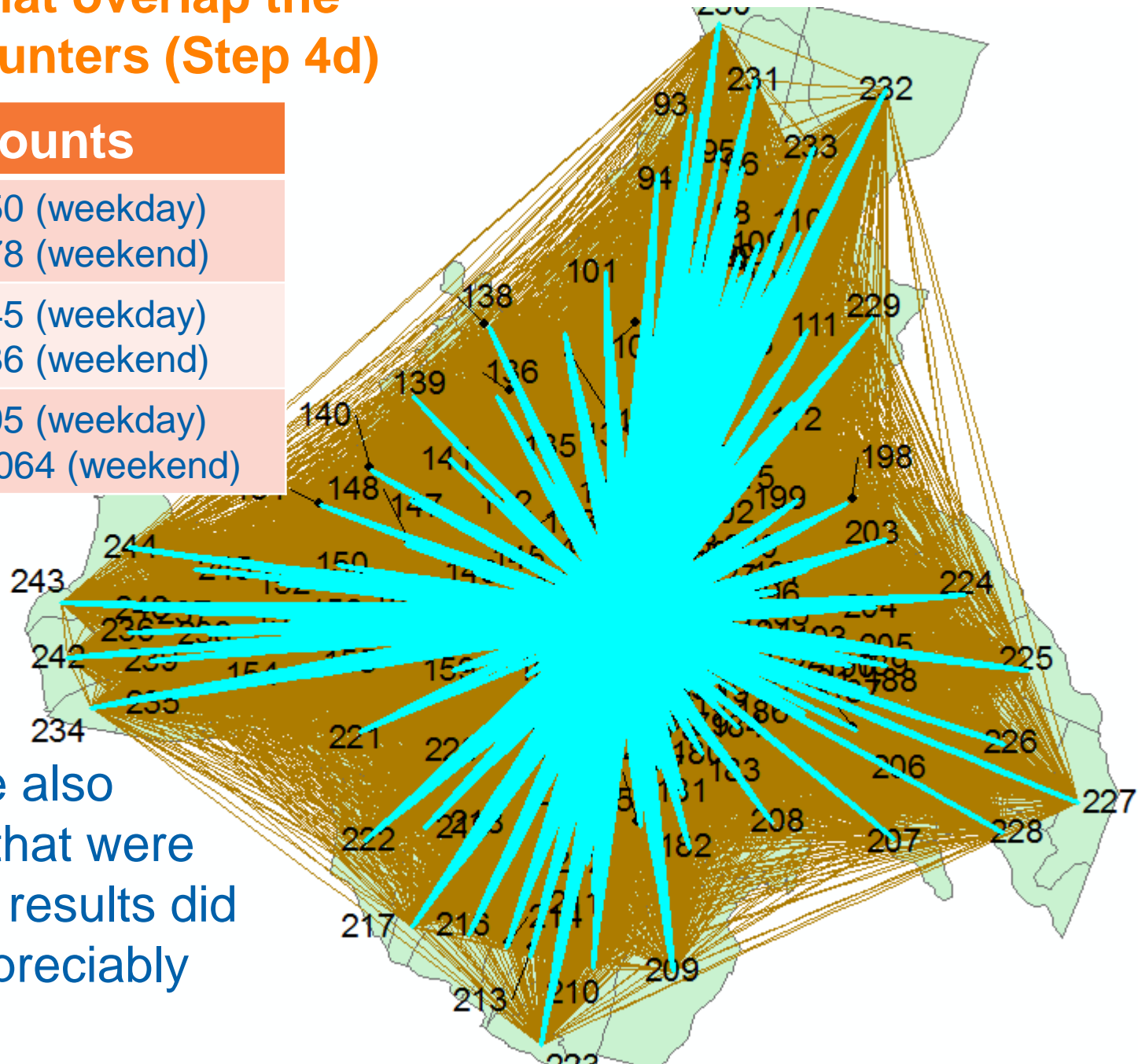
Peds between zones 60 and 89 **will likely not** use the counter in zone 59

### Simplifications

1. Desire lines versus street network
2. The counter is smaller than the zone

## Desire lines that overlap the pedestrian counters (Step 4d)

Zone	Counts
92	450 (weekday) 378 (weekend)
59	445 (weekday) 686 (weekend)
Total	895 (weekday) 1,064 (weekend)



As a check, we also removed trips that were above 2 miles; results did not change appreciably

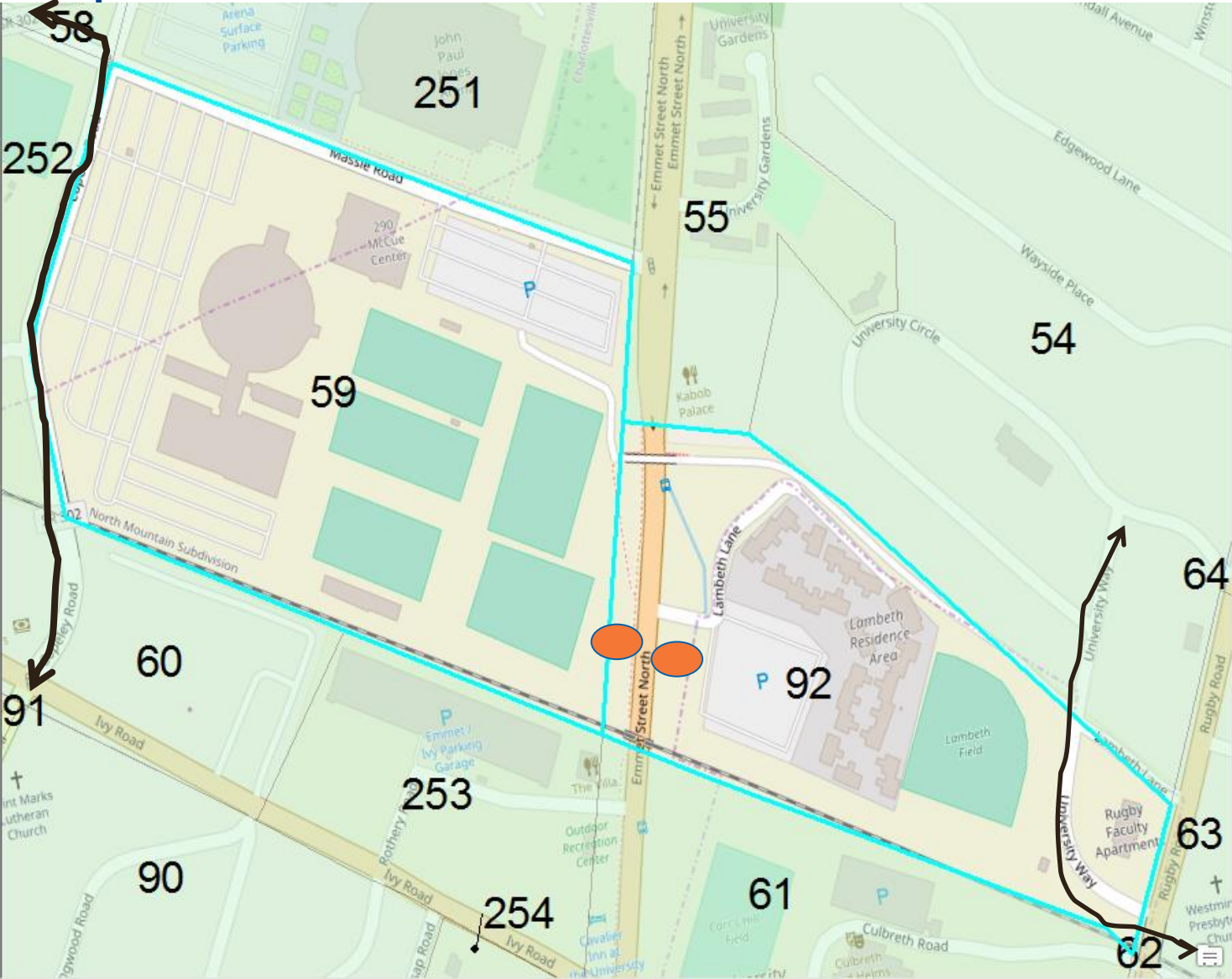
## Step 4 Results: Compare Modeled and Counted Pedestrian Volumes

Pedestrian counts in 2017 (both directions at both counters)	Average of modeled trips for 2010 and 2025
895 (weekday)	4,336 [all trips]
1,064 (weekend)	4,259 [trips < 2.0 mi]
	3,828 [trips < 1.5 mi]
	2,079 [trips < 1.0 mi]

Counts taken Thursday, September 22, 2016 to Monday, January 09, 2017

# Step 4 Discussion. Why the Discrepancy?

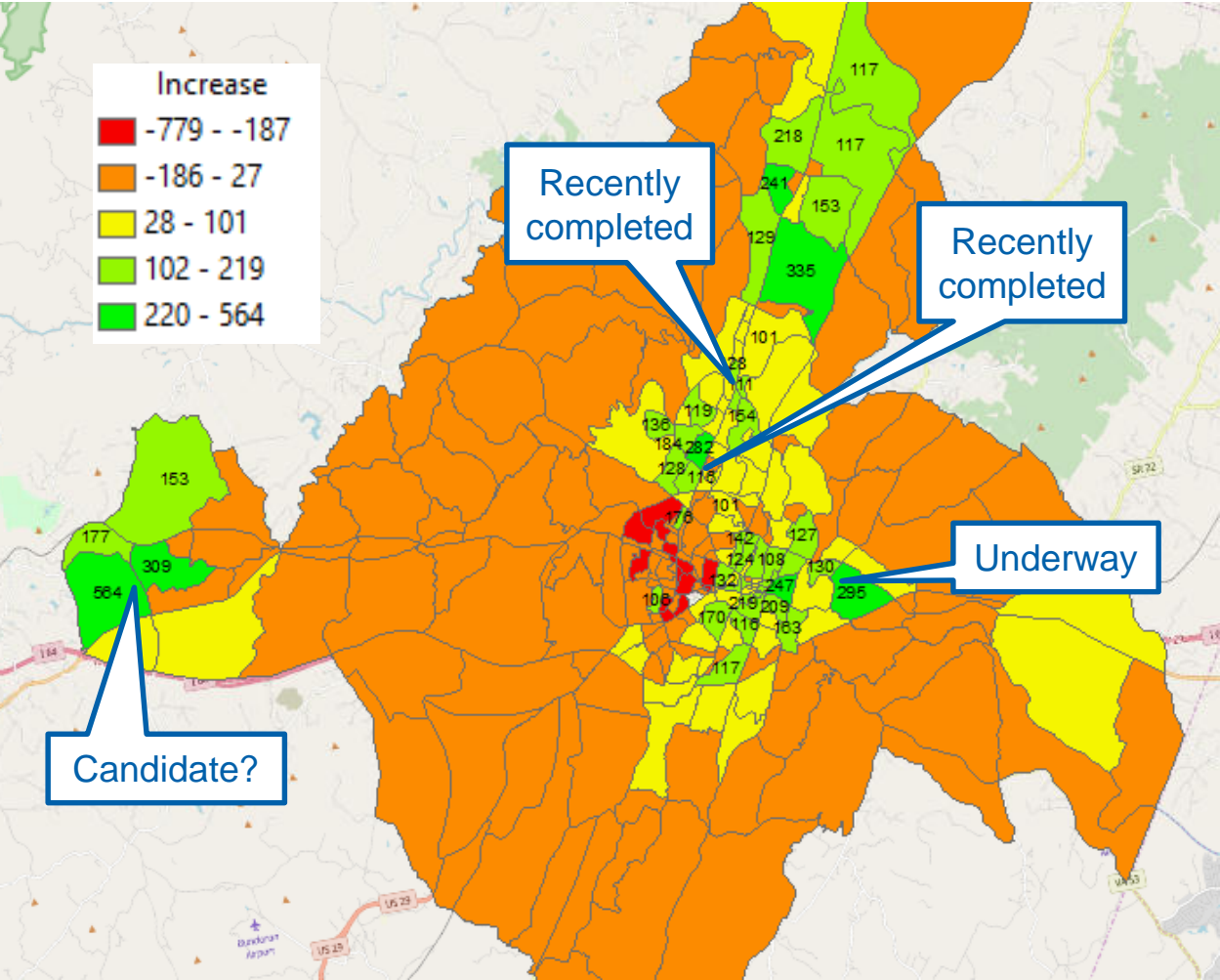
Many other possible places to walk!



## Step 5. So What?

- ❑ **How could a regional model that better estimates pedestrian trips affect investment decisions?**
- ❑ **Key: Examine how the regional model affects decisions being made at present.**
- ❑ **Example 1: Let's plan for a plan: Which areas should undergo small-area planning?**
- ❑ **Example 2: Let's look at SMART SCALE (Virginia's tool for prioritizing projects). How would the scoring for these projects be altered?**

# Prioritizing Neighborhoods for Small-Area Planning

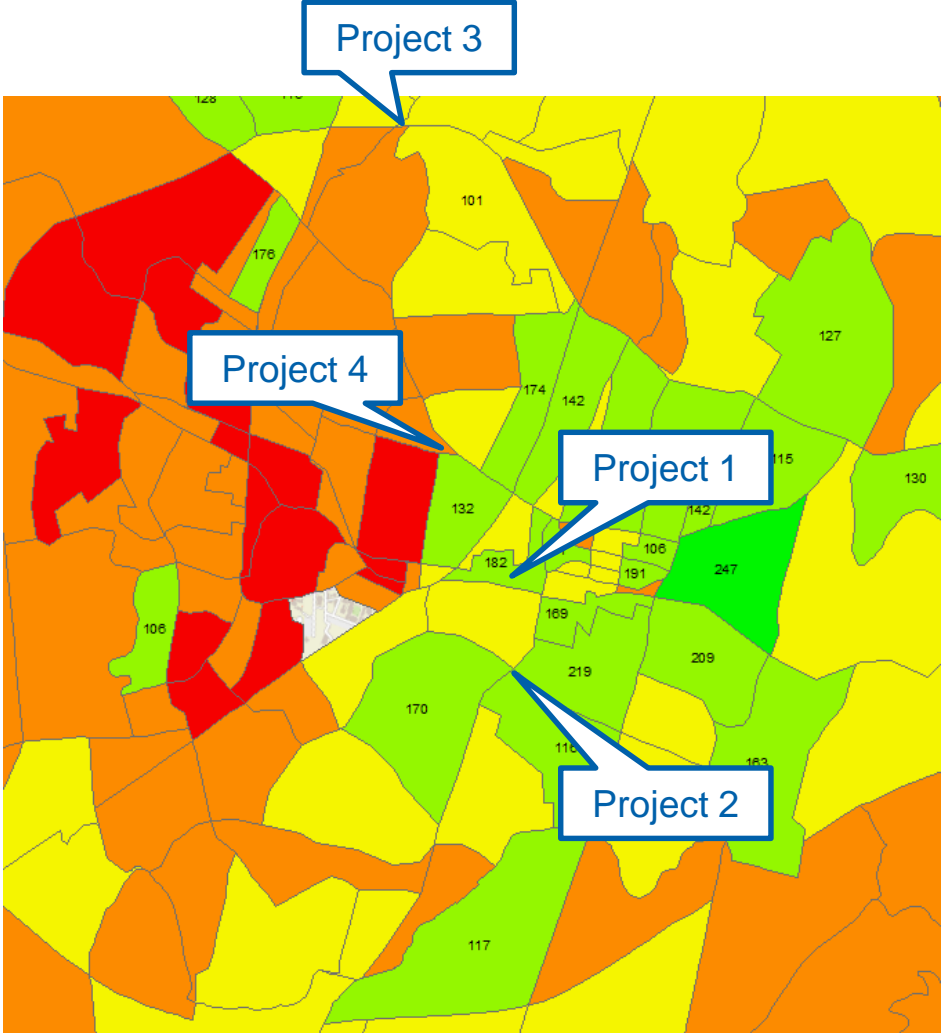


# Evaluating Projects for Funding Allocations



**SMART SCALE**

*Funding the Right Transportation Projects in Virginia*



## Conclusions

- ❑ **NHTS data provide one way to update, relatively quickly, regional models that have a self-calibration procedure.**
- ❑ **In some cases, such as those here, at least one variable in NHTS (density) has an association to pedestrian trip-making ( $p < 0.01$ ) for most purposes.**
- ❑ **Because regional models may not directly reflect pedestrian trips on the network, some additional GIS-based analysis is required to relate modeled pedestrian trips to ground counts.**
- ❑ **In this case study, the updated model has a potential impact on investment decisions.**