

Spatial and Temporal Difference in Weekday Travel Durations between Private-for-Hire Transportation Services and Transit in the City Center



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Background

US cities are investing heavily in sustainable transportation modes to reduce dependence on the automobile. City centers have benefitted from the hub-and-spoke design of most US systems and remain the areas with the highest levels of transit accessibility within a region (Figure 1). Given the redevelopment of centers and migration of people into them, there is great potential for transit to serve this population. However, there is increasing evidence that ride hailing services are diverting trips from transit services and worsening congestion and greenhouse gas emissions because of increased low-occupancy vehicle trips.

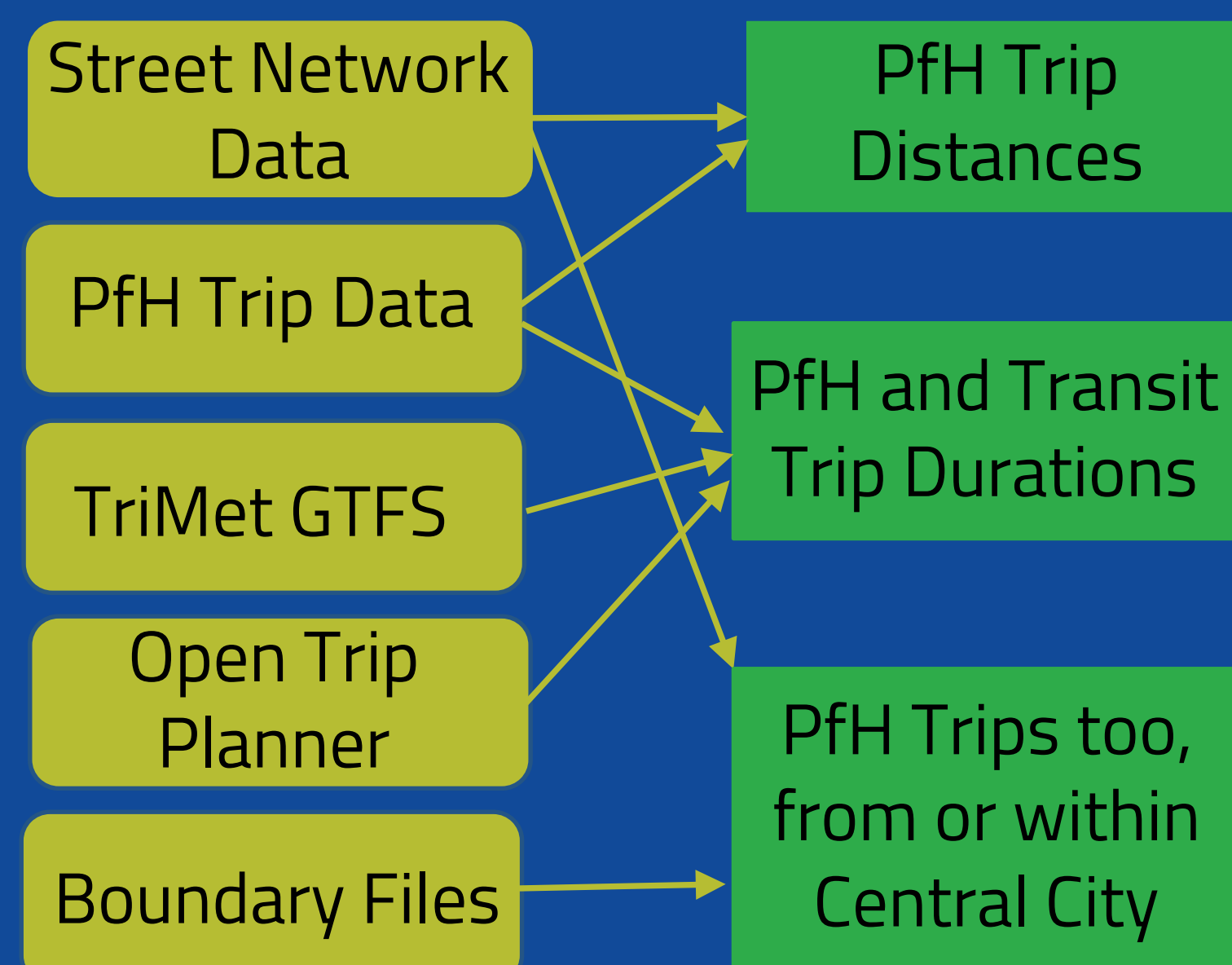
Research Questions

- What percentage of private-for-hire (PfH) trips have origins or destinations in the central city?
- When and where is transit time-competitive with private-for-hire trips?
- When and where are private-for-hire services filling a mobility gap?

Data

- Timestamped origin and destination coordinates for all of the 277,647 weekday PfH trips taken within the city of Portland, OR during the weeks of October 15–21, 2017 and June 17–23, 2018.
- Transit network data provided by Portland Metro transit agency, TriMet.
- Portland street network, transit route, city and neighborhood boundary data provided by Open Street Map (OSM) and regional MPO, Metro.

Methods



Acknowledgements

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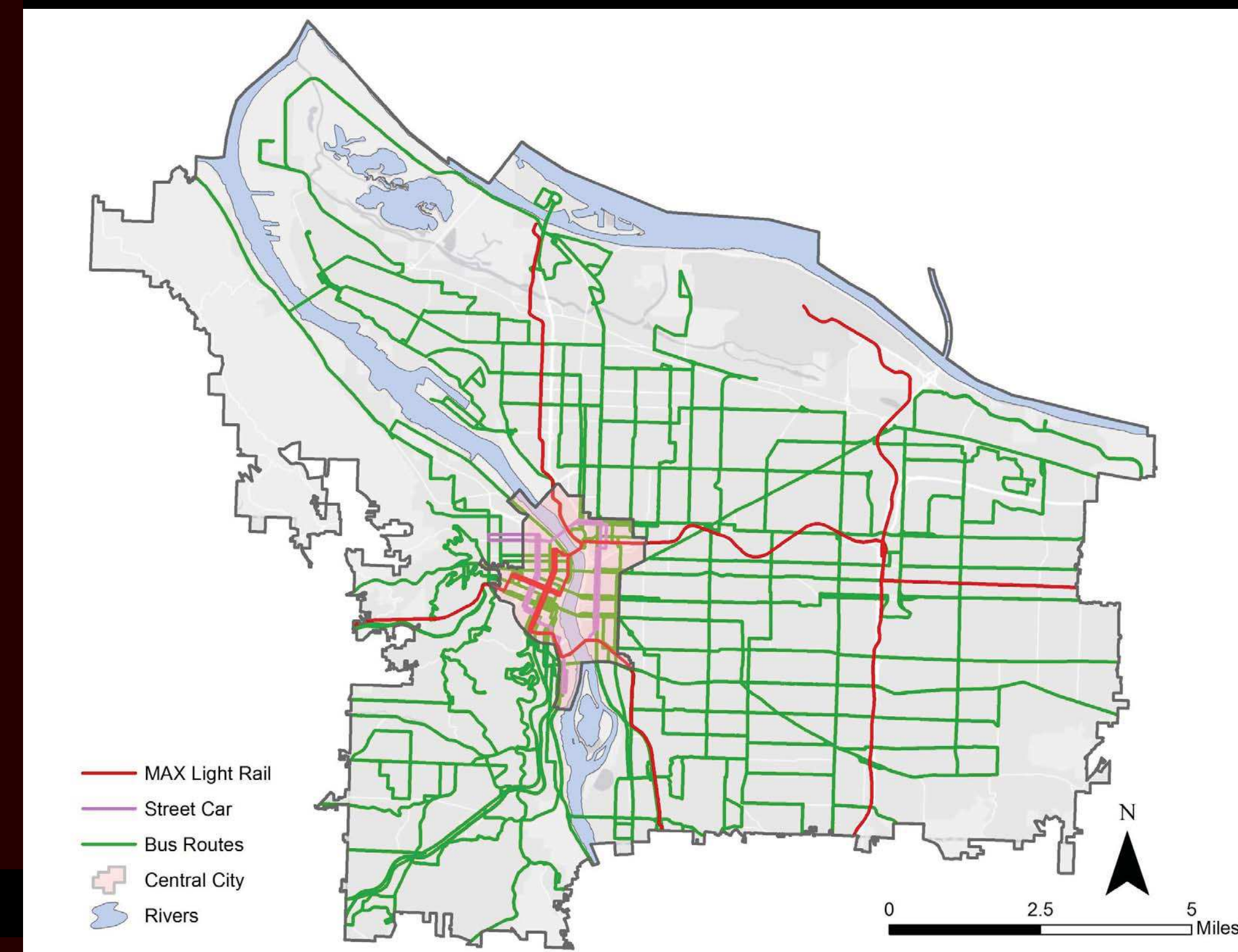


Figure 1: City of Portland Boundary, Central City Delineation and Transit Network

	N Trips	Mean Trip Distance (miles)	Mean PfH Trip Duration (minutes)	Mean Transit Trip Duration (minutes)	% PfH Trips Where Transit Not Available
All Central City Trips					
Early Morning	4,087	5.1	18.5	37.2	34%
AM Peak	12,749	3.8	15.6	30.0	3%
Mid-Day	29,572	3.8	15.9	30.6	3%
PM Peak	19,110	3.5	14.9	29.8	3%
Evening	29,581	3.4	14.6	30.1	5%
Late Night	16,477	3.5	14.8	33.1	18%
Total	111,576	3.7	15.3	30.9	7%
Origin in Central City*					
Early Morning	3,121	5.3	18.8	37.9	37%
AM Peak	6,253	3.6	14.6	27.7	3%
Mid-Day	16,612	3.5	14.6	27.7	3%
PM Peak	12,167	3.1	13.8	27.4	2%
Evening	19,007	2.9	13.4	28.9	5%
Late Night	11,680	3.0	13.9	30.9	18%
Total	68,840	3.3	14.2	29.0	7%
Destination in Central City*					
Early Morning	1,538	3.3	14.4	28.6	28%
AM Peak	9,268	3.1	14.3	27.3	2%
Mid-Day	19,524	3.5	14.7	28.1	2%
PM Peak	11,566	3.1	13.8	27.1	2%
Evening	17,898	3.0	13.6	25.6	3%
Late Night	8,875	3.0	13.3	28.5	13%
Total	68,669	3.2	14.0	27.3	5%
Within Central City					
Early Morning	572	1.2	9.1	18.1	32%
AM Peak	2,772	1.2	9.2	16.3	0%
Mid-Day	6,564	1.2	9.0	16.0	0%
PM Peak	4,623	1.2	9.1	16.7	0%
Evening	7,324	1.2	8.9	16.1	0%
Late Night	4,078	1.2	8.8	17.1	7%
Total	25,933	1.2	9.0	16.4	2%

*Trips with origins or destinations within the central city include those within the central city

Table 1: Weekday Private for Hire Trips into or out of the Central City of Portland, OR

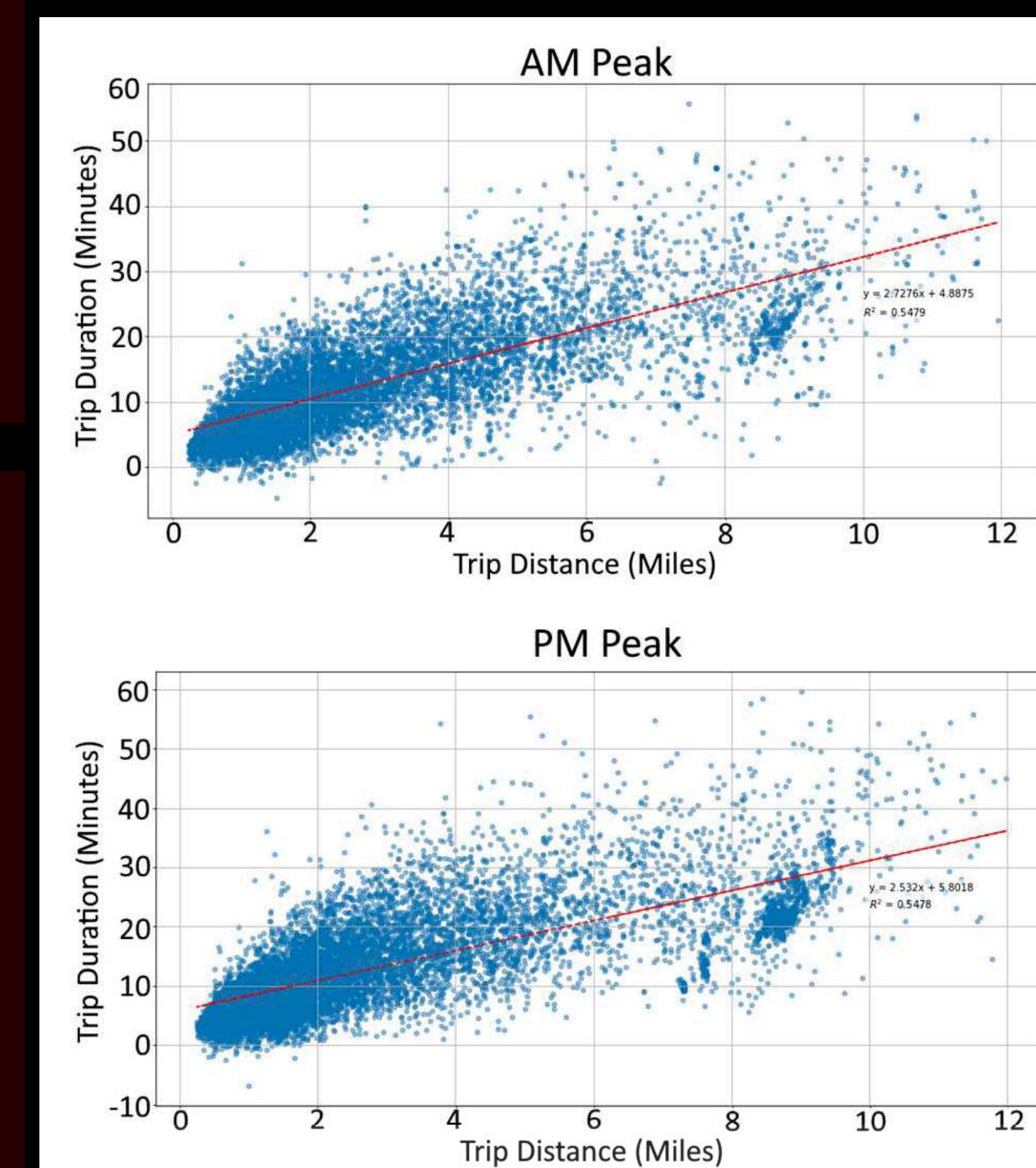


Figure 2: Absolute travel duration differences between transit and PfH for weekday trips destined for the central city by distance (miles)

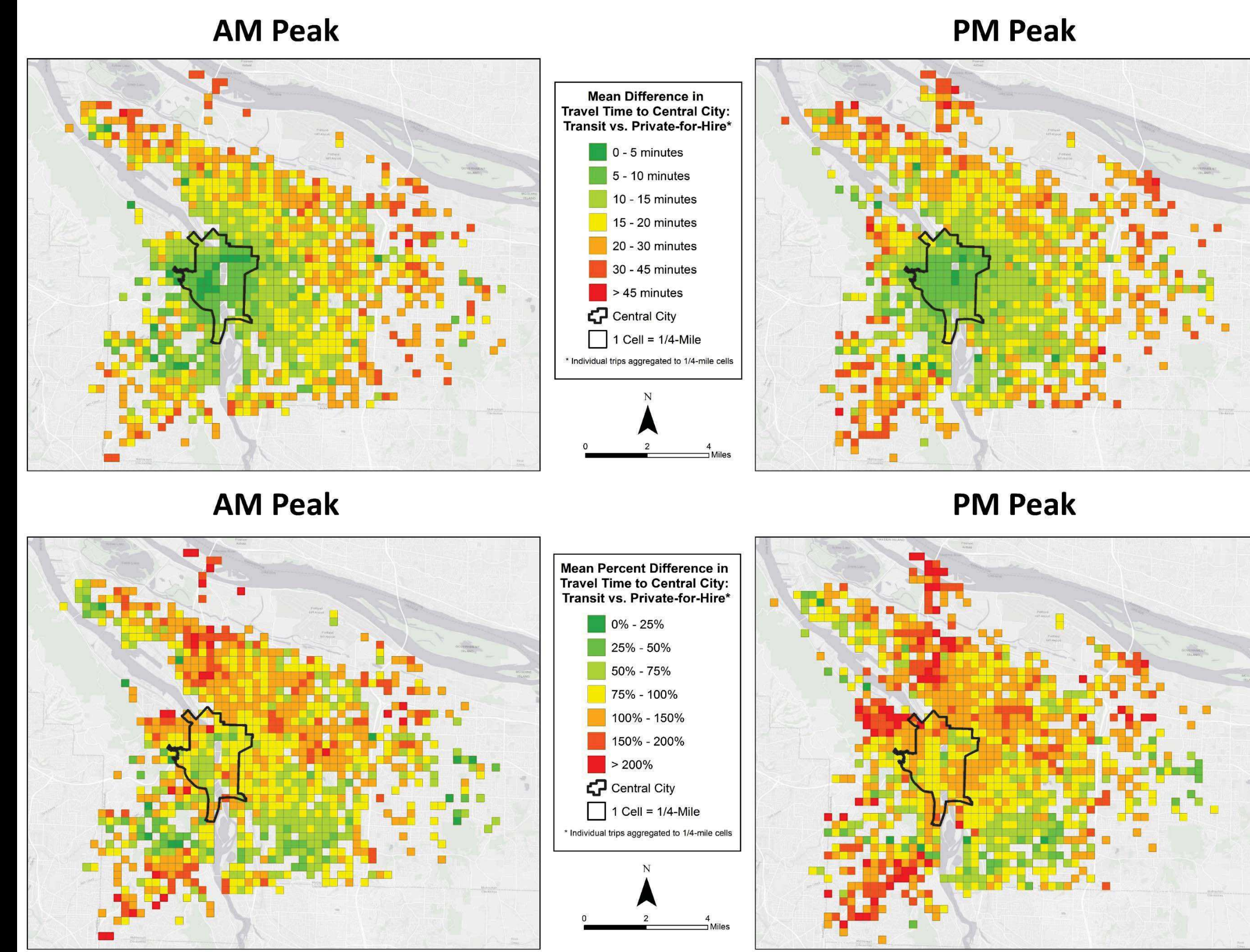


Figure 3: Average differences (top) and percent differences (bottom) in travel durations between transit and PfH for peak-period weekday trips destined for the central city

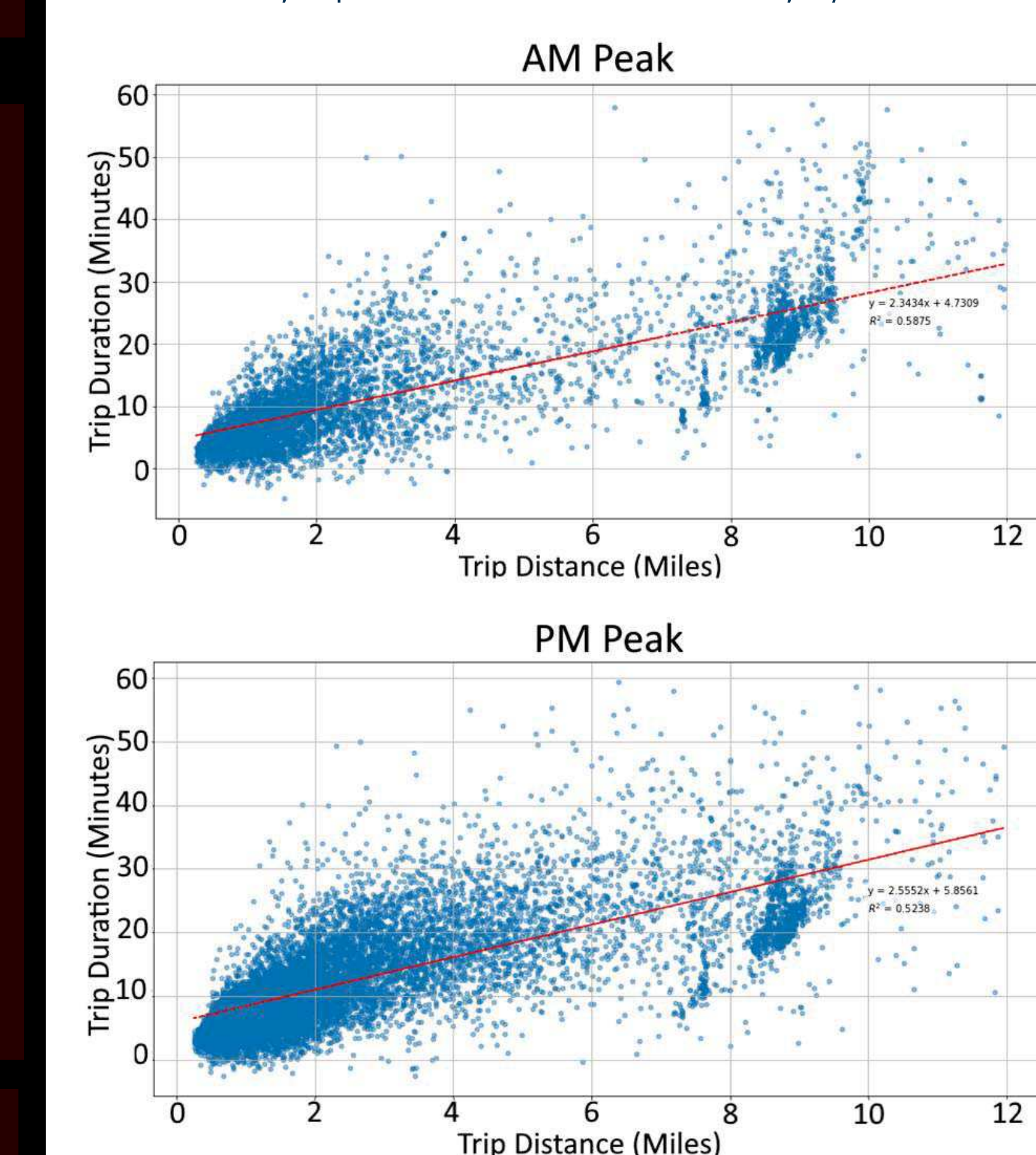


Figure 4: Absolute travel duration differences between transit and PfH for weekday trips originating in the central city by distance (miles)

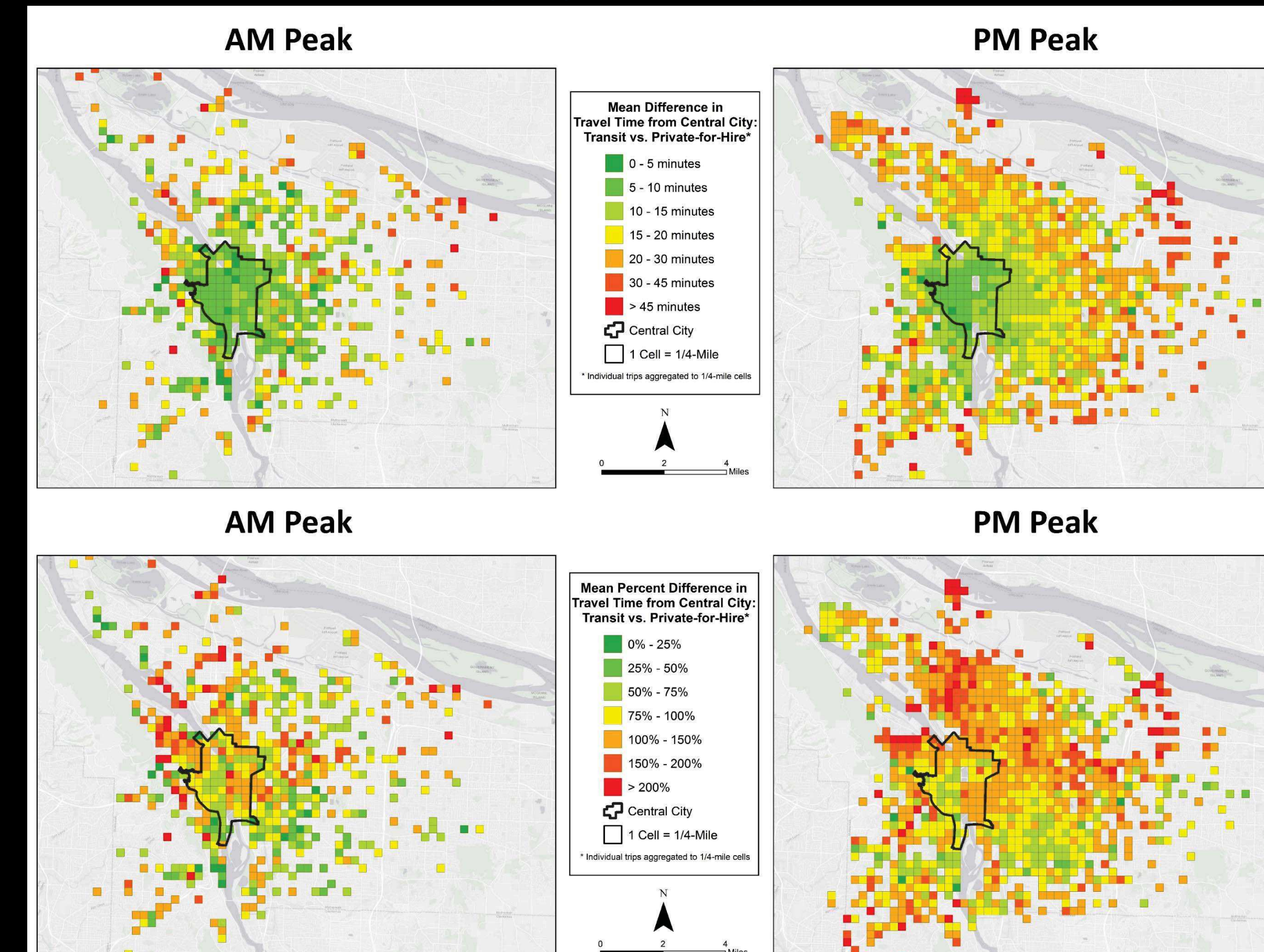
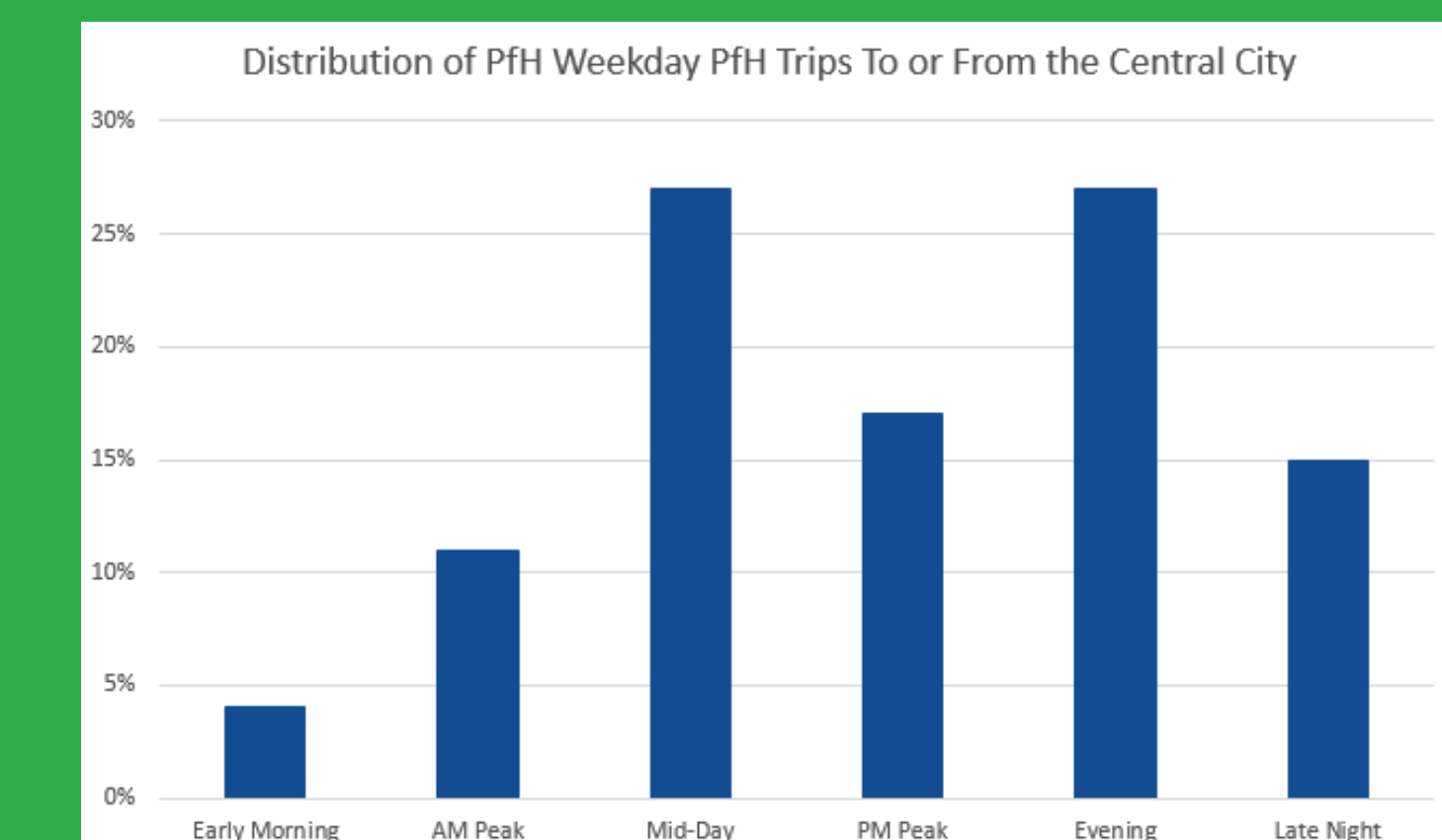


Figure 5: Average differences (top) and percent differences (bottom) in travel durations between transit and PfH for peak-period weekday trips originating in the central city

Results

- **Filling Mobility Gaps:** The largest percentage of PfH trips where transit was not available (wait time > 1hr; access or egress trip > ½ mile) occurred in the early morning or late night when most TriMet lines have limited or no service.
- **Central City Trips:**
- 56% of all weekday trips have origin or destination in the central city.
- 14% of all weekday trips occurred *within* the central city.



Peak Period Central City Trips:

- Very few trips (N=791) where transit trip durations are faster than PfH trip durations.
- 37% of AM peak trips and 36% of PM peak trips would have been within 10 minutes in duration if taken via transit.
- Gap between transit and PfH travel durations increases with distance (Figure 2 and 4).
- Transit may have been time-competitive (within 15 min) with 14% of all PfH trips and 23% of all central city trips – most often within the central city or on the east side of Portland (Figure 3 and 5).
- 40% of PfH trips would have taken at least twice as long if completed via transit (fig 3 and 5)
- Trip durations into the central city most closely match PfH trip durations in the evening hours (advantage of segments with dedicated transit ROW during AM peak negated by other factors) (Table 1).

Implications

- Pricing, policy making, and other regulatory frameworks to preserve transit investments.
- Negative public health outcomes because of increased Co2 emissions and reduced transit access walking trips (mean walk time to access transit was 9.1 minutes).

Next Steps

- Account for PfH wait time and transit wait, access, and egress time.
- Account for cost of both modes.