STREETLIGHT InSight StreetLight Speed Validation

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Speed Metric Summary

We are continuously improving our Metrics in order to bring the best results possible to our customers. StreetLight's Speed Metric algorithm has been enhanced in order to improve speed accuracy on curves, and eliminate mode confusion near transit, higher speeds near freeways, and extreme outlier speeds. This paper demonstrates data validation for three of StreetLight's available Speed Metrics: 85th percentile speeds, speed distributions and hourly speeds.

In order to validate StreetLight's Speed Metric, we looked for the highest quality publicly available speed data published by state agencies for comparison. Specifically, we utilized speed reports provided by Washington State Department of Transportation (WSDOT)¹ which published 85th percentile speeds as well as speed distributions for select locations. To evaluate hourly speed data, we relied on data published by the California Department of Transportation's Performance Management System (PeMS)².

In total we utilized 202 sample locations from WSDOT and 71 sample locations from PeMS for this validation. Both state agencies used permanent loop counters to collect speed data. Permanent loop counters are prone to error, however, since some counters detect only speeds within a certain range, or estimate speeds in cases of single (as opposed to dual) loop detectors. Meanwhile, StreetLight speeds may be subject to error in scenarios where trip samples are limited, or road network configuration contributes to trip-locking challenges. In order to avoid atypical speeds that might have occurred in 2020 due to the COVID-19 pandemic, we compared StreetLight's Speed Metric from 2019 to published speeds from the same year. All locations were uploaded as line segment zones and run as Segment Analyses within StreetLight InSight®. StreetLight InSight® Speed Metrics are available in both the U.S. and Canada. Even though this validation just looks at locations from the U.S., the latest Metric improvements apply to Segment Analyses, Origin-Destination Analyses, and Origin-Destination through Middle Filter analyses run in both the U.S. and Canada.

85th Percentile Validation

Traffic engineers use the 85th percentile speed as a standard to set the speed limit at a safe speed, thus minimizing crashes and promoting uniform traffic flow along a corridor. For the sampled locations, StreetLight's 85th percentile speeds had a strong correlation with an R² value of 0.91.

² https://pems.dot.ca.gov/

¹ https://www.wsdot.wa.gov/mapsdata/travel/speedreport.htm





Figure 1: Scatter plot illustrating the correlation between WSDOT's 85th Percentile speeds and those reported by StreetLight. The plot shows strong correlation with an R² of 0.91.

Table 1 highlights the difference between StreetLight's 85th percentile speeds and WSDOT's reported values for the same locations over an entire day. Therefore, if WSDOT reports a speed of 70 mph and StreetLight reports a speed of 71 mph, the difference is "1." Table 1 illustrates the distribution of those differences as percentiles, while Figure 2 illustrates the distribution as a histogram.

Bias - 50 th	25 th Percentile	50 th Percentile	75 th Percentile	95 th Percentile
Percentile	Absolute	Absolute	Absolute	Absolute
Difference	Difference	Difference	Difference	Difference
(mph)	(mph)	(mph)	(mph)	(mph)
-1	1	2	3	6

Table 1: Distribution of the difference between StreetLight's reported 85th percentile speed and those reported by WSDOT for the same locations for an average day in April 2019. Two outliers were removed due to insufficient sample.





Figure 2: Histogram illustrating the difference between StreetLight's reported 85th percentile speed and those reported by WSDOT for the same locations for average days in April 2019. The majority of locations are within 3 mph of WSDOT's published values.

Speed Distribution Validation

WSDOT also published the distribution of vehicle speeds over an average day at 5 mph intervals. StreetLight evaluated similar speed distributions for the same locations across Washington State. The following figures illustrate the comparison between speed distributions at select locations. We look for the distribution between the two sources to have a similar shape, with highs and lows clustered around the same 5 mph bins.



Figure 3: Comparison of speed distributions across 5 mph bins at a site on Highway 5 near Tacoma, Washington.





Figure 4: Comparison of speed distributions across 5 mph bins at a site on Highway 405 near Bellevue, Washington.



Figure 5: Comparison of speed distributions across 5 mph bins at a site on North Newport Highway near Spokane, Washington.

Hourly Speed Validation

The following validation compares 2019 PeMS speed metrics to average hourly speeds from StreetLight. In the following figures, we compare hourly average speeds across the two sources for a select location on average weekdays and weekends across 2019. For the select site, both sources show slower speeds at the peak AM and PM hours during weekdays, and relatively consistent speeds across the day on average weekends.





Figure 6: Comparison of average hourly speeds on weekdays at a site on Costa Mesa Highway in Orange County, California.



Figure 7: Comparison of average hourly speeds on weekends at a site on Costa Mesa Highway in Orange County, California.

About StreetLight Data

<u>StreetLight Data, Inc.</u> pioneered the use of Big Data analytics to help transportation professionals solve their biggest problems. Applying proprietary machine-learning algorithms to over four trillion spatial data points over time, StreetLight measures multimodal travel patterns



and makes them available on-demand via the world's first SaaS platform for mobility, StreetLight InSight®. From identifying sources of congestion to optimizing new infrastructure to planning for autonomous vehicles, StreetLight powers more than 6,000 global projects every month.



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