

**WORTH NOTING: IMPRESSION GUARANTEES**

It is standard in advertising contracts for **online ads** that the threshold for “impressions delivered” is met when the impressions delivered by the campaign are within +/-10% of those contracted.

## Inventory Unit Viewsheds

Geopath started the process by [creating viewsheds](#) around all of the roadside inventory that has been audited within the last 12 months. This included more than 280,000 structures across the country.

As part of the day to day Geopath auditing process, roadway segments are manually reviewed and assigned to each advertising unit. Each manual assignment is unique and captures the inventory’s distance from that roadway and the relative orientation to the audience on that roadway among other physical details. Each inventory unit has at least one assignment to a roadway.



Those manually assigned road segments were expanded to cover the full area intersecting with the viewshed (defined by the orientation and dimensions of the inventory unit) and then buffered based on the number of lanes on those segments.

## Mobile Device Activity

Intermx accesses device activity from hundreds of millions of devices across multiple location SDK aggregators. Data from these mobile devices can inform us about the movement of the population at the national and local level, such as traffic trends, average miles traveled, exposure to out-of-home inventory, and place of residence for additional population weighting purposes.

Combined, these data sources provide robust information from more than 100 million unique devices in the United States every month. Intermx culls those data down to a statistically significant, representative sample of the best devices available to generate the data utilized in the model. This sample ranges between seven and ten million qualified devices each week.

High Quality Devices were selected to create a representative sample on a weekly basis. These devices are seen every day for at least eight hours per day and have an identifiable home location (at the Census Block Group level). Non-qualified device activity is discarded.

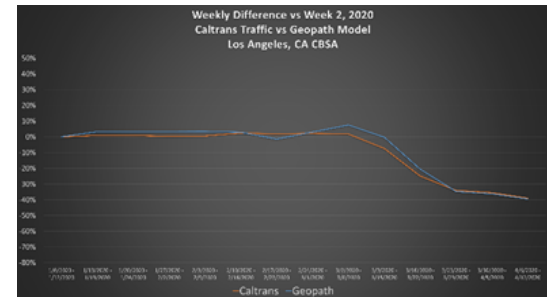
The curated nationwide historical device activity was layered on top of the generated viewsheds to document each observed opportunity a device had to see the associated inventory.

## Weighting Device Exposure and Panel Devices

To determine the average variation of traffic activity across an area for a period, Geopath leverages 1) the curated mobile device panel **activity within the inventory unit viewsheds**, 2) the **relative activity of each individual device** compared to the curated panel of devices every week, and 3) the **activity of all of the devices** within the curated panel across each geography.

The device activity captured within the viewsheds is weighted to estimate how much of the total population that observation represents.

1. The **sample rate** of panel devices versus the **total population** in each block group.
2. How many **hours** a device is observed each day and the **distance** the device travels.
3. How many **minutes per hour** (when travel is happening) a device is observed and the resulting probability of having activity captured considering the amount of inventory in each county.

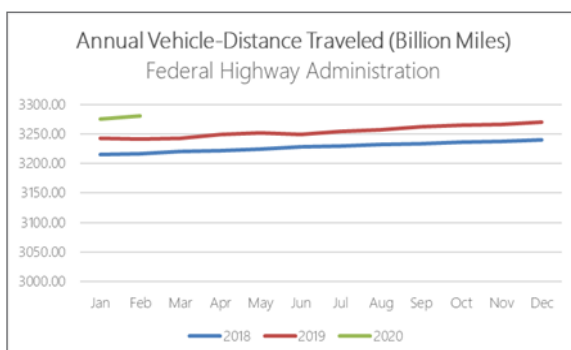
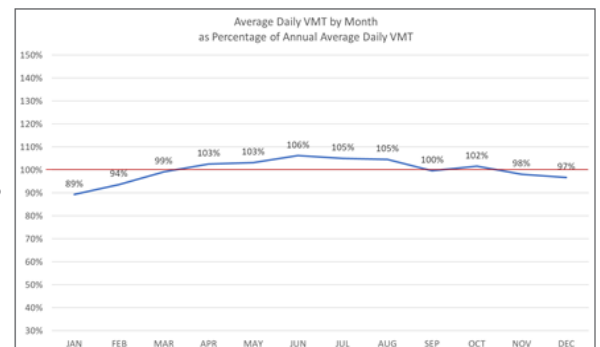


The resulting weighted travel activity change per market on a week to week basis is the measure that Geopath is using to document changing exposure to various media types.

## Average Annual Adjustment Reference Point

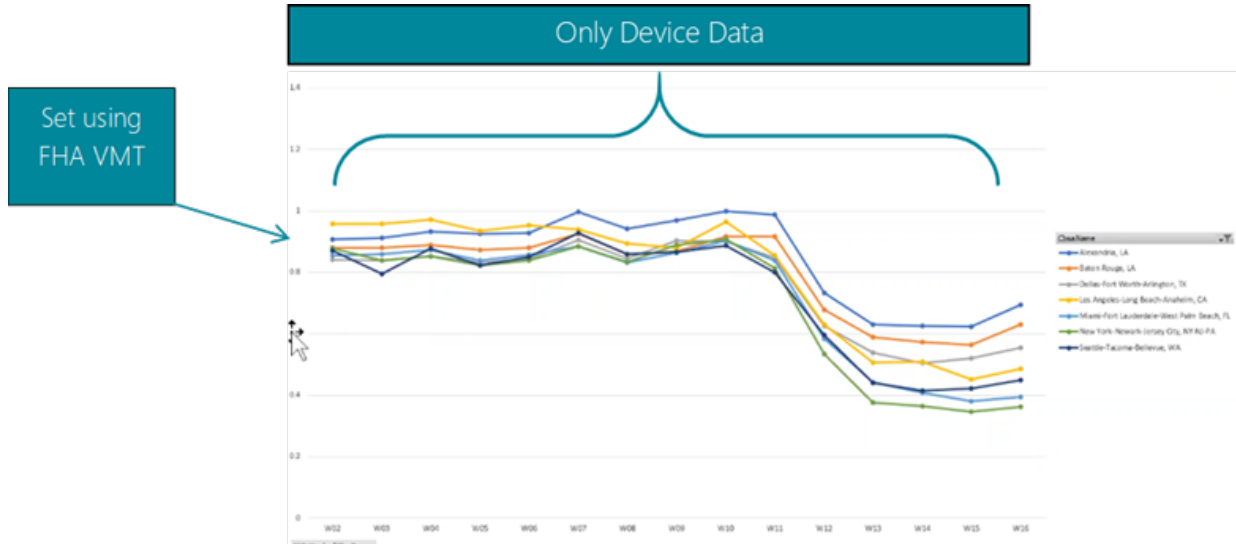
The observed weighted activity per county is set across the month of January 2020 to align with the documented traffic activity level (vehicle miles traveled a.k.a. VMT) for January versus the annual average traffic levels as reported by the [Federal Highway Administration](#).

Historically, January has the lowest daily vehicular miles traveled in any given month of the year, at approximately 90% of the annual norm. Whereas June has the highest daily vehicular miles traveled in and given month of the year at 106% of the annual norm. This ebb and flow of traffic activity occurs every year as the population's travel patterns change with the seasons.



The FHWA has indicated in the initial reports for the months of January and February 2020, that those months have been more active year-over-year vs 2019. This increase year-over-year is greater than the population growth during the same period and this year-over-year increase has been accounted for in the activity adjustments.

The VMT data are only used to set the baseline for the start of reporting – it is a link to ground truth for the expectation on freeways and major highways in January. The reported data is solely based on weighted device exposures within viewsheds and panel activity within the market. VMT metrics from the federal highway administration are not incorporated into the reported data.



## Confidence Metrics

To determine the confidence interval for each reported period, the average daily sample size of observed devices per unit of inventory per market being aggregated is used as the sample size for statistical analysis utilizing a basic confidence interval as shown below:

Unlimited population:

$$CI = \hat{p} \pm z \times \sqrt{\frac{p(1-p)}{n}}$$

where

**z** is z score

**p̂** is the population proportion

**n** and **n'** are sample size

Because the actual traffic is unknown day-to-day (this is what is ultimately being measured), we use 0.5 as the proportion (p).

Because the population of the market and the daily traffic for the roadways being measures are both very large, utilizing the infinite population equation simplifies the approach and results in a more conservative metric.

### Confidence Intervals – LA Example at 90% Confidence:

Cbsa Name	Construction T..	Media Type	MAR 2-8		MAR 9-15		MAR 16-22		MAR 23-29		MAR 30-APR 5		APR 6-12	
			Average	90% CI	Average	90% CI	Average	90% CI	Average	90% CI	Average	90% CI	Average	90% CI
Los Angeles-Long Beach-Anaheim, CA	Exterior Wall	Murals	107.6%	0.3%	99.7%	0.3%	80.4%	0.6%	66.1%	0.6%	64.9%	0.7%	61.8%	0.8%
		Panel	108.6%	0.3%	101.1%	0.4%	81.1%	0.6%	67.0%	0.7%	65.7%	0.8%	62.4%	0.9%
Los Angeles-Long Beach-Anaheim, CA	Freestanding	Bulletin	113.0%	0.5%	104.9%	0.5%	83.5%	0.9%	68.7%	1.0%	67.2%	1.1%	63.8%	1.2%
		Junior Pos..	110.7%	0.4%	103.3%	0.5%	82.6%	0.8%	68.3%	0.9%	66.9%	1.0%	63.5%	1.1%
		Panel	103.8%	0.2%	96.0%	0.3%	78.1%	0.5%	64.1%	0.6%	63.1%	0.6%	60.2%	0.7%
		Poster	111.1%	0.5%	103.7%	0.6%	82.8%	0.9%	68.5%	1.0%	67.0%	1.2%	63.5%	1.2%
	Furniture	Panel	110.1%	0.5%	102.7%	0.6%	82.1%	0.9%	67.9%	1.0%	66.4%	1.2%	63.1%	1.2%

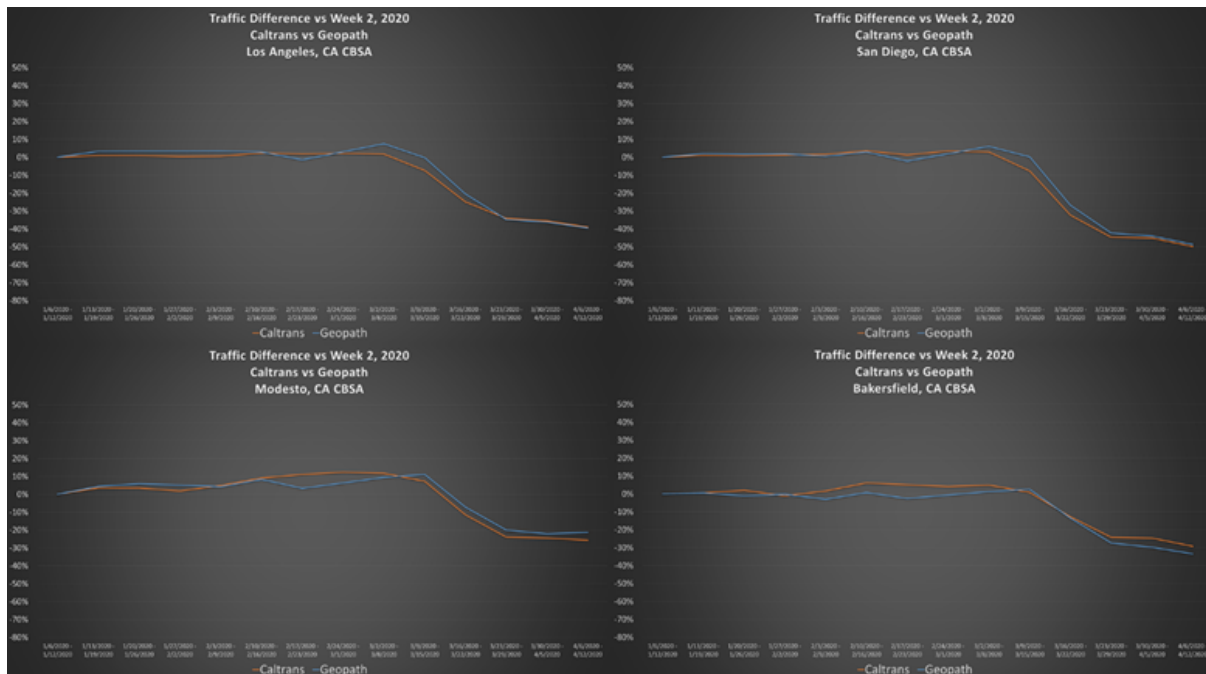
## Validation of Data

The model developed by Geopath to determine the weekly variation of audience exposure to out-of-home media is built solely upon the changes in mobile device activity, the federal governments traffic trend studies, and the population demographics from syndicated research. In order to validate the quality of the model, a completely separate data source is used to confirm that the activity variation being derived aligns with observations in the ground truth set.

The state of California has the largest network of continuous counting stations (CCS) of any state and makes available a [real-time data platform with information from these sensors](#). This type of rich data is not available or as easily accessible in every state. Caltrans has over 30,000 continuous counting stations across the state.

**The Caltrans data were not used to inform the model itself, only to validate the output.**

Geopath utilized those data sets as a “spot check” to validate that the Geopath/Intermx model presents realistic outcomes market-by-market week-over-week of 2020 by comparable road types. All CBSAs with inventory located within them were used in the validation process, including the largest and smallest markets in the state. Markets such as Los Angeles and San Diego have population density seven to ten times greater than the average CBSA in the US, while San Luis Obispo and Visalia have population density three times less. The average correlation coefficient across the 23 markets used to validate the model was 0.953.



# Appendix

## Data Sources

**1. Mobile SDK Data Aggregators** utilized to understand:

- Average Miles Traveled
- Viewshed Exposure
- Block group of Residence

Combined, these two data sources provide data from more than 100 million devices in the United States. Intermx culls those data down to a statistically significant, representative sample of the best devices available to generate the data utilized in the model. This sample includes between seven and ten million devices a week.

- 2. [Federal Highway Administration](#)** – utilized to understand vehicular miles traveled. Traffic Volume Trends is a [monthly report](#) based on hourly traffic count data reported by the States. These data are collected at approximately 5,000 continuous traffic counting locations nationwide and are used to estimate the percent change in traffic for the current month compared with the same month in the previous year.
- 3. [Geopath Inventory Database](#)** – utilized to generate viewsheds. Roadside inventory that was audited within the last 12 months was used to generate the viewshed analysis, totaling more than 280,000 locations across the United States.
- 4. [Claritas Pop-Facts](#)** – utilized to define and scale the panel based on current year population and household estimates. The database consists of approximately 4,100 demographic variables, based on U.S. census and American Community Survey data. It provides 2019 estimates and 2024 projections. The variables in this database are grouped into 30 categories that provide details on population, housing, race, employment and more. Pop-Facts Premier offers a wide range of census and other geographic areas down to the block group level.
- 5. [HERE Technologies](#)** – utilized to identify current roadway definitions in creation of the viewsheds. The company is majority-owned by Audi, BMW and Daimler. Here captures location content such as road networks, buildings, parks and traffic patterns. HERE data are used globally by the majority of OOH research bodies. They also supply location services to mapping providers such as Bing, Facebook, and Yahoo! Maps. Here draws on more than 80,000 data sources including a vehicle fleet, which collects data through panoramic cameras, position sensors and laser technology for 3D footprints.

# Appendix

## Data Sources

### 7. Super-smart, unsung data gurus:

- [Dr. Olga Taran](#) - Data Scientist at [IntermX](#)
- [Dr. Josie Kressner](#) - President/Founder of [Transport Foundry](#)

### 8. California Department of Transportation, [Caltrans](#) and [PeMS](#) – Caltrans Performance Measurement System (PeMS) collects movement in real-time from over 39,000 movement detectors. These sensors cover the freeway systems across all major metro areas in California.

PeMS is an Archived Data User Service (ADUS), which also provides over ten years of historical data. It incorporates a variety of information from Caltrans, and from other local sources.