Indicator Name	Indicator Category | **Stressor**
• *Traffic Density in Watershed*	Subcategory | *Roads & Railways*
	Available in RPS Tool files for all lower 48 states

Indicator Description

Background

Vehicle traffic describes the number of vehicles that use a roadway during a specific period of time (e.g., number of cars per day on a specific roadway). *Traffic density* is the amount of traffic per unit of road length (e.g., cars per day per kilometer) and can be useful for comparing of the level of traffic between two or more areas.

What the Indicator Measures

This indicator measures the average daily traffic density in a HUC12 subwatershed[*] (Figure 1):

• **Traffic Density in Watershed** - values reflect the number of vehicles that use roadways daily in the HUC12 relative to the total length of roads in the HUC12.

Relevance to Water Quality Restoration and Protection

Vehicles that burn fossil fuels and produce emissions can contribute to air, water, and noise pollution and climate change.[1] The chemical pollutants from vehicle traffic (e.g., heavy metals and dust, soot, or other particulates) and noise pollution can harm human health.[2] One study conducted by the Harvard School of Public Health found an estimated total of 3,000 premature deaths in 2005 attributable to air pollution from traffic congestion across 83 of America's largest urban areas.[3]

Research finds that low-income, Hispanic, and non-Hispanic Blacks, are more likely to live in counties with worse particulate pollution from traffic and other sources[4,5] and face heightened risk of negative health affects due to traffic and air pollution.[4,5]

Water pollution from vehicle emissions in high traffic areas poses another health concern for communities. Vehicle emissions can deposit pollutants directly into waterbodies and onto the land. Particulates, heavy metals, and other pollutants that have settled onto the land and roadways can be washed into waterbodies by runoff. Communities can be exposed to such pollutants through water-based recreation, contamination of drinking water supplies, or other pathways.
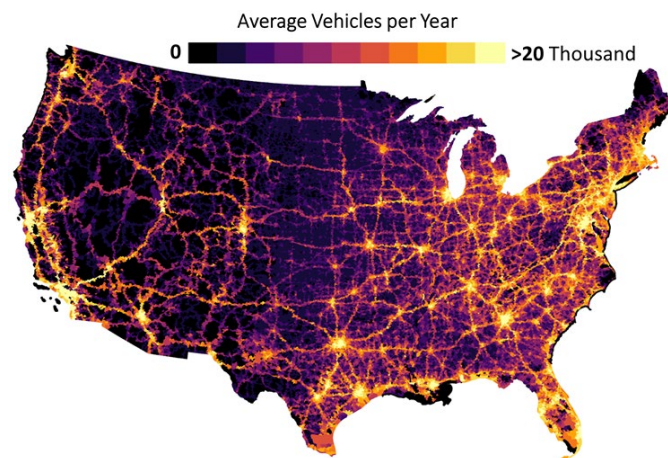

Average Vehicles per Year

0 — >20 Thousand

*Figure 1. Map of **Traffic Density in Watershed** for HUC12s across the contiguous US.*

This indicator is derived from the US Department of Transportation Highway Performance Monitoring System (HPMS). The HPMS contains map layers of road segments across the US and reports the average daily traffic volume for each road segment in the database. The October 2020 version of HPMS road segment map layers were acquired and analyzed to quantify HUC12 values of traffic density.

Traffic density in each HUC12 was determined by overlaying the HPMS road segment map layers with HUC12 boundaries to identify road segments that intersected each HUC12. Traffic density per HUC12 was then calculated by summing the average traffic volume reported for each road segment in the HUC12 adjusted by road segment length (average vehicle-kilometers per day) and dividing by total road length in the HUC12 (kilometers). An example overlay map of road segment traffic density and HUC12 boundaries is provided in Figure 2.

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[*] HUC12s are subwatershed delineations in the National Watershed Boundary Dataset. HUC12s are referenced by their 12-digit Hydrologic Unit Code.
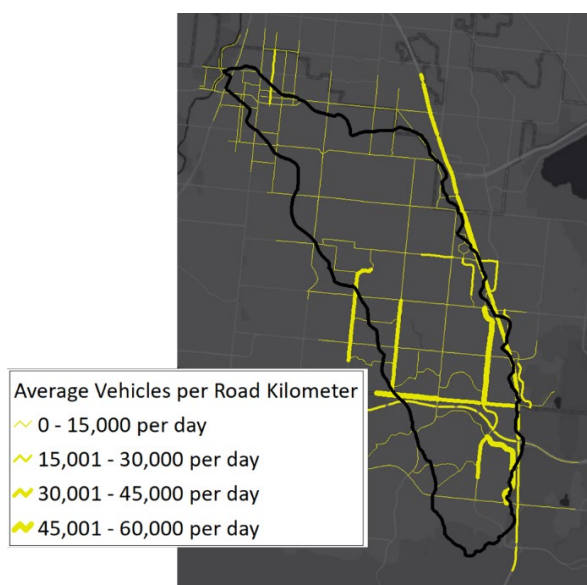
Average Vehicles per Road Kilometer
- 0 - 15,000 per day
- 15,001 - 30,000 per day
- 30,001 - 45,000 per day
- 45,001 - 60,000 per day

Figure 2. Map of traffic density for road segments in an example HUC12.

Limitations

- The impacts of traffic on human health in part depend on the proximity of households to high traffic areas. The proximity of human populations to roadways is not accounted for in this indicator.

- The HPMS is intended to represent an inventory of all roads in the US that are open to public travel. The completeness and accuracy of the HPMS dataset may vary by state depending on the mapping methods applied by state highway agencies.

- The method for calculating traffic density included a step to divide traffic volume in the HUC12 by total road length in the HUC12. This step resulted in high traffic densities for HUC12s with very small values of road length. Traffic density was therefore set to zero for HUC12s with less than 1.5 kilometers (about 1 mile) of total road length.

Links to Access Data and Additional Information

HUC12 indicator data can be accessed within the EPA Restoration and Protection Screening (RPS) Tool, in downloadable data files, or as a web service. Visit the EPA RPS website for links to access the RPS Tool, HUC12 indicator database, and web service.

The HPMS road segment map layers used to calculate traffic density can be accessed from the Bureau of Transportation Statistics Open Data website.

References

[1] Dongarrà, G., et al. 2008. Possible markers of traffic-related emissions. *Environmental Monitoring and Assessment*. 154(1): 117-125.

[2] Zhang, K. et al. 2013. Air pollution and health risks due to vehicle traffic. *Science of the Total Environment*. 450: 307-316.

[3] Levy, J., et al. 2010. Evaluation of the public health impacts of traffic congestion: a health risk assessment. *Environmental Health*. 9(1): 1-12.

[4] Miranda, M., et al. 2011. Making the environmental justice grade: the relative burden of air pollution exposure in the United States. *International Journal of Environmental Research and Public Health*. 8(6): 1755-1771.

[5] Bell, M., et al. 2012. Environmental inequality in exposures to airborne particulate matter components in the United States. *Environmental Health Perspectives*. 120(12): 1699-1704.