

Freight-Focused Cumulative Impacts Map: Data & Methods

This document corresponds to the index found in the 'Camera Locations Map' on CNT's Chicago Truck Count Data Portal webpage (chicagotruckcounts.cnt.org). In other words, the color-coded map that appears under the truck count locations when a user selects 'show freight-focused cumulative impacts scores.' This index can be toggled on or off.



Figure 1: Screengrab of freight-focused cumulative impacts map from chicagotruckcounts.cnt.org

The purpose of this document is to list the data sources and explain the methodology used to calculate the cumulative impact scores (1 - 5) for each Census block group in Chicago and Suburban Chicago, in the six counties of Cook, DuPage, Kane, Lake, McHenry, and Will. A score of 1 represents a Census block group with the least cumulative burden, with a score of 5 representing a Census block group with the most cumulative burden according to the quantitative data CNT used¹.

¹ Census block groups with certain scores calculated using the data & methods described in this document may not resonate with local resident lived experience. Quantitative scores are secondary to on-the-ground perspectives— read more on this in the Data Limitations section.

Background

CNT created an earlier version of this map in 2021 through the Delivering Zero Emissions Communities accelerator program. The map was originally developed in conversation with Little Village Environmental Justice Organization (LVEJO) and the National Resources Defense Council (NRDC).

In 2018, NRDC developed a <u>cumulative burden of environmental exposures and</u> <u>population vulnerability map</u> for Chicago which informed CNT's methodology for this map version. Additionally, CNT referred to the Chicago Department of Public Health's 2020 <u>Air</u> <u>Quality and Health Report</u> for additional sources.

In 2024, CNT updated the methodology of this map to include proximity to major airports, the modeled traffic dataset *Replica*, and re-calculate the distance of freight facilities to a staggered ¼mi, ½mi, ¾mi, or 1mi of a Census Block Group's perimeter. Updates also included updating the datasets used to be most recent to 2024 where available.

Unlike other cumulative impacts maps, CNT's freight-focused cumulative impacts map factors in existing annual average heavy commercial vehicle traffic data as well as other freight variables: intermodal rail yards in Chicago, industrial corridors in Chicago, and freight clusters in Suburban Chicago. CNT acknowledges limitations in the data, which are described on pages 10 - 11 of this document.

Geographic Scales: Chicago & Suburban Chicago

The types and sources of data used differ slightly between the city-level (Chicago) and county-level (Suburban Chicago), based on available data sources attained in 2024. See Table 1 and Table 2 below for the source, year, spatial resolution, attribute of data, and which index layer it was used for Chicago and Suburban Chicago. All data from both geographies were categorized in one of four layers: Demographics, Environmental Exposure, Health, and Freight/Logistics. The indicators are all based on Census Block Groups (BGs).

Data Sources

Chicago and Suburban Counties (Cook, DuPage, Kane, Lake, McHenry, and Will Counties Illinois)

Data Source	Year	Spatial	Attribute of Interest	Contributed to
		Resolution		which Index
				Layer
Census American Community Survey 5 Year Estimates	2022	Census Block Group	 Population of Racially Minoritized People Low Income Less than High School Education Linguistic Isolation Over 64 Under 5 Unemployed 	Demographics
			(all as defined by the <u>EPA EJ</u> <u>Screen</u>)	
Environmental Protection Agency Environmental Justice Screen 1.0	2023	Census Block Group	 NATA (National Air Toxics Assessment) Cancer Risk NATA Respiratory Index NATA Diesel PM (Particulate Matter) PM 2.5 Ozone Lead Paint Indicator Proximity to Risk Management Plan Sites Proximity to Hazardous Waste Facilities Proximity to National Priorities List Wastewater Discharge Indicator 	Environmental Exposure
Center for Disease Control and Prevention PLACES	2021	Census Tracts (2019 Geography; 2021 data)	 Asthma Heart Disease COPD (Chronic Obstructive Pulmonary Disease) Diabetes No insurance 	Health

			 General Health, self- report Physical Health, self- report Mental Health, self- report 	
Illinois Department of Transportation	2022	Street Segment	• AADT (Annual Average Daily Traffic), All Vehicle Volumes	Freight/Logistics
Replica Chicago Data Hub	2021 2021	Street Segment Polygons	 Modeled commercial Vehicle Traffic Volumes Industrial Corridors 	Freight/Logistics Freight/Logistics
Chicago Metropolitan Agency for Planning	2023	Polygons based on Travel Analysis Zones	Freight Clusters	Freight/Logistics – Suburban Locations only
Department of Motor Vehicle (DMV) registrations, accessed through partnership with CalStart.	2019	Zip code (ZCTA)	• Truck registration locations (Class 3 – 8 commercial vehicles)	Freight/Logistics
CNT dataset: Estimation of intermodal rail yard geography based on CMAP's active intermodals while referencing facility maps from rail companies and ESRI imagery basemap.	2024	Polygons	• Intermodal rail yard	Freight/Logistics
CNT dataset: Estimation of O'Hare and Midway Airport geography based on Open Street Map imagery basemap.	2024	Polygons	• Airports (O'Hare; Midway)	Freight/Logistics

 Table 1. Data used to calculate freight-focused cumulative impacts scores in Chicago and Suburban Chicago

Methodology

The freight-focused cumulative impacts scores were calculated in the following ways:

Layers: Demographics, Environmental Exposure, and Health

Chicago & Suburban Chicago

- Data in the demographic, environmental exposure, and health layers were disaggregated to the block group scale where necessary. This was done by assigning the same value to all block groups within a Census tract for Chicago or by assigning the scaled weighted average rate to all block groups intersected either the 2019 Census Tracts or zip codes where appropriate.
- 2. For each attribute of interest, the value was converted to a ratio of the spatial resolution's population and the block groups were ranked against each other. These ranks were assigned a percentile within the 6,012 BGs in the six-county area, with the highest ratio scoring as a 100 and the lowest ratio scoring as a 0.
- 3. For each layer, these attribute percentiles were averaged and then split into quintiles to derive the quintile score (from 1 to 5) for the whole layer.

Layer: Freight/Logistics – Both Chicago and Suburban Areas

Freight facilities – industrial corridor, intermodal rail yard, and major airport data:

- 4. We identified block groups whose perimeters are near truck-generating facilities. For each of these measures we used the following method to rank the proximity of a block group to the facility:
 - We count the number of facilities that intersect a ¼ mile, ½ mile ¾ mile and 1 mile buffer around each block groups.
 - We then added these numbers together to establish an index of proximity.
 - We then used those sums to rank and assign percentiles to each BG.
 - Consider the following example from the southwest side of Chicago, and nearby Chicago Industrial Corridors:



Figure 2:. Staggered buffers around example Chicago Block Group.

- 5. By counting the number of intersecting Industrial Corridors with each buffer, you find that:
 - 1 intersects with the ¼ mile buffer, giving a value of 1 point,
 - 2 intersect with the ½ mile buffer, giving a value of 2 points,
 - 3 intersect with the 34 mile buffer, giving a value of 3 points,
 - 4 intersect with the 1-mile buffer, giving a value of 4 points.
 - And the sum of these adds up to 10 points.
 - We ranked and calculated each block group's percentile, by its point value, for each of the facility types (industrial corridor, intermodal rail yard, and major airport).
- 6. Because the Chicago Industrial Corridors are not available in suburban areas, the CMAP Freight Clusters were used the same way. Then ranking the block groups by

this indicator in the suburban areas, they were then ranked along with the Chicago Industrial Corridor indicator.

Limitation: These two measures are not the same, but for the purposes of relative truck proximity we believe they are comparable.

Truck traffic data:

7. We intersected the IDOT street layer that showed AADT with block groups that were within a ½ mile of all IDOT street segments, summing the AADT counts. The length of the portion of the street segment that intersected the ½ mile buffer around the BG was calculated, the sum of all of the traffic volume (AADT) time the length of each segment is calculated. Thus, giving a measure of the total distance vehicles traveled time the number of vehicles traveling per year within a half mile of the block group.

Limitation: This is a measure of all traffic not just heavy-duty commercial vehicles.

8. We calculated the proportion of heavy commercial vehicle (HCV) annual average daily traffic we performed the same calculations above but this time the source for the vehicle count was the Replica modeled data.

Rationale: The IDOT measurements of HCV are limited to only the IDOT Designated Truck Routes which do not include most city streets, so using the Replica data covers more of the truck traffic in neighborhoods.

- 9. We also took the ratio of the two measures above. This gives an estimate of the fraction of traffic that is related to HCVs.
- 10. We ranked and calculated each block group's percentile and averaged them to give a score between 0-100 with 100 assigned for the highest average percentile.

Truck registration data:

- 11. We filtered the DMV data for vehicles that were larger than Class 2 and were not a bus (school or non-school) or motor home.
- 12. We aggregated the registrations to provide a count per zip code in the in the zip code. Then we calculated the number of trucks per square mile, or truck density, within each zip code area (using the Census Bureau's Zip Code Tabulation Area or ZCTA). We then disaggregated that ratio to the block groups. Most block groups were completely within its ZCTA, but when a block group intersected more than one ZCTA the area weighted average of truck density was used.

Limitation: Truck registrations are not equally distributed across a zip code so some block groups may be over or underrepresented by this method.

13. For the final freight/logistics layer, we summed the industrial corridor, intermodal rail yard, major airport, truck traffic, and truck registration percentiles and ranked them again to derive a new percentile for every census block group in the whole layer.

FINAL SCORES for Demographics, Environmental Exposure, Health, and Freight/Logistics

Chicago & Suburban Chicago

- 14. We joined all the layers for each block group in Chicago and Suburban Chicago and summed the percentiles scores from each layer.
- 15. Then, we split these sums into quintiles again to derive the percentiles and assigned a new **total percentile** base on this sum.
- 16. We then assigned a final index from 1 to 5 each representing 1 quintile (fifth) of all the regional block groups:
- 17. We overlayed community area boundaries for Chicago and municipal area boundaries for Suburban Chicago on top of the index to help identify which Chicago neighborhoods or 6 counties included the most burdened block groups. See the maps at the end of this document of each of the scores and the overall Freight-Focused Cumulative Impact Score.

Data Limitations

• Quintile scores for block groups (Chicago) or zip codes (Suburban Chicago) may not match residents' lived experiences in these geographies. In other words, block groups or zip codes may appear less burdened on the index than they are in real life. Although CNT created this index using many different data sources, the data does not capture all negative externalities communities face from industry. This is because certain data sources may not yet exist, are inaccessible, or are not inclusive enough. For example, IDOT traffic data is not collected on smaller residential roads, so this potential point of burden for communities cannot be reflected on our index. This is why it's important to advocate for ongoing and scientifically valid community-led data collection efforts that can be used for policy change.

- Data source limitations listed throughout our methods:
 - IDOT does not collect data on every street, therefore the *Replica* modeled data was used.
 - Truck registrations are not equally distributed across a zip code so the smaller geographies of block groups in Chicago may be over or underrepresented by this method.

• Additional data source limitations:

- Our data sources are limited mostly to public data sets (aside from the commercial vehicle registration dataset we received from CalStart as a technical assistance partner of the Delivering Zero Emissions Communities program). This includes sources accessible through a FOIA (Freedom of Information Act) request.
- Traffic from specific industries and other truck-generating facilities are not included as this data is non-existent or private/inaccessible.
- The commercial truck registration data assumes that where trucks are registered is where they are being used the most. This is an inaccurate assumption stemming from the limited available data about truck locations or routes.
- CDC PLACES undercounts geographic areas with resident populations without healthcare insurance. Meaning, although we included data on populations without health insurance, the CDC Places health data (asthma, heart disease, COPD, and diabetes) does not include people who may have these issues but are undiagnosed given they do not have health insurance to see a healthcare provider.
- CDC PLACES collects data for people 18 years old and older. Meaning, people \leq 17 years old are not accounted for.

• Other notes:

- We listed only the most predominant data limitations, there may be other limitations to consider.
- None of this data is intended to be extrapolated.

Individual Score Maps



Figure 3: Demographic Score



Figure 4: Environmental Exposure Score



Figure 5: Health Score



Figure 6: Freight/Logistics Score



Figure 7: Freight-Focused Cumulative Impacts Score