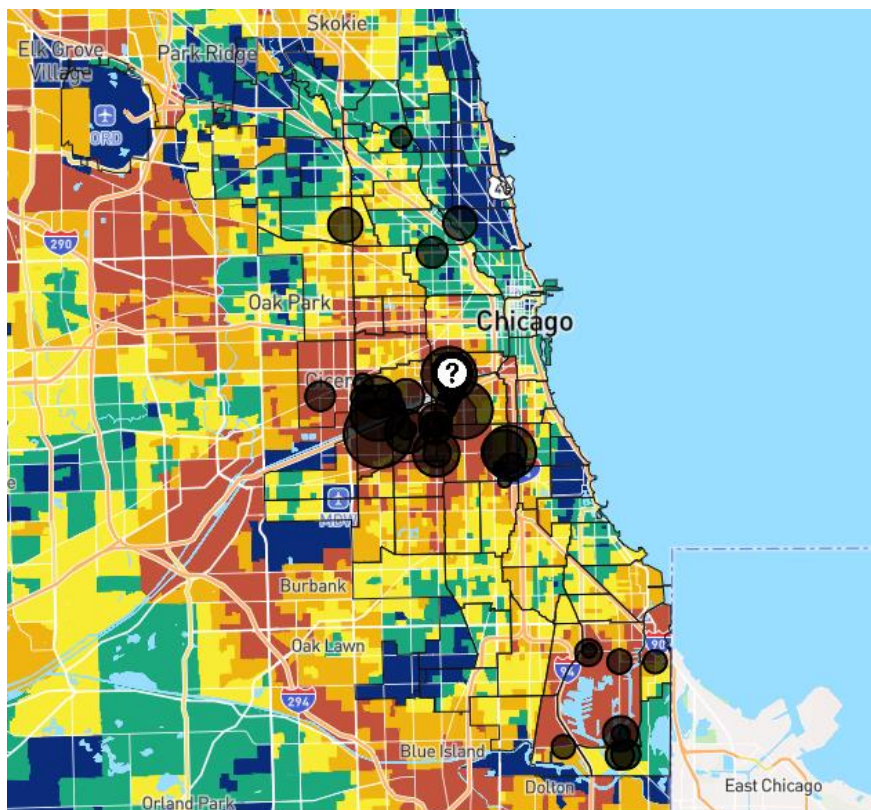


Freight-Focused Cumulative Impacts Map: **Data & Methods**

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.



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 each zip code* in Suburban Chicago, in the six counties of Cook, DuPage, Kane, Lake, McHenry, and Will. A score of 1 represents a Census block group or zip code with the least cumulative burden, with a score of 5 representing a Census block group or zip code with the most cumulative burden according to the quantitative data CNT used**.

**CNT calculated scores at the zip code instead of block group level for Suburban Chicago given the spatial resolution of the available low birth weight data (a layer within our health index).*

***Census block groups or zip codes 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 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 [cumulative burden of environmental exposures and population vulnerability map](#) for Chicago which informed CNT’s methodology for this map version. Additionally, CNT referred to the Chicago Department of Public Health’s 2020 [Air Quality and Health Report](#) for additional sources.

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: Chicago Census block groups ½ mile or less of an intermodal rail yard, Chicago Census block groups 250 meters or less to industrial corridor, and Suburban Chicago zip codes ½ mile or less from a freight cluster. 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 2021. 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 demographic composition percentages in Chicago are based on official community area boundaries.

Data Sources

Chicago

Data Source	Year	Spatial Resolution	Attribute of Interest	Contributed to which Index Layer
Census American Community Survey 5 Year Estimates	2019	Census Block Group	<ul style="list-style-type: none"> • Population of Racially Minoritized People • Low Income • Less than High School Education • Linguistic Isolation • Over 64 • Under 5 • Unemployed <p>(all as defined by the EPA EJ Screen)</p>	Demographics
Environmental Protection Agency Environmental Justice Screen 1.0	Downloaded 2021	Census Block Group	<ul style="list-style-type: none"> • 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 Tract	<ul style="list-style-type: none"> • Asthma • Heart Disease • COPD (Chronic Obstructive Pulmonary Disease) • Diabetes • No insurance • General Health, self-report • Physical Health, self-report • Mental Health, self-report 	Health

Chicago Department of Public Health Air Quality and Health Index Report, Office of Epidemiology	2013–2017 (accessed from 2020 CDPH health index)	Census Block Group	<ul style="list-style-type: none"> • Low birthweight 	Health
Illinois Department of Transportation	2019	Street Segment	<ul style="list-style-type: none"> • AADT (Annual Average Daily Traffic), Heavy Commercial Vehicle Volume • AADT (Annual Average Daily Traffic), All Vehicle Volumes 	Freight/Logistics
Chicago Data Hub	Downloaded 2021	Polygons	<ul style="list-style-type: none"> • Industrial Corridors 	Freight/Logistics
Department of Motor Vehicle registrations, accessed through partnership with CalStart	2019	Zip code (ZCTA)	<ul style="list-style-type: none"> • 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	2016	Polygons	<ul style="list-style-type: none"> • Intermodal rail yard 	Freight/Logistics

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

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

Data Source	Year	Spatial Resolution	Attribute of Interest	Layer
Census American Community Survey 5 Year Estimates	2019	Census Block Group	<ul style="list-style-type: none"> • Population of Racially Minoritized People • Low Income • Less than High School Education • Linguistic Isolation • Over 64 • Under 5 • Unemployed <p>(all as defined by the EPA EJ Screen)</p>	Demographics
Environmental Protection Agency Environmental Justice Screen 1.0	Downloaded 2021	Census Block Group	<ul style="list-style-type: none"> • 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 Places	2021	Census Tract	<ul style="list-style-type: none"> • Asthma • Heart Disease • COPD (Chronic Obstructive Pulmonary Disease) • Diabetes • No insurance 	Health

			<ul style="list-style-type: none"> • General Health, self-report • Physical Health, self-report • Mental Health, self-report 	
Freedom of Information Act request from the Illinois Department of Public Health	2013 - 2017	Zip code	• Low birthweight	Health
Illinois Department of Transportation	2019	Street Segment	• AADT (Annual Average Daily Traffic), Heavy Commercial Vehicle Volume	Freight/Logistics
Chicago Metropolitan Agency for Planning	2018	Polygons	• Freight clusters	Freight/Logistics
Department of Motor Vehicle registrations, accessed through partnership with CalStart	2019	Zip code (ZCTA)	• Truck registration locations (Class 3 – 8 commercial vehicles)	Freight/Logistics

Table 2. Data used to calculate freight-focused cumulative impacts scores in Suburban Chicago

Methodology

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

Layers: Demographics, Environmental Exposure, and Health

Chicago & Suburban Chicago

1. 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 same rate to all block groups with a centroid in a zip code for Suburban Chicago.
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 split and scored into quintiles, with the highest ratio scoring as a 5 and the lowest ratio scoring as a 1.
3. For each layer, these attribute quintiles were summed and then split into quintiles again to derive the quintile score for the whole layer.

Layer: Freight/Logistics

Chicago

Note: CNT used a 1/2mi buffer around intermodal rail yards and street segments. This was based on conversations with community advocates finding that air pollution from traffic spread to about a half mile around the source. This buffer distance does not account for wind patterns or micro-climate effects on air pollutants.

Industrial corridor and intermodal rail yard data:

1. We identified block group centroids in or \leq 250 meters away from one or more of Chicago's 24 industrial corridors and scored them a five (5). Block group centroids $>250\text{m}$ of an industrial corridor scored a one (1).
2. We identified block group centroids within a 1/2mi buffer of Chicago's 19 intermodal rail yards and scored them a five (5). Block group centroids not within a 1/2mi of an intermodal rail yard scored a one (1).
3. Each block group's industrial corridor and intermodal rail yard quintile scores were joined to make a combined quintile score:
 - a. Quintile 1: Scores 1 on intermodal rail yard and 1 on industrial corridor
 - b. Quintile 2: Scores 1 on intermodal rail yard and 5 on industrial corridor
 - c. Quintile 3: No block group given a score of 3
 - d. Quintile 4: Scores 5 on intermodal rail yard and 1 on industrial corridor
 - e. Quintile 5: Scores 5 on intermodal rail yard and 5 on industrial corridor

Truck traffic data:

4. We calculated the proportion of heavy commercial vehicle annual average daily traffic (HCV AADT) to all vehicle annual average daily traffic (AADT) for each street segment available through IDOT that had greater than zero heavy commercial vehicles.
 - a. *Rationale:* There are high traffic volumes across Chicago, so a mere count of HCV may overly weight street segments with lots of total traffic instead of weighting the street segments that have more heavy-duty vehicles comparatively.
 - b. *Limitation:* IDOT data only counts HCV on highways so HCV on other road classes is unknown with this data set.
5. We intersected the IDOT street layer that showed AADT with block groups that were within a 1/2mi of all IDOT street segments, summing the HCV counts and AADT counts. Then, the proportion of HCV AADT to all vehicle AADT was calculated for each block group.

- a. *Limitation:* Each street segment does not neatly fit into one block group.
6. We ranked and separated the block groups into quintiles and gave a score between 1-5 with 5 assigned for the highest proportion.

Truck registration data:

7. We filtered the CalStart data for vehicles that were larger than Class 2 and were not a bus (school or non-school) or motor home.
8. We aggregated the registrations to provide a count per zip code in the city. The concentration of registrations for each zip code was calculated by finding the ratio of registrations per zip code compared to the total number of registrations in the city. This ratio was then assigned to each block group with a centroid in the zip code. The block groups were ranked and separated into quintiles and given a score of between 1-5 with 5 assigned for the highest proportion.
 - a. *Limitation:* Truck registrations are not equally distributed across a zip code so some block groups may be over or underrepresented by this method.
9. **For the final freight/logistics layer**, we summed the industrial corridor & intermodal rail yard, truck traffic, and truck registration quintiles and split them into quintiles again to derive the quintile score for the whole layer.

Layer: Freight/Logistics

Suburban Chicago

Note: CNT used a 1/2mi buffer around freight clusters and street segments. This was based on conversations with community advocates finding that air pollution from traffic spread to about a half mile around the source. This buffer distance does not account for wind patterns or micro-climate effects on air pollutants.

Freight cluster data:

1. Block groups with a centroid within a 1/2mi of a [freight cluster](#) were identified and scored as a 5, those without scored 1.

Truck traffic data:

2. HCV AADT was calculated for each street segment available through IDOT that had greater than zero heavy commercial vehicles.
 - a. *Rationale:* There are generally low traffic volumes in rural parts of counties that are less populated. So, if a ratio to AADT was taken, rural roads would be overrepresented in the data.

- b. *Limitation:* IDOT data only counts HCV on highways so HCV on other road classes is unknown with this data set.
3. We intersected the IDOT street layer that showed AADT with block groups that were within a 1/2mi of all IDOT street segments, summing the HCV counts. Then, we counted the HCV for each block group.
 - c. *Limitation:* Each street segment does not neatly fit into one block group.
4. The block groups were ranked against each other, separated into quintiles, and given a score between 1-5 with 5 assigned for the highest proportion.

Truck registration data:

5. We filtered the CalStart data for vehicles that were larger than Class 2 and were not a bus (school or non-school) or motor home.
6. We aggregated the registrations to provide a count per zip code. The concentration of registrations for each zip code was calculated by finding the ratio of registrations per zip code compared to the total number of registrations for the 6-county area mapped. This ratio was then assigned to each block group with a centroid in the zip code. The block groups were ranked and separated into quintiles and given a score of between 1-5 with 5 assigned for the highest proportion.
7. **For the final freight/logistics layer**, we summed the freight cluster, truck traffic, and truck registration quintiles and split them into quintiles again to derive the quintile score for the whole layer.

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

Chicago & Suburban Chicago

1. We joined all the layers for each block group in Chicago or zip code in Suburban Chicago and summed the quintile scores from each layer.
2. Then, we split these sums into quintiles again to derive the quintile score for the final index, with 5 as the most burdened.
3. We overlaid 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.

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; IDOT data only counts HCV on highways so HCV on residential roads is unknown with this data set.
 - Each IDOT street segment does not neatly fit into one block group in Chicago or zip code in Suburban Chicago, so some block groups or zip codes may be over or underrepresented by this method.
 - 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 ≤ 17 years old are not accounted for.
- Low birthweight data, from the City of Chicago's and the State of Illinois' Departments of Public Health, is the only data source considering young children. Additionally, there is a limitation on the completeness of low birthweight data because of privacy concerns. For example, if zip codes have too few low birthweights, these zip codes would not be included in the data attained through the FOIA.
- **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.

April 2024