Vulnerable Population Index (VPI)

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I. Vulnerable Population

Title VI of the Civil Rights Act of 1964 and the 1994 President's Executive Order on Environmental Justice (#12898) state that no person or group shall be excluded from participation in, or denied the benefits of, any program or activity utilizing federal funds. Each federal agency is required to identify any disproportionately high and adverse health or environmental effects of its programs on minority and low-income populations. In turn, Metropolitan Planning Organizations (MPOs) are charged with evaluating their plans and programs for environmental justice (EJ) sensitivity, and expanding their outreach efforts to low-income, minority, and other disadvantaged populations, as part of the United States Department of Transportation's certification requirements.

H-GAC uses data from the US Census Bureau to determine the concentrations of eight sensitive populations for the region and for each census block group. A block group with a concentration of a sensitive population greater than the concentration of the H-GAC region as a whole is considered to be "vulnerable" for the sensitive population. The Vulnerable Population Index (VPI) indicated the number of vulnerable populations for each block group, and thus provides a general indication of the extent to which each block group is vulnerable.

The following eight populations were determined to be sensitive based on understanding of both federal requirements and regional demographics:
- Poverty
- Non-Hispanic, non-white
- Hispanic
- Limited English proficiency
- Disabled family
- Elderly
- Car-less
- Single female householder with child/children in the household.

1. Poverty

The Census Bureau uses a set of income thresholds that vary by household size and composition to determine poverty. If a household's total income is less than the threshold, then that household and every individual in it is considered in poverty. For example, the threshold for 2015 for a four-person household with two dependents is $24,036. While the thresholds do not vary by place, they are updated for inflation using the Consumer Price Index (CPI-U).

2. Non-Hispanic, non-white

The U.S. Department of Transportation (DOT) Order (5610.2) on EJ defines "Minority" as:
- Black: a person having origins in any of the black racial groups of Africa
- Asian American: a person having origins in any of the original peoples of the Far East, Southeast Asia,
- the Indian subcontinent
- Native Hawaiian or Pacific Islander
- American Indian and Alaskan Native: a person having origins in any of the original people of North America who maintain cultural identification through tribal affiliation or community recognition

In addition to the groups mentioned above, the U.S. Census recognizes two additional racial categories:
- Some other race alone and
- Two or more races

2. Hispanic

The U.S. Census Bureau defines Hispanic as person(s) of Mexican, Puerto Rican, Cuban, Central or South American, or other Spanish culture or origin, regardless of race.

3. Limited English proficiency

The Limited English Proficiency(LEP) population is defined as households in which no one (14 and over) speaks English only; or speaks a language other than English at home, and speaks English "not well" or "not at all."

4. Disabled Family

The U.S. Census Bureau classifies individuals as disabled if they report difficulties working at a job, leaving home, or report long-lasting sensory, physical, mental, emotional, or self-care disabilities. A disabled family is a family whose head, spouse, or sole member is a person with disabilities. It may include two or more persons with disabilities living together, or one or more persons with disabilities living with one or more live-in aides.

5. Elderly

Elderly is defined as age 75 and above.

6. Car-less

The U.S. Census Bureau defines car-less as a household with no vehicle access.

7. Single female householder with child/children in the household

The number and percent of single mothers with own children under 18 years of age.

II.   Calculation of Vulnerable Population Index

The Vulnerable Population Index (VPI) represents the relative degree of vulnerability of population in one area compared to that of the entire region (or County).

The calculation methods are explained as following:

Step 1: Extract the demographic and social-economic data from the 2017 American Community Survey and obtain the concentration of vulnerable population in each category for both target regions (block group) and background regions (county or H-GAC area).

BG_Var% =BG_Population_Var/BG_Total_Population

Region_Var%= Region_Population_Var/Region_Total_Population

Step 2: For each vulnerable population category, calculate the vulnerability quotient.

Quotient_Var=(BG_Var%)/(Region_Var%)

Step 3: For each vulnerable population category, block groups with vulnerability quotient greater or equal to 1 are considered to have a vulnerable population.

If Quotient_Var >=1 then VP_Var=1; Else If Quotient_Var <1 then VP_Var=0

Step 4: Sum up the VP values for all categories and the VPI for each block group is generated.

VPI=Sum(VP_all_vars)

VPI should be integers between 0 and 8.

The steps 5 and onward are used to obtain standardized vulnerability quotient index (VQI).

Step 5: Sum up the vulnerability quotient for all vulnerability categories.

Quotient_Sum=sum(Quotient_all_vars)

Step 6: Rank all block groups in ascending order of Quotient_Sum. Sum up the Quotient_Sum for all block groups in the background region (county/H-GAC Area) as Quotient_Total.

Quotient_Total=sum(Quotient_Sum) (for all block groups)

Step 7: Calculate the cumulative percentage of Quotient_Sum (for each block group, in ascending order of Quotient_Sum) to the background region (Each block group's respective county or entire H-GAC region) as the VQI. The VQI should be distributed from 0 to 1. The block group that has the greatest Quotient_Sum in the background region has a VQI of 1.

VQI=(Cumulative Quotient_Sum)/Quotient_Total

Vulnerable Population

	H-GAC Region	Austin	Brazoria	Chambers	Colorado	Fort Bend	Galveston	Harris	Liberty	Matagorda	Montgomery	Walker	Waller	Wharton
Total population (2017)	6,949,959	29,565	353,999	40,292	21,022	739,342	327,089	4,602,523	81,862	36,743	554,445	71,539	49,987	41,551
Total household population (2017)	6,850,007	29,287	342,408	40,020	20,690	733,624	320,541	4,561,215	74,682	36,359	551,333	53,444	45,422	40,982
Total households (2017)	2,368,252	11,041	118,762	13,529	7,511	230,381	119,181	1,583,486	26,203	13,636	192,823	21,636	14,807	15,256
1. Population in Poverty	981,475	3,159	31,553	5,072	2,242	57,565	42,158	739,100	11,047	7,293	54,526	12,881	7,697	7,182
% of Total household population	14.3%	10.8%	9.2%	12.7%	10.8%	7.8%	13.2%	16.2%	14.8%	20.1%	9.9%	24.1%	16.9%	17.5%
2. Non-Hispanic Minorities	1,821,594	3,221	76,946	4,313	2,967	310,375	59,017	1,259,528	9,939	4,972	52,636	18,242	13,513	5,925
% of Total population	26.2%	10.9%	21.7%	10.7%	14.1%	42.0%	18.0%	27.4%	12.1%	13.5%	9.5%	25.5%	27.0%	14.3%
3. Hispanic Minorities	2,557,924	7,819	106,731	8,793	6,200	179,653	79,406	1,958,963	19,098	15,441	131,147	12,787	14,903	16,983
% of Total population	36.8%	26.4%	30.2%	21.8%	29.5%	24.3%	24.3%	42.6%	23.3%	42.0%	23.7%	17.9%	29.8%	40.9%
4. Limited English Proficiency	600,469	1,449	13,581	1,504	932	37,059	11,073	499,288	3,012	2,262	22,785	2,057	3,137	2,330
% of Total population	8.6%	4.9%	3.8%	3.7%	4.4%	5.0%	3.4%	10.8%	3.7%	6.2%	4.1%	2.9%	6.3%	5.6%
5. Disable Family	496,116	2,843	25,868	3,586	2,286	41,482	34,048	317,453	9,505	4,447	42,284	3,980	3,844	4,490
% of Total households	20.9%	25.7%	21.8%	26.5%	30.4%	18.0%	28.6%	20.0%	36.3%	32.6%	21.9%	18.4%	26.0%	29.4%
6. Elderly	273,929	2,151	15,201	1,577	1,996	25,231	17,023	169,956	3,934	2,686	25,556	3,520	2,060	3,038
% of Total population	3.9%	7.3%	4.3%	3.9%	9.5%	3.4%	5.2%	3.7%	4.8%	7.3%	4.6%	4.9%	4.1%	7.3%
7. Car-less	123,480	490	3,768	588	405	5,052	6,450	95,285	1,617	824	6,577	972	534	918
% of Total Households	5.2%	4.4%	3.2%	4.3%	5.4%	2.2%	5.4%	6.0%	6.2%	6.0%	3.4%	4.5%	3.6%	6.0%
8. Single Female Householder with Child/children in the household	228,125	633	8,893	801	485	17,964	9,877	168,819	2,050	967	13,446	1,368	1,203	1,619
% of Total Households	9.6%	5.7%	7.5%	5.9%	6.5%	7.8%	8.3%	10.7%	7.8%	7.1%	7.0%	6.3%	8.1%	10.6%

Source: American Community Survey (ACS) 2014-2018