

# A : Methodology

# 1 Equity Index

## Communities of Color

### Source

- American Community Survey 5-Year Estimates, 2017
- Table B03002 by Census Block Group
- [Factfinder.census.gov](https://factfinder.census.gov)

### Variables

- Percent non-white (includes individuals who identify as one or more ethnicities other than white and all individuals who identify as Hispanic/Latino)

### Calculations

The ACS provides ethnicity information for non-Hispanic/Latino and Hispanic/Latino groups. For this analysis, communities of color included all race and ethnicity classifications other than white alone.

Variable	Meta Data	Description	Calculation
Total_nw	Percent Non-white	Total number of individuals who identify as Non-Hispanic/Latino (nhl) and Black (black), American Indian and Alaskan Native, Asian (ai_an), Hawaiian and Pacific Islander (haw_pi), Other (otheralone, twoother), Two or more (twoplus), as well as those who identify as Hispanic/Latino (hlat) alone and one or more these ethnicities. It does not include Non-Hispanic/Latino (nhl) individual who identify as White alone (white).	$= Est\_nhl\_black + Est\_nhl\_ai\_an + Est\_nhl\_asian + Est\_nhl\_haw\_pi + Est\_nhl\_otheralone + Est\_nhl\_twoplus + Est\_nhl\_two\_twoother + Est\_nhl\_two\_three + Est\_hlat + Est\_hlat\_white + Est\_hlat\_black + Est\_hlat\_ai\_an + Est\_hlat\_asian + Est\_hlat\_na\_pi + Est\_hlat\_otheralone + Est\_hlat\_twoplus + Est\_hlat\_two\_other + Est\_two\_three$
Est_tot	Estimate Total	Total number of individuals in block group, as reported by Census.	
Per_nw	Total number of Non-White	Percentage of Non-white individuals in block group.	$= Total\_nw / Est\_Tot$

## Low-Income Households

### Source

- American Community Survey 5-Year Estimates, 2017
- Table B19013 Median Household Income in the past 12 months by Census Tract
- [Factfinder.census.gov](https://factfinder.census.gov)

### Variables

- Median Income

### Calculations

Median household income by census tract was used to determine average median income across the region. Any tracts above-average median income receives a score of 0. Those between 80-100% of average median income received a score of 1; between 50-80% a score of 2; and those where median income was lower than 50% of average median income received a score of 3.

Variable	Meta Data	Description	Calculation
Median_inc	Median income	Median income by census tracts	
Low income score	Low income by % below median regional income	An average of the median income in all census tracts in the region was calculate as well as thresholds for 80% & 50% of that level	$=average(Median\_inc)$ $=average(Median\_inc) \times 0.8$ $=average(Median\_inc) \times 0.5$

## Cost-Burdened Households

### Source

- American Community Survey 5-Year Estimates, 2017
- Table B25106 Tenure by housing costs as a percentage of household income in the past 12 months by Census Tract
- [Factfinder.census.gov](https://factfinder.census.gov)

### Variables

- Percentage of households with housing costs greater than 30% of household income

### Calculations

30% of household income is recognized as the Federal affordability threshold. Households who spend over 30% of their income on housing are considered cost-burdened households. Identifying areas with a high proportion of cost-burdened households was used to identify areas of need.

Variable	Meta Data	Description	Calculation
pct_CB	Percent Cost-Burdened	Percentage of households who rent or own in a census block who are paying more than 30% of household income towards housing costs	$= \text{sum}('30 \text{ percent or more}') / 'total'$

## Limited English Proficiency

### Source

- American Community Survey 5-Year Estimates, 2017
- Table C16002 Household Language by Household Limited English-Speaking Status by Census Block Group
- [Factfinder.census.gov](https://factfinder.census.gov)

### Variables

- Limited English-Speaking (LEP) Households

### Calculations

The ACS provides information about Limited English-speaking households generally as well as for Spanish, Other Indo-European Languages, Asian and Pacific Island Languages, and all Other Languages.

Variable	Meta Data	Description	Calculation
TotalHH	Estimate, Total Households	Total number of households estimated per Census Block Group as reported by Census.	
Tot_LEPHH	Total LEP Households	Total number of LEP households including Spanish (LEP_Spanish), Indo European (LEP_IndoEuro), Asian and Pacific (LEP_AsianPI), and Other Languages (LEP_Other).	$= \text{LEP\_Spanish} + \text{LEP\_IndoEuro} + \text{LEP\_AsianPI} + \text{LEP\_Other}$
Per_LEPHH	Percent LEP Households	Percent of LEP Households per Census Block Group.	$= \text{Total\_LEPHH} / \text{TotalHH}$

## School Demographics

### Sources

- Metro Data Resource Center, Public and private school locations (points) Shapefile. Original Source: Oregon Dept. of Education (ODE) Open Institution List.
- U.S. Department of Education National Center for Education Statistics Common Core of Data (CCD) "Public Elementary/Secondary School Universe Survey" 2016-17 v.1a; "Public Elementary/Secondary School Universe Survey Geographic Data (EDGE)" 2016-17 v.1a.
- [Educationdata.urban.org](http://Educationdata.urban.org)

### Variables

- Percent non-white students by public school
- Average percent of non-white students at each school per block group

### Calculations

NCES Common Core data provides enrolment characteristics for each public and private school and/or district, including several school types. The total number of non-white students was calculated by school (all types), which includes all students identifying as a race other than white or two or more races.

The Oregon dataset was filtered by county to include Multnomah, Washington and Clackamas Counties (n = 407 schools). Three schools had data that was flagged by NCES as “not applicable” and were removed. The final clean dataset (n = 404) was then joined to the Schools shapefile (points) available through the Metro Data Resource Center (updated February 2019) using the NCES School ID (NCESSchID), resulting in a shapefile with a feature for each school and information about the percentage of non-white students by school (n = 394).

The schools\_join was then spatially joined to the block groups shapefile, which provided calculations of average percent of non-white students per school for each block group. Some block groups did not have any schools; therefore, the average percentage of students of color was zero. When calculating averages and quartiles, the zero values were removed to avoid skewing the data. Block groups thus determined the quartiles and thresholds for scoring with schools.

Variable	Meta Data	Description	Calculation
Total	Total Students	Total Race/Ethnicity as reported by NCES Common Core.	
Tot_nw	Total Non-white Students	Total number of students identifying as American Indian/Alaska Native (AIAN), Asian or Asian/Pacific Islander (APII), Hispanic (Hisp), Black (Black), White (White), Hawaiian Nat./Pacific Islander (HaiPI), and Two or More Races (Two).	$= AIAN + APII + Hisp + Black + White + HaiPI + Two$

Variable	Meta Data	Description	Calculation
Per_nw	Percent Non-White Students	Percentage of non-white students by school.	$= Total\_nw / Est\_Tot$
Ave_per_nw	Average percent of non-white students	Average percentage of non-white students in schools by block group, achieved by joining schools shapefile to final block groups shapefile.	$= SumBG(Per\_nw)/Total\ schools$

## English Language Learners

### Source

- Metro Data Resource Center, School Districts (polys) Shapefile.
- U.S. Department of Education National Center for Education Statistics Common Core of Data (CCD) "Public Elementary/Secondary School Universe Survey" 2016.
- [Educationdata.urban.org](http://Educationdata.urban.org)

### Variables

- Total English Language Learners per school district
- Percent English Language Learners per school district
- Average percent English Language Learners per block group

### Calculations

The NCES Common Core provides a variety of information about student enrolment and characteristics by school or district. Students identified as English Language Learners can enroll in special programs to build English language proficiency and improve their overall educational outcomes. For this analysis, the total number of English Language Learners (ELL) students and total number of enrolled students were used to calculate the average ELL student population in each district. The data table was joined to the Metro School Districts Shapefile, which was then spatially joined to the block groups shapefile to calculate average percent ELL student population by block group. Each block group ultimately is assigned the same average percent ELL students as the district(s) it overlaps.

Variable	Meta Data	Description	Calculation
english_language_learners (ELL)	Total number of English Language Learners	Total number of students who are identified as English Language Learners by the NCES Common Core.	
Enrollment	Total enrolled students	Total number of students enrolled in school districts as reported by the NCES Common Core.	

Variable	Meta Data	Description	Calculation
Per_ELL	Percent English Language Learners	Percent of ELL students per school district.	= $\frac{\text{English\_language\_learners}}{\text{Enrollment}}$
Avg_Per_ELL	Average English Language Learners	Average number of ELL students per district by census block group.	= $\frac{\text{SumBG(Per\_ELL)}}{\#\text{School Districts}}$

## Youth and Older Adults

### Source

- American Community Survey 5-Year Estimates, 2017
- Table B01001 Sex by Age by Census Block Group
- [Factfinder.census.gov](https://factfinder.census.gov)

### Variables

- Percent of population under age 18
- Percent of population over age 65

### Calculations

The ACS provides data on the percent of the population in different age groups by block group. For this analysis, children were identified as individuals under age 18 and older adults were identified as individuals over age 65.

Variable	Meta Data	Description	Calculation
pctUnder18	Percent under Age 18	Percent of population of children age 18 or under, as reported by ACS.	= $\frac{\text{Sum(under18)}}{\text{total}}$
pctOver65	Percent over Age 62	Older adults age 65 or older, as reported by ACS.	= $\frac{\text{Sum(over 65)}}{\text{total}}$

## Retirement Facilities

### Source

- Metro Data Resource Center Multifamily Housing Inventory, January 25, 2019
- Shapefile of polygons for all multifamily types in Clackamas, Washington and Multnomah Counties.
- [RLIS Discovery](#)

### Variables

- Unit Type (Retirement Facility)
- Total Number of Units (Retirement Facility) per Block Group

### Calculations

The total number of retirement facility units per block group was calculated in ArcGIS through a spatial join. The initial table of multifamily housing was filtered by Unit Type (Retirement Facility). This selection was then exported to a separate shapefile and layer. The Retirement Facility layer was spatially joined to the Census Block Group Layer. In the process, the Sum\_Units variable was created, which provided a total number of units per block group. Other variables of interest that were not used for the indices include the min, maximum and average number of retirement facilities per block group.

Variable	Meta Data	Description	Calculation
Units	Housing units	Number of housing units per facility as reported by Metro Data Resource Center.	
Sum_Units	Sum of housing units per block group	Sum of housing units per block group.	<i>= SUM Units (Retirement Facility)</i>

## People with Disabilities

### Source

- American Community Survey 5-Year Estimates, 2017
- Table S1810 by Census Tract
- [Factfinder.census.gov](https://factfinder.census.gov)

### Variables

- Total Number of People with Disability
- Total Number of People with Physical Impairment (Ambulatory, Hearing, Vision)

### Calculations

The American Community Survey data counts individuals who report having a disability. Disability is classified in the American Community Survey into several defined types of impairment: hearing, vision, ambulatory, cognitive, self-care, and independent living. This study mapped the total number of people per census tract that reported having a disability.

Variable	Meta Data	Description	Calculation
Total_disa	Total number of people with disability	All individuals who report having a disability, as reported by Census.	

## 2 Safety Index

### Source

- Oregon Department of Transportation Crash Data

### Variables

- Number of pedestrians involved in collision
- Number of bicyclists involved collision
- Number of pedestrian fatalities
- Number of bicyclist fatalities

### Calculations

The safety index score identifies block groups with the highest regional proportion of bike and pedestrian collisions and fatalities. Collision data provided by Metro, originally sourced from the Oregon Department of Transportation, reported individual collisions in the region between 2011-2015. Bike and pedestrian involved collisions were separated and these collisions were mapped using coordinate data and then spatially joined to the block group shapefile. Through the spatial join, the number of pedestrians, bicyclists, and fatalities were summed by block group. Total number of active transportation collisions was calculated by adding pedestrians and bicyclists, and % of fatal AT collisions was calculated by dividing the number of AT fatalities by those bicyclists and pedestrians involved in collisions. Fatalities were used as an indicator, as data on injury severity was limited. All active transportation collisions reported were either a fatality or high level of severity, which suggests that less severe bike and ped collisions are typically not reported.

Variable	Meta Data	Description	Calculation
bikeped	Total number of bicyclists and pedestrians involved in collisions	The number of bicyclists and pedestrians involved in a collision as reported by ODOT	
fatal_pct	Percentage of bicycle and pedestrian involved collisions that are fatal to bicyclist or pedestrian	The number of reported bicyclist and pedestrian fatalities divided by the total number of bicyclists or pedestrians that were involved in collisions	$= \text{fatal} / \text{bikeped}$

# 3 TDM Index

## TDM Programs and Support

### Source

- TDM Geodatabase (TDM Inventory Phase I)
- Employee Commute Options (ECO) Programs

### Variables

- Number of TDM programs per block group
- Number of different subcategories per block group (maximum 17)
- Number of ECO employer programs per block group (max 10)

### Calculations

The following steps were completed to assemble a master TDM dataset that included information on how many projects in which categories were occurring in each block group.

1. Shapefiles in the previous database were copied into a new geodatabase. Attribute tables were modified using the Delete Fields Data Management Tool to include identifying fields (JoinID, Project Name, Major Categories, Subcategories, and others) and to eliminate long string fields that would impede spatial joins.
2. Using ModelBuilder, a batch one-to-many batch join process was implemented that joined each project in each shapefile's attribute table to each block group it intersected.
3. The join outputs (DBF files) were imported to Excel and appended into one master file using the Power Query Feature. The result was a complete list of all Project-Block Group pairs.
4. The final TDM\_join dataset was copied into the evaluation matrix.

The final TDM\_join dataset included a master table of all TDM project and block group strategies for the following major categories: infrastructure, new mobility, TDM programs and support, and policy/plans. For this Index, only the TDM Programs and Support projects were needed; these were filtered and moved into an Input Tab.

Variable	Description	Calculation
Total	Total number of TDM programs per block group.	$=Count(Subcategories\ A\ and\ B)$
Categories	Percentage of unique TDM subcategories (base 17)	$= (Total\ Subcategory\ A + Subcategory\ B) / Total\ Subcategory\ (17)$

## ECO Employer Data

### Source

- Employee Commute Options (ECO) Dataset, Metro

### Variables

- Number of employer programs per block group (maximum 10)

### Calculations

The dataset includes information about employer worksites and their TDM programs throughout the Metro region. In order to determine the levels of employer programming per block group, the addresses from the ECO dataset were geocoded to obtain X,Y coordinates for each registered employer program. This information was converted to a shapefile and spatially joined to the Metro region block groups shapefiles, which calculated the count of employers programs per block group.

The output from this calculation was included in the TDM Index as a distinct subcategory column. The maximum number of points was capped at 10, which prevented the Index Score from being skewed towards employer-based programs.

Variable	Meta Data	Description	Calculation
Employers	ECO Employers	The number of ECO employer programs per block group.	= <i>CountBG (Employers)</i>

# 4 Access Index

## Context Score

### Source

- Metro Context Score database

### Variables

- Bike Path Access
- Sidewalk Density
- Transit Access
- ULI Urban Amenities

### Calculations

The context score is an existing index provided by Metro that displays modal access regionally as a raster. For this analysis, average context score for each of the four variables was calculated by block group using the following process:



Variable	Meta Data	Description	Calculation
Avg_grid_c (Transitaccess)	Average index score for transit access	How accessible are high-quality transit options throughout the block group	<i>(assigned through above process)</i>
Avg_grid_c (Bikeaccess)	Average index score for bicycle facilities	How accessible are bicycle facilities throughout the block group	
Avg_grid_c (ULI)	Average index score for urban amenities	How accessible are urban amenities/community destinations within the block group	
Avg_grid_c (Sidewalkdens)	Average index score for sidewalk density	The level of sidewalk coverage on streets within the block group	

## New Mobility

### Source

- TDM Geodatabase (TDM Inventory Phase I)

### Variables

- Number of New Mobility strategies per block group

### Calculations

The following steps were completed to assemble a master TDM dataset that included information on how many projects in which categories were occurring in each block group.

5. Shapefiles in the previous database were copied into a new geodatabase. Attribute tables were modified using the Delete Fields Data Management Tool to include identifying fields (JoinID, Project Name, Major Categories, Subcategories, and others) and to eliminate long string fields that would impede spatial joins.
6. Using ModelBuilder, a batch one-to-many batch join process was implemented that joined each project in each shapefile's attribute table to each block group it intersected.
7. The join outputs (DBF files) were imported to Excel and appended into one master file using the Power Query Feature. The result was a complete list of all Project-Block Group pairs.
8. The final TDM\_join dataset was copied into the evaluation matrix.

The final TDM\_join dataset included a master table of all TDM project and block group strategies for the following major categories: infrastructure, new mobility, TDM programs and support, and policy/plans. For this Index, only the New Mobility projects were needed; these were filtered and moved into an Input Tab.

Also, these were further refined to include only shared mobility service areas and fixed/on-demand services subcategories. Smart payment systems and multimodal tools were removed as they do not indicate access to alternative modes.

Variable	Description	Calculation
Total	Total number of New Mobility programs per block group.	<i>=Count(Shared Mobility Service Areas, Fixed/On-Demand Services)</i>

# 5 Infrastructure Index

## Source

- TDM Geodatabase (TDM Inventory Phase I)

## Variables

- Number of infrastructure strategies per block group

## Calculations

The following steps were completed to assemble a master TDM dataset that included information on how many projects in which categories were occurring in each block group.

1. Shapefiles in the previous database were copied into a new geodatabase. Attribute tables were modified using the Delete Fields Data Management Tool to include identifying fields (JoinID, Project Name, Major Categories, Subcategories, and others) and to eliminate long string fields that would impede spatial joins.
2. Using ModelBuilder, a batch one-to-many batch join process was implemented that joined each project in each shapefile's attribute table to each block group it intersected.
3. The join outputs (DBF files) were imported to Excel and appended into one master file using the Power Query Feature. The result was a complete list of all Project-Block Group pairs.
4. The final TDM\_join dataset was copied into the evaluation matrix.

The final TDM\_join dataset included a master table of all TDM project and block group strategies for the following major categories: Infrastructure, New Mobility, TDM programs and support, and policy/plans. For this Index, only the Infrastructure projects were needed; these were filtered and moved into an Input Tab. Also, these were further refined to count only "new" infrastructure projects completed within the 2016-2021 window.

Variable	Description	Calculation
Total	Total number of Infrastructure projects completed within 2016 to 2021 window per block group.	<i>=Count(Infrastructure)</i>

# 6 Partner Index

## Participating Partners

### Source

- TDM Geodatabase (TDM Inventory Phase I)

### Variables

- Number of unique participating organizations per block group

### Calculations

The master table of TDM projects and block groups (see TDM Index) was used to isolate a unique list of organizations participating in regional TDM programs. Organizations listed as Project Owners in the present TDM geodatabase were considered Participating Partners.

## Potential Partners

### Source

- TDM Geodatabase (TDM Inventory Phase I)

### Variables

- Number of potential partner organizations per block group

### Calculations

A spatial dataset was created similar to the TDM geodatabase to calculate the number of potential partners in each block group. Metro provided a list of potential partners and a description of service areas.

1. Shapefiles were created for each partner service area. In some cases, there were duplicate or overlapping service areas. Similar to the TDM index, a spatial join was
2. Using ModelBuilder, a batch one-to-many batch join process was implemented that joined each shapefile to each block group it intersected.
3. The join outputs (DBF files) were imported to Excel and appended into one master file using the Power Query Feature. The result was a complete list of all Service Area-Block Group pairs.
4. Using Access, a lookup was created to link each potential partner to each service area and thus to each block group.
5. The potential partner – block group list of pairs was then used to calculate the number of unique potential partners using a *countif* function.

# 7 Gentrification Analysis

## Source

- American Community Survey 5-Year Estimates, 2017
- Census 2000 Summary File 3 (SF 3) - Sample Data

## Variables

- B01003 Total Population 2017
- P001 Total Population 2000
- H007 Tenure 2000
- P007 Race 2000
- B03002 Race 2017
- P088 Ratio of Income to Poverty Level 2000
- C17002 Ratio of Income to Poverty Level 2017
- P037 Educational Attainment for the Population 25 Years and Older 2000
- B15003 Educational Attainment for the Population 25 Years and Older 2017
- H063 Median Gross Rent 2000
- B25064 Median Gross Rent 2017
- P053 Median Household Income 2000
- B19013 Median Household Income 2017

## Calculations

The gentrification analysis compares demographic data from 2000 to 2017 to identify areas which have undergone significant demographic change that is indicative of population displacement. Gentrification was applied to the Opportunity Index as a balancer to adjust for conditions that may lead to overinvestment due to gentrification.

The analysis utilizes a two-step process that first identifies if a block group is vulnerable to gentrifying and then those whole display markers of gentrification, by comparing factors like change in race, educational attainment, median income and median rent to the change in these indicators' region-wide. This process was developed based on a UCLA neighborhood change database analysis<sup>1</sup>.

A crosswalk was used to compare data across changing census tract boundaries from 2000 to 2010 census.

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<sup>1</sup> <https://www.urbandisplacement.org/map/social>

Scoring	Qualifier – Disadvantaged Neighborhood	Indicators – Gentrified Neighborhood
Variables	% low income households > regional median % college educated < regional median % renters > regional median % nonwhite > regional median	Change in % college-educated > region Change in % non-Hispanic white > region Change in median household income > Region Change in median gross rent > change in region
Eligibility	Meets at least 3 out of 4 indicators to qualify	0-1 indicator: 0 2 indicators: -1 3 indicators: -2 4 indicators: -3

The Gentrification Analysis supports Metro in its strategic equity goals and helps to avoid assigning gentrified communities a higher Equity score based on a population that has been displaced from the neighborhood. In addition, in areas experiencing or vulnerable to gentrification, public investment can accelerate gentrification by driving up land values and attracting outside businesses and population to an area. It is helpful to work with community partners to ensure investment will benefit those who are from the community and ensure actions do not make existing community members more vulnerable to displacement.