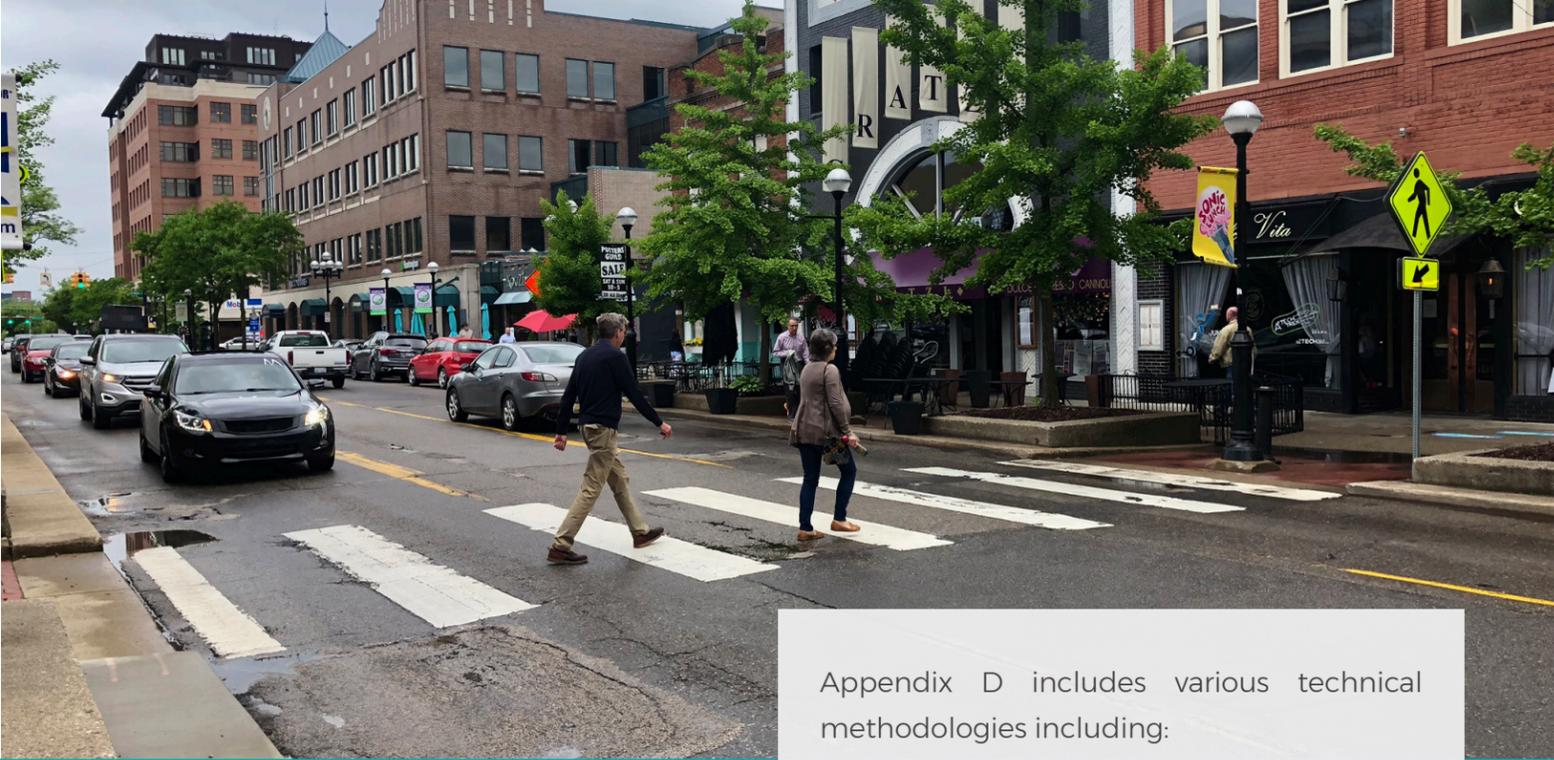


Analysis Methodologies



Appendix D includes various technical methodologies including:

- Pedestrian Demand Index
- Level of Traffic Stress
- Safety Analysis
- Equity Analysis
- Uncontrolled Crosswalk Locations
- Bike Intersections
- Sidewalk Gaps
- 20 Minute Neighborhood

D

ANALYSIS METHODOLOGIES

Pedestrian Demand Index

- » A pedestrian demand score was calculated for each street segment (using Ann Arbor centerlines shapefile). For population characteristics, data from the surrounding block group was spatially joined to the street segment. For other categories, instances within a .25 mile buffer of each street segment were counted.
 - » Population characteristics
 - » Population (2016 ACS) (10 points)
 - » Zero-vehicle households (2016 ACS) (8 points)
 - » Low-income households (2016 ACS) (8 points)
 - » Older adults (2016 ACS) (5 points)
 - » Children (2016 ACS) (5 points)
 - » Employment
 - » Total jobs (LEHD 2015) (10 points)
 - » Education
 - » Schools (City dataset) (10 points)
 - » Universities (City dataset) (10 points)
 - » Land use
 - » Parks + open spaces (City dataset) (3 points)
 - » Grocery stores (developed layer using Google Places) (3 points)
 - » Shopping + hotel + downtown parcels (selected relevant parcels from City land use dataset) (20 points)
 - » Public libraries (City dataset) (3 points)
 - » Transit
 - » AAATA Bus Stops (AAATA dataset 2018) (5 points)

Each factor was indexed to the prescribed point scale. All factors were then summed to determine final pedestrian demand score.



All Ages and Abilities

- » Criteria for evaluating the existing and the potential for future All Ages and Abilities bike routes were developed based on Level of Traffic Stress (LTS) methodologies from Dr. Peter Furth at Northeastern University and NACTO.
- » Shared use paths were examined individually and scored based on width of path and level of separation from the street. Shared use paths with no to minimal level of separation from the street were given a higher level of traffic stress than those with comfortable separation.

Speed Limit	AAADT < 3,000	AAADT 3,000-10,000	AAADT > 10,000
<= 25 mph	All facility types	Bike Blvd./Route	Bike Blvd./Route
		Bike Lane	Bike Lane
		Buffered Bike Lane	Buffered Bike Lane
		Protected Bike Lane	Protected Bike Lane
30 mph		Bike Blvd./Route	Bike Blvd./Route
		Bike Lane	Bike Lane
		Buffered Bike Lane	Buffered Bike Lane
		Protected Bike Lane	Protected Bike Lane
35 mph		Bike Blvd./Route	Bike Blvd./Route
		Bike Lane	Bike Lane
		Buffered Bike Lane	Buffered Bike Lane
		Protected Bike Lane	Protected Bike Lane
>= 40 mph		Bike Blvd./Route	Bike Blvd./Route
		Bike Lane	Bike Lane
		Buffered Bike Lane	Buffered Bike Lane
		Protected Bike Lane	Protected Bike Lane

LTS 1	LTS 2	LTS 3	LTS 4
-------	-------	-------	-------

Safety Analysis

All traffic crashes in Ann Arbor were analyzed ('2014_2018_crashes' layer package) between 2014 and 2018 from SEMCOG. All crashes on interstates and highways have been removed from the data.

Focus intersections were established ('Focus_intersections' layer package) based off traffic crashes between 2014 and 2018. Crash scores for intersections were calculated using the formula below. Additional intersections with the highest number of crashes involving people walking/biking were also deemed focus intersections.

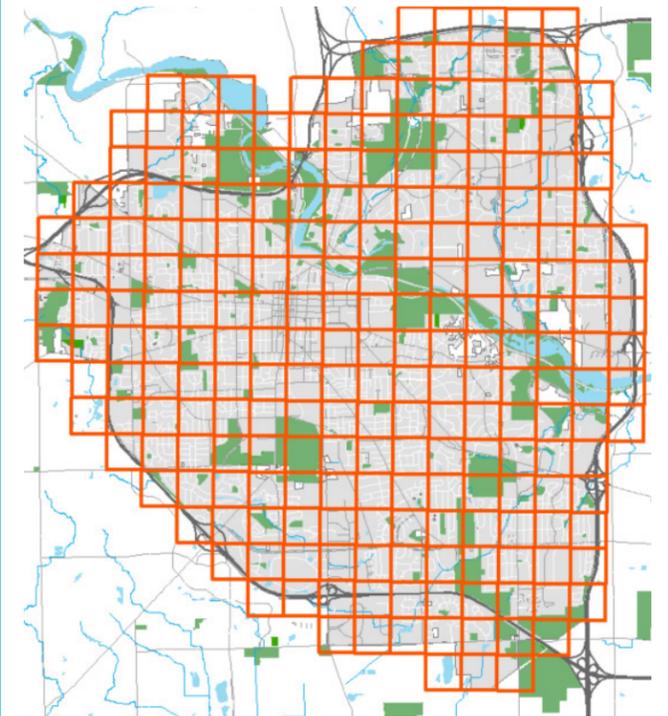
$$(\text{property damage crashes} \times .5) + (\text{fatalities} \times 50) + (\text{serious injuries} \times 40) + (\text{b injuries} \times 5) + (\text{c injuries})$$

Focus corridors were established ('Focus_corridors' layer package) based off traffic crashes between 2014 and 2018. Crash scores for corridors were calculated using the same formula as above. Additional corridors with the highest number of crashes involving people walking/biking were also deemed focus corridors.

Access to Jobs

- » The city was divided into a grid of 235 2,000 X 2,000 ft. cells (about a 10-minute walking distance) and the number of jobs within each cell (LEHD 2015) was calculated.
- » For driving and transit modes, Google Distance Matrix API was used to calculate travel time between every cell at 8am, 12pm, 5pm, and 9pm.

- » For walking, ArcGIS Network Analyst was used to calculate travel time between every cell using sidewalks/paths.
- » For biking, ArcGIS Network Analyst was used to calculate travel time between every cell using all streets (excluding interstate/highways) with an assumed biking speed of 10 mph. Travel time was calculated between every cell using only streets coded LTS 1 or 2, as well as streets where insufficient data was available to calculate the LTS score (the vast majority of which are low-stress residential streets).
- » For each cell and each mode, the number of jobs accessible within 20 minutes was calculated by totaling all of the jobs in the cells that could be reached in 20 minutes or less.



Equity Analysis

Census data is provided in the layer package titled 'Census_BlockGroups_Equity'. The layer provides various data by census block group.

An equity score was calculated for each census block group using 2016 5-year ACS data and data from the Center for Neighborhood Technologies housing and transportation affordability index. The equity score can be found in the attribute column 'Eq_Score' within the 'Census_BlockGroups_Equity' layer.

Eight variables were indexed to derive the equity score (see table on the facing page):

- A. Dependent population
- B. Minority population
- C. Unemployment
- D. Renter population
- E. No vehicle households
- F. Household costs spent on transportation
- G. Educational attainment (less than high school education)
- H. Per capita income

For each variable, the census data was organized by quintile, or the distribution of values divided into five equal groups. For variables A through G, the following points were awarded by quintile:

- » The first quintile, or the lowest 20%, received **1 point**.
- » The second quintile, 20% to 40%, received **2 points**.
- » The third quintile, 40 to 60%, received **3 points**.
- » The fourth quintile, 60% to 80%, received **4 points**.

- » The fifth quintile, 80% to 100%, received **5 points**.

For variable H ('per capita income'), the following points were awarded by quintile:

- » The first quintile, or the lowest 20%, received **5 points**.
- » The second quintile, 20% to 40%, received **4 points**.
- » The third quintile, 40 to 60%, received **3 points**.
- » The fourth quintile, 60% to 80%, received **2 points**.
- » The fifth quintile, 80% to 100%, received **1 point**.

One challenge in identifying areas with high equity needs in Ann Arbor is that many traditional indicators used to identify priority populations can also overlap with college students. To negate this issue, two variables ('dependent population' and 'educational attainment') were weighted more heavily (150%) due to their inverse relationship with concentrations of college students.

For Ann Arbor's Comprehensive Transportation Plan, reducing transportation costs for low-income residents is a critical strategy to help preserve affordability in the city. With this priority in mind, the equity analysis includes an additional "bonus" category for census block groups that rank in the top 20% in terms of the % of household costs spent on transportation AND in the top 20% for lowest per capita incomes, in order

Eight variables and scoring process:

Variable	Points	Weight	Score
A % dependent population Percentage of the population under 18 or over 64 years of age	1 to 5	150%	Points x Weight
B % minority	1 to 5		Points
C % unemployed Percentage of the population under 18 or over 64 years of age	1 to 5		Points
D % renter	1 to 5		Points
E % no vehicle households	1 to 5		Points
F % of household costs spent on transportation Transportation costs percentage income for the regional typical household	1 to 5		Points
G Educational attainment Percentage of the population over the age of 25 who have less than a high school education	1 to 5	150%	Points x Weight
H Per capita income	1 to 5		Points
I Bonus Additional points provided if Variable F and Variable H are both in the 5th quintile	7		Points
Total Equity Score			Total points (including weights) for variables A - I

to further highlight the transportation equity needs within these communities. We initially assigned a value of five points to the "bonus" category, but increased this value to seven after testing several iterations.

The final equity score is a total of all points multiplied by the weighting. A larger score indicates the higher need for equity.

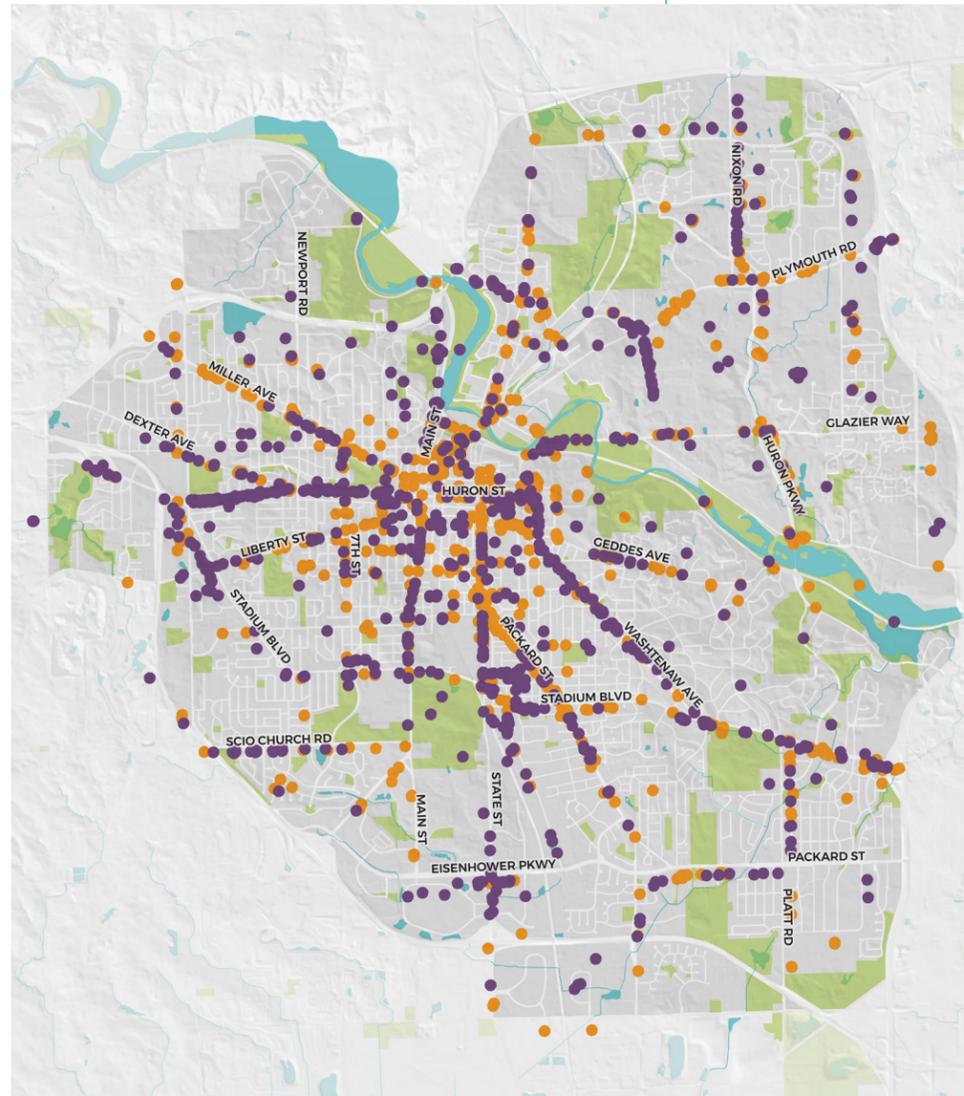


Uncontrolled Crosswalk Locations

There are locations around the city that require new uncontrolled crosswalks to increase convenience and safety for people walking.

The Pedestrian Crossing Survey included a map-based activity where respondents could identify places where new crosswalks are needed (see mapping activity below). A total of 954 people completed this Pedestrian Crossing Survey with 3,325 entries on the interactive map. Using this input, 26 priority

locations for new uncontrolled crosswalks were identified based on the location's distance from an existing crosswalk or signalized intersection and crash history.



- I would like to cross here
- I would like this crossing improved

Bike Intersections

Key intersections (11 high priority intersections and 68 secondary priority intersections) along the proposed all ages and abilities bike network were identified based on:

1. Safety issues, measured by:
 - » Number and severity of crashes involving people biking
 - » Data on perceived comfort, captured by surveys and other forms of community engagement
2. Existing and potential bike volumes:
 - » Bike counts
 - » Data on locations where people would like to bike, captured through surveys and other forms of community engagement

Sidewalk Gaps

The city's 2013 Non-Motorized Transportation Plan (an update from the 2007 Non-motorized Transportation Plan) identified 25 miles of sidewalk gaps that were crucial to fill in the near-term and to-date 15 miles of these gaps have been addressed. In addition to completing the remaining 10 miles of near-term sidewalk gaps, there are an additional 18 miles of sidewalk gaps on major streets around the city.

The city uses a variety of criteria, including proximity to schools, transit, and affordable housing, to identify the highest priority sidewalk gaps the city should work to address

first. Ann Arbor has been systematically installing new sidewalks based on the prioritization results from the 2013 Non-Motorized Transportation Plan and should begin prioritizing the remaining gaps along major streets.

20 Minute Neighborhood

A 20-minute neighborhood is a place where residents can meet most of their daily, non-work needs (like shopping, groceries, parks, and schools) within a safe, convenient 20-minute walk.

The 20-minute neighborhood analysis looked at grocery stores, parks, retail, and schools. Shapefiles containing the destinations for each of the location needs were created. The park layer excluded the Ann Arbor Golf & Outing Club and University of Michigan Golf Course.

Census blocks accessibility were compared to to the destination points, observing census blocks that have access to a park, school, grocery store, and retail parcel within a 20-minute walk versus those that don't.

