

CTA Accessibility and Transfer-Connectivity Quality in Relation to Chicago's Disadvantaged Population

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Introduction

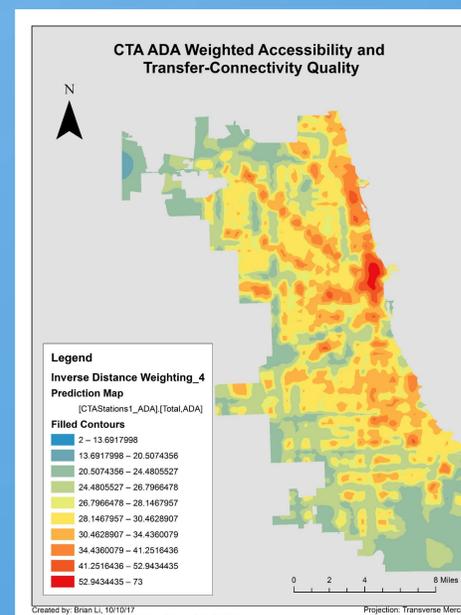
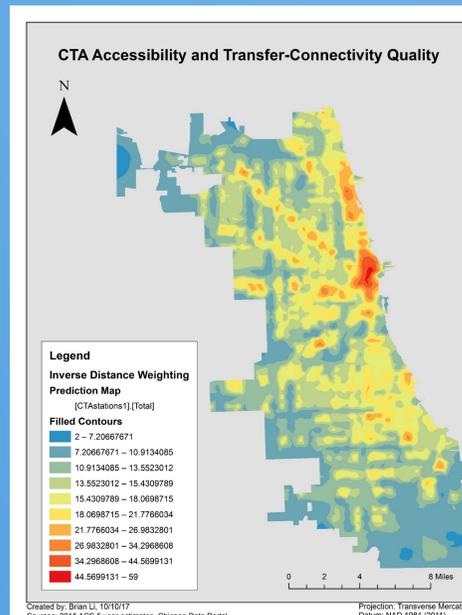
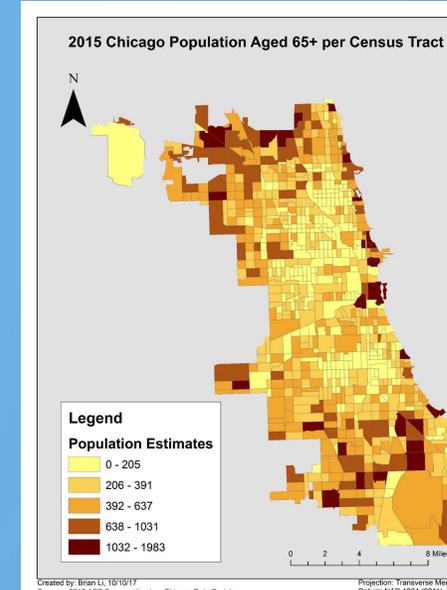
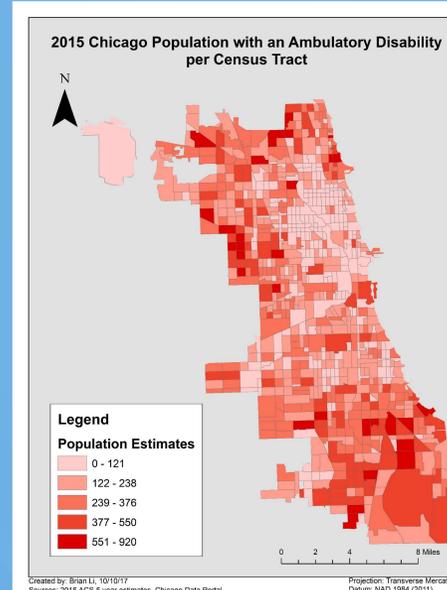
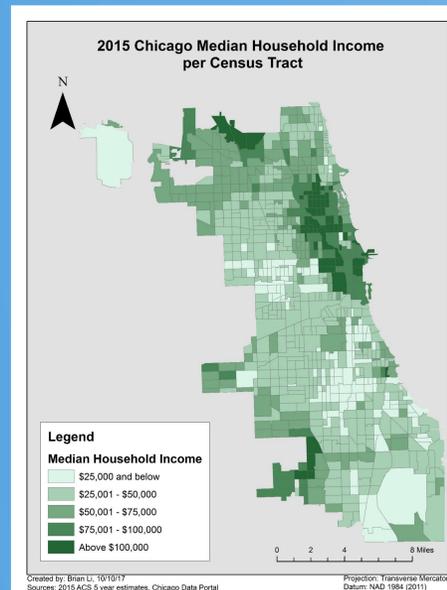
The Chicago Transit Authority (CTA) is the government agency that operates the mass transit system in Chicago, IL. It consists of the Chicago "L" (elevated train system) and bus service.

There have been many different indices that measure the quality of transit service based on various parameters. Example of such parameters include accessibility, mobility, and connectivity. Various attributes are used to measure these parameters in many studies.

In this project, a new index has been created to measure the quality of transit based specifically on accessibility and transfer-connectivity. Accessibility and transfer-connectivity are major factors for many transit commuters especially for the disadvantaged population. Disadvantaged populations include people belonging to a low socio-economic class, the disabled, and the elderly.

Objective

The objective of this project is to use GIS techniques to determine which areas in Chicago have low transit equity based on the quality of transit accessibility and transfer-connectivity in places with high concentrations of disadvantaged people. This is to help transportation planners know where to improve or expand their transit lines and infrastructure to raise transit equity among the population.



Methodology

To quantify the quality of transit accessibility and transfer-connectivity, a new index has been created which measures three attributes and aggregates their values into a composite score as the quality score of the index. The index is used on each CTA station (bus or train). The three attributes are as follows: 1) ADA accessibility which gets a score of 1 if it is available or 0 if not, 2) Number of stations within a 0.25 mile radius of the station under measure, and 3) The number of different bus routes or train lines available to transfer from at the same station.

The 1st attribute measures accessibility, while the 3rd attribute measures transfer-connectivity, and the 2nd attribute measures both accessibility and transfer-connectivity. A radius of 0.25 mile is used for the second attribute because it is the shorter threshold which is used to determine usually how far a commuter would walk to get to somewhere. It equates to about a 5 minute walk. The longer threshold generally used is 0.5 mile which equates to a 10 minute walk is not used in this project because the shorter threshold would give better accuracy due to being of a smaller scale. This is all done in ArcMap by geocoding the station points, using the buffer tool, spatial join, using feature to point tool, merging bus and train station datasets, and using the field calculator to calculate the quality score in a new field.

To display a prediction of the spatial distribution of the quality of transit within the city, inverse distance weighted (IDW) spatial interpolation from the geostatistical analyst toolbar is used. The source dataset for the interpolation being the merged stations layer and the data field being the quality score. IDW was chosen because over other techniques because this is just to show a generalized prediction of the transit quality of areas and other factors like directional trends are not needed to be accounted for here.

To compare the spatial distribution of transit quality with the spatial distribution of disadvantaged populations, 3 graduated color maps for the latest (2015) Chicago census tracts: 1) median household income, 2) population with an ambulatory disability estimates, and 3) population aged 65+ estimates were created to be viewed side by side with the transit quality map.

Since ADA accessibility is of greater importance for the disabled and elderly population, a separate transit quality map using IDW interpolation is created where the settings are all the same as the original with the exception that the ADA scores were multiplied by 1.5 to give a greater weighting for ADA accessibility in the quality score. Multiplication by 1.5 was chosen because it seems to visually accentuate the ADA accessibility of the transit quality very well in the map result.

Results

The results of the comparisons show that the transit quality is much better in the Loop and north side areas just above it including Lincoln Park, Lakeview, and Logan Square. Comparisons of the ADA accessibility weighted quality maps show that the areas with the highest concentrations of disabled population which are all in the northern, northwestern, and far southern parts of the city had very low transit quality. This is also the same with the elderly population where majority live in those far edges of the city with the exception of the Loop, Hyde Park, and Near Northside.

Conclusion

With these results, it is very clear that the transit quality based on accessibility and transfer-connectivity is not equally distributed among the demographics of Chicago. What transportation planners can do to improve the transit quality is to install elevators in all train stations that don't have them and expand more bus routes that run by the edges of the city where majority of the disabled and elderly population live. Expansion of train lines are also a great option for improving transit quality but may not be feasible as it would be really expensive.

Acknowledgements

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