The Disconnect Between the Practice's and Community's View on Transportation Performance

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ABSTRACT

The purpose of this research is to assess whether the public perception and measured or observed level of transportation performance correlate. When the public perception of transportation performance differs from the observed level, this indicates the need to develop or re-calibrate conventional performance measures to better reflect public satisfaction and perceptions of transportation performance. Outlining the disconnect will assist practitioners in vetting their internally-set standards of satisfactory service and in return create better access to opportunity for the community. This case study captures the community's perspective of current transit accessibility and transportation costs in the north Texas region by allowing them to rank their satisfaction level and express their transit difficulties in hopes to see improvement of how transit is constructed in the future. The spatial analysis between these two data sets creates a backbone for the argument that the practices measures are inconsistent and not reliable sources of current conditions.

INTRODUCTION

Providing access to opportunity requires transportation needs and gaps to be identified. How are we to best identify and understand what are those gaps? Researchers and practitioners in the field of transportation have been using a series of quantitative tools to assess the level of performance in the current transportation systems and therefore to form future improvements. To measure these performance levels, researchers conventionally consider affordability, reliability, travel time, and all serviced areas. While quantifying these concepts is a common practice of the field, very limited research has been conducted to assess whether the public perception confirms or conflicts with our performance measures and findings. The proposed research is seeking to investigate this issue. Does the public agree with the conclusions that our data analysis has given us, or is there a disconnect between the practice's and community's appraisal of transportation performance?

The research demonstrates the need to make sure that selected performance measures achieve the intended goal. This case study is designed to further our understanding of the transportation needs in the north Texas region while directly assisting practitioners in vetting their internally-set standards of satisfactory service. A considerable benefit of this research is that while performing community outreach, we are also educating the public about the process and efforts undertaken to increase their access to opportunity. Building community support is an integral part of ensuring equity in the decision-making process in transportation. We are building awareness about our efforts to make a difference and in return hope to see a solution that will improve their daily lives. The community-based aspect of this analysis helps to ensure that our data is accurate to what the people need and not just what the calculated computer data thinks people need. As engineers, it is difficult at times to understand that no matter how many computer simulations and equations are worked out, it is impossible to predict the public's reaction without talking to the people in person. All the hypotheses could be formed in a lab, but nothing will compare to reaching out the public and listening to their needs and complications in their specific community.

BACKGROUND AND METHODOLOGY

The research relies on two major data sources; two transportation indices made available by the U.S. Department of Housing and Urban Development (HUD), and a survey currently distributed throughout the Dallas-Fort Worth region. The transportation indices are capturing two important factors: (1) transit accessibility and (2) transportation costs. The second major data source of the research includes a survey currently available and distributed for a Regional Assessment of Fair Housing (AFH) to be performed.

HUD Indices

Both the transportation cost index and the transit accessibility index values are nationally ranked percentiles ranging from 0 to 100. The benefit of these values being percentile ranked nationally is that a comparative analysis can be made to other parts of the region and country. However, the drawback is that there are no true values assigned to each index score making it difficult to truly know what is considered high or low. Index estimates come from the Location Affordability Index (LAI). The LAI relies on data from the American Community Survey and is obtained by a

function of a household's employment location, environmental variables, travel patterns, number of vehicles, and other demographic factors. This data set being used is from 2012 and is represented on the census tract level.

The HUD data that is available to be used in this is research is very limited to one population; a 3-person single-parent family with income at 50% of the median income for renters for the region. There are other index types that allow for different household sizes and homeownership, however, this data is no longer publicly available as HUD no longer supports the LAI or the AFH tool.

The transit trip index is a proxy for measuring the propensity of someone to utilize public transit. The index controls for income such that the higher index score better reflects a resident's access and utilization of transit. The transportation cost index is a proxy for estimating transportation costs for the given family. The values are calculated and inverted such that the higher ranking indicates a lower cost of transportation in that census tract. Costs are affected by access to public transit and density of homes, services, and jobs in that neighborhood and surrounding community. (1)

The LAI cost estimate comes from three components of travel behavior: auto ownership, auto use, and transit use. The total transportation costs are calculated by a cost per unit multiplier and then summed to provide average values for each census block group. The basis for auto use cost and auto ownership components comes from the Consumer Expenditure Survey (CES) generated by the U.S. Bureau of Labor Statistics. The expenses are segmented by five ranges of household incomes from range 1 of $0-$20,000 to range 5 of $100,000 and above. An additional inflation factor of 1.052913 is used to adjust to 2012 dollars. The expenditures related to the purchase and operation of vehicles is divided into categories. The categories include: (2)

- Average annual service flow value from the time the vehicle was purchased to the time the consumer responded to the CES;
- Average annual finance charge paid;
- Ownership costs: cost of continuing to own a purchased vehicle even if it is not driven;
- Drivability costs: cost of keeping the vehicle in drivable shape, i.e. maintenance and repairs;
- Driving costs: cost of fuel used to drive the vehicle.

The calculation of auto cost is obtained by the following formula:

$$Cost = A * \left(V_{sf} + V_{fc} + V_{fixed}\right) + \left(\frac{VMT}{MPG}\right) * G * (1 + R)$$

Where

A = Modeled autos per household

V_{sf} = Per vehicle service flow costs from Table 1 (1) – for the appropriate income group

V_{fc} = Per vehicle finance charge from Table 1 (2) – for the appropriate income group

V_{fixed} = Per vehicle (fixed) ownership cost from Table 1 (3) – for the appropriate income group

VMT = the modeled annual household vehicle miles traveled

MPG = the national average fuel efficiency in miles per gallon (20.7 for 2008)

G = the cost of gas per gallon (3)

R = the Average Ratio drivability to fuel cost from Table 1 (7) – for the appropriate income group

(2)

TABLE 1 Per-Vehicle Costs by Income Group among Households with at Least One Vehicle (2)

Income group number and income rage	**Average Annual Service Flow (1)**	**Finance Charges (2)**	**Per vehicle (fixed) ownership costs (3)**	**Per vehicle (variable) drivability costs (4)**	**Per vehicle fuel costs (5)**	**Number of Vehicles (6)**	**Average Ratio drivability to fuel costs (7)**
1 ($0-$20,000)	$2,396	$73	$657.30	$400.80	$1,182.00	1.4	0.34
2 ($20,000-$40,000)	$2,478	$133	$732.00	$421.10	$1,369.50	1.6	0.31
3 ($40,000-$60,000)	$2,586	$182	$755.60	$458.80	$1,494.20	1.9	0.31
4 ($60,000-$100,000)	$2,727	$211	$758.60	$477.60	$1,552.80	2.2	0.31
5 ($100,000 & above)	$3,139	$201	$836.60	$593.10	$1,635.60	2.5	0.36
Overall average	$2,717	$165	$752.50	$474.50	$1,460.90	1.9	0.32

Transit cost data was obtained from the 2010 National Transit Database (NTD). To estimate average household transit costs, the number of transit commuters for each block group is calculated, summed across block groups to estimate the total number of transit commuters, derived by dividing by the number of households in the area, and then allocating the metro wide transit revenue to blocks groups accordingly to the proportion of the regions commuters. Similarly, the average number of household transit trips for each block group is estimated by finding the total number of annual trips in each area and allocating the trip proportionally to block groups based on the number of household and the percent of journey to work trips.

AFH Survey

The Regional Assessment of Fair Housing is a comprehensive analysis examining challenges related to housing, transportation, employment, and accessibility to opportunity. The survey for the assessment was distributed through focus groups, public meetings, and other city and relevant organization staff of 22 jurisdictions throughout the north Texas region. Organizations such as city Housing Authorities, Homeless Coalitions, United Way, NCTCOG, the Salvation Army, churches, and many others were included in the distribution and meetings. Within the AFH Survey, the focus is on the responses from one question. “How satisfied are you with current transportation options?” The respondent selects a value between 1 and 5 with 1 being very satisfied and 5 being not at all satisfied. The survey also captures the zip code of the respondent. The map in Figure 1 shows all the zip codes in the region where the survey was distributed and therefore is the large scope of the case study area.

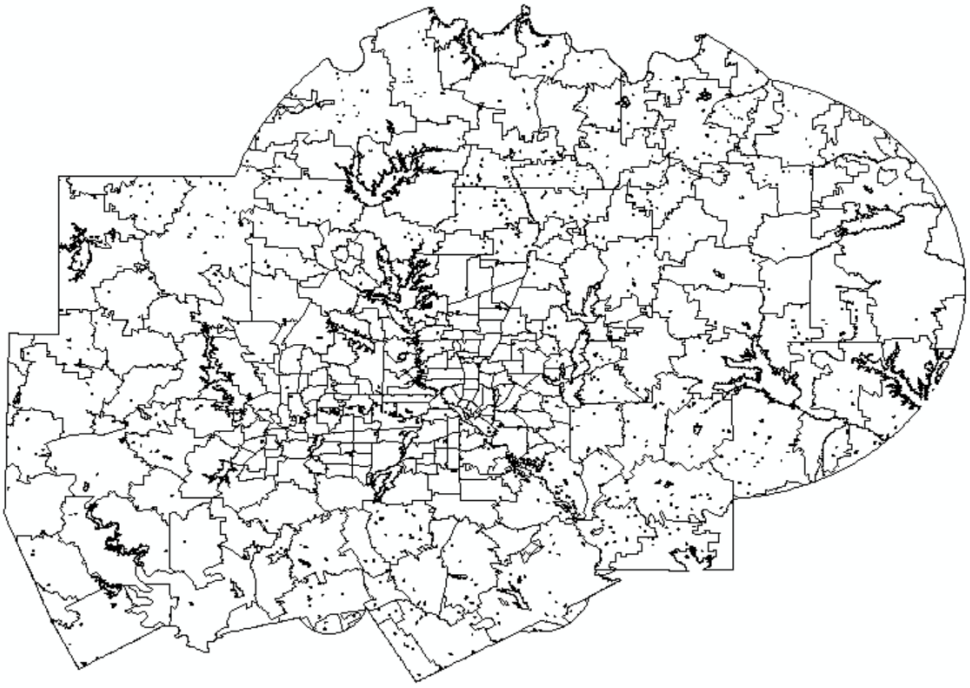

FIGURE 1 Zipcode boundaries for the large scope of the case study area

DATA ANALYSIS

To analyze the data, a cross analysis was performed to observe if there is a correlation between the two data sets. This is done by using the geographical information system (GIS) program, ArcMap. The data sets are given on two different scales: percentile rankings for the HUD index scores and ordinal variable counts for the survey data. Because of these differences, both data sets were chosen to be graphed into ArcMap for a visual comparative analysis to me made. The survey responses were grouped by zip code and the median score was calculated. The median score was chosen as the best measure of central tendency because of the ordinal data collected. The number of survey responses in each zip code ranged from 1 response to 171 responses. To ensure that the median survey response for each zip code was not biased to one or two respondents, only data with zip codes containing five or more responses has been analyzed. This

data is shown in Figure 2. The corresponding legend represents the median responses with the lower value indicating a higher level of satisfaction (green indicating more satisfied and red indicating less satisfied).

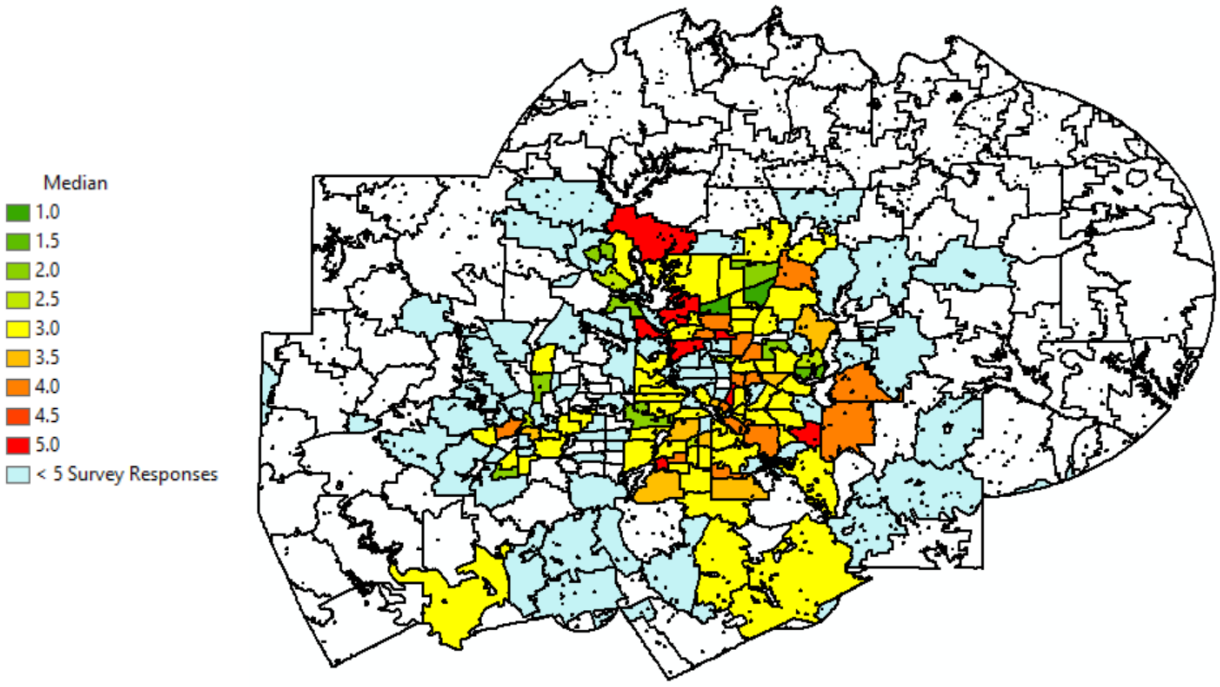

FIGURE 2. Survey responses with greater than 5 responses per zip code

The transportation cost index scores represented in the project limits contain a minimum index score of 5, maximum index score of 99, and a median score of 58. This data is shown in Figure 3. The transit trip index scores represented in the project limits contain a minimum index score of 0, maximum score of 81, and a median score or 46. This data is shown in Figure 4. For each index map the data ranges were broken equally into intervals of 20 for a better representation of the score with respect to the rest of the country. A zip code map was also overlaid atop the census tract data to help for a better visual comparison against the survey responses. Once again, the lower score (red) indicates worse access and utilization of transit or higher transportation costs while the higher score (green) indicates better access and utilization of transit or lower transportation costs. (4)

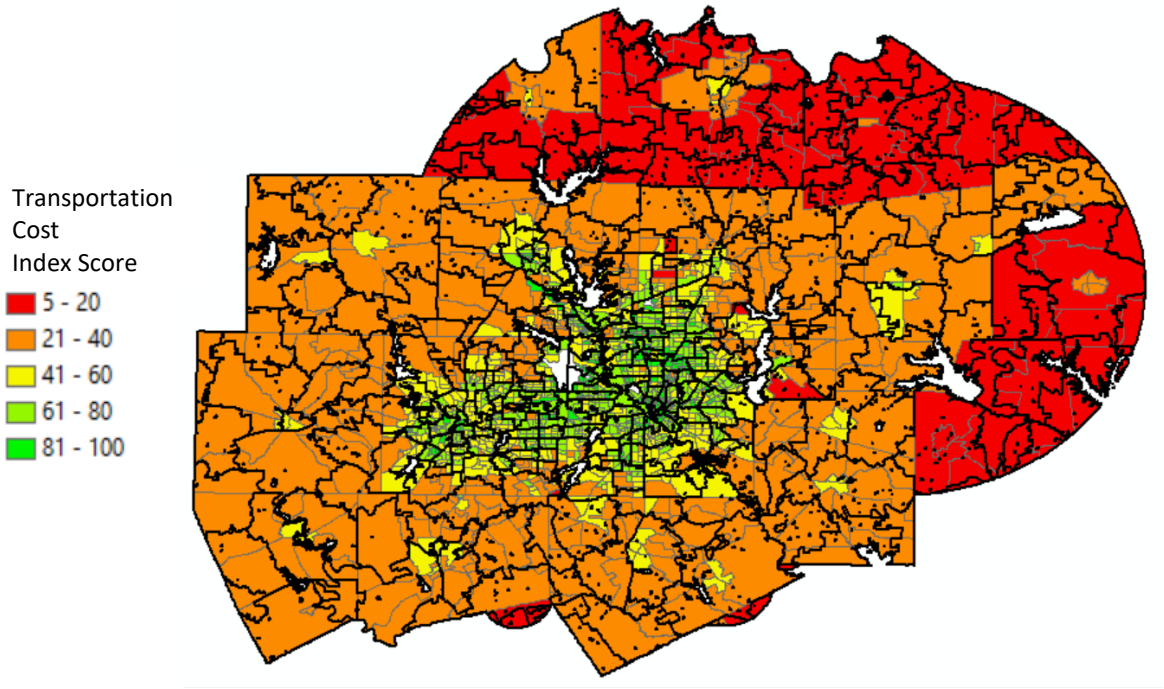

FIGURE 3. Transportation Cost Index

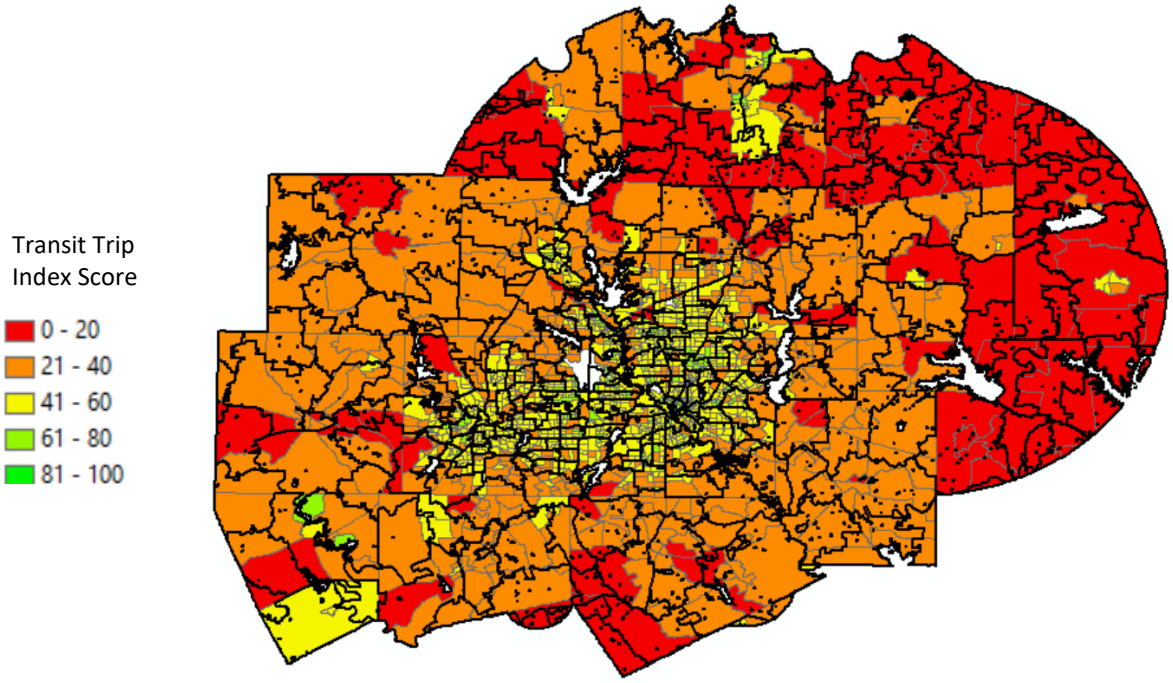

FIGURE 4. Transit Trip Index

The case study scope area overall was too large to be able to perform a spatially analysis between the three maps with refence to the low volume of survey responses received in the outer regions. The study region was downsized to the areas surrounding the central Dallas Fort Worth region. These areas are shown in Figure 5.

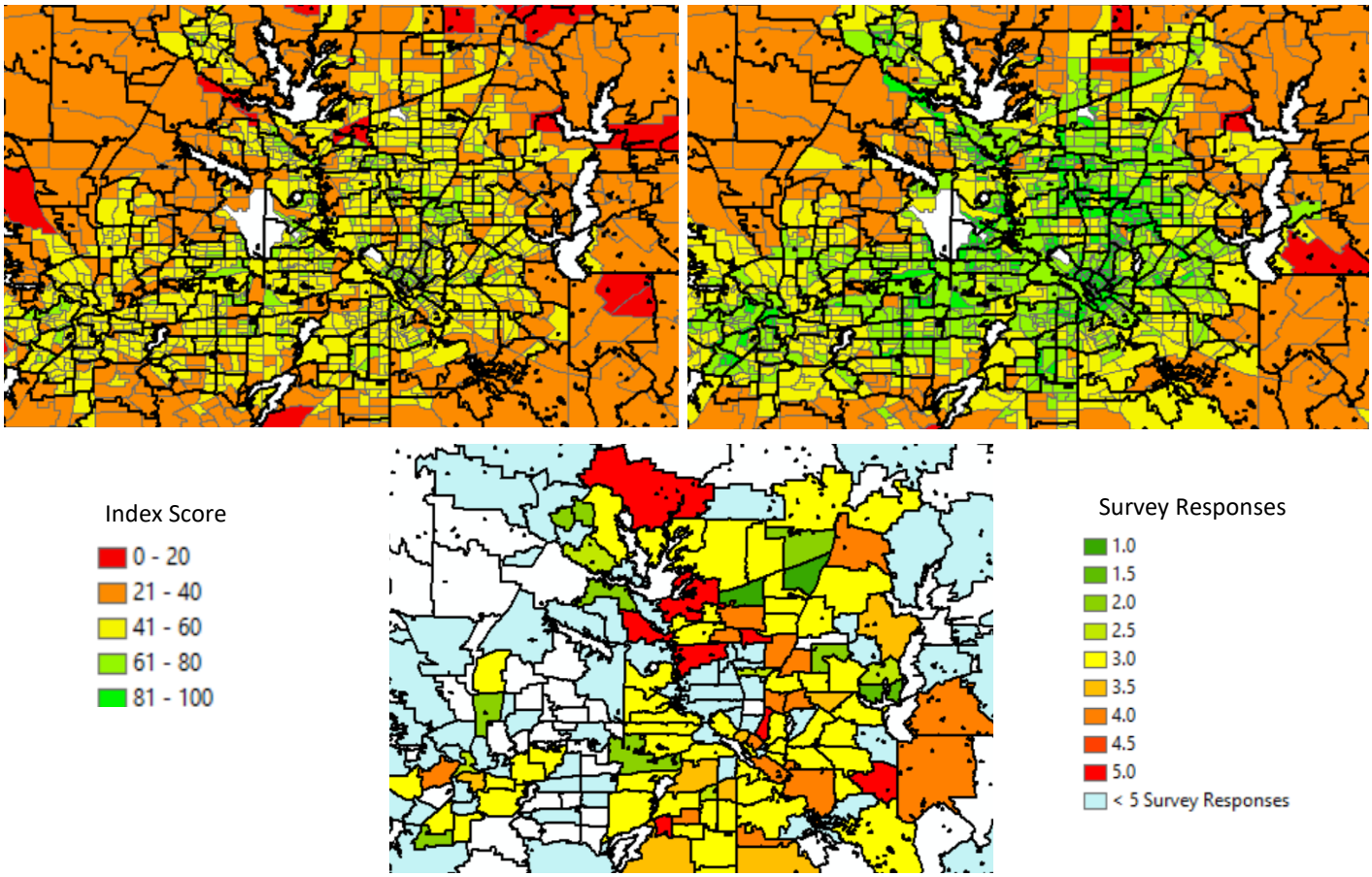

FIGURE 5. Transit Trip Index (top left), Transportation Cost Index (top right), Survey Responses (bottom)

To make this comparative spatial analysis, we are looking for specific zip codes to have generally the same color between each map set; transit trip index versus survey responses and transportation cost index versus survey responses. From observing all three images in Figure 5, we notice that there does not seem to be a pattern between each index and the corresponding survey responses. There are zip codes where accessibility index shows in the 61st to 80th percentile, the cost index shows in the 81st to 100th percentile, yet the survey response shows a median value of 4 (unsatisfied). Another example is the area around downtown Dallas; the survey responses generally are around a ranking of 3.0 to 4.0 while both indices show scores in the 41st percentile and greater. Overall, it's apparent that the data provided for practitioners in this region is not matching up to what the public is saying about their level of satisfaction.

DISCUSSION OF RESULTS AND CONCLUSIONS

A problem that arises from the Transit Trip index map is that a large majority of the tracts in the 21st to 40th percentile range do not have any form of public transportation in their vicinity. How is a tract to have a score greater than 0 with the absence of public transit? Arlington, Texas for example is the largest U.S. city without public transit yet somehow, the city has a median to high score for both indices with the transit trip score ranging around the 50th percentile and the transportation cost score ranging around the 70th percentile. This city is home to a professional

football team, professional baseball team, two large amusement parks, and the University of Texas at Arlington bringing in thousands of tourists, new residents, and students yearly. Yet, if you do not have a vehicle, you are forced to call a private car service or walk along many non-walkable streets. This city alone is a solid representation that the scoring of the index is skewed and ineffective.

Looking at regions individually, instead of nationally, would give a better insight into each region's greatest needs. A region like north Texas may look very affordable when compared to regions on the west or north eastern coast, however, the environment for living in these different regions is so extremely different that they should not be put on the same scale when it comes to determining government funding or providing public assistance. To improve the situations occurring in the north Texas Region and all over the U.S., the way the data is shown needs to be changed. Transportations costs and transit trips would be better expressed in true number ranges instead of percentile rankings. Percentile rankings do not hold a strong enough meaning to its value and can have inconsistent gaps between adjacent percentile scores. A benefit that would stem from this change could be how practitioners go about their ways. An area around north Texas may be constantly over looked when seeking out places with a lack of access to opportunity because these government scores of data are positive. Recalibrating the data and taking the publics word into account will help to bridge the gap.

While changing the way this government data is portrayed may take some time to implement and work effectively, practitioners need to be aware that the data does not speak the full truth. As I have seen from the numerous public meetings and focus groups around the DFW region, places we thought were sufficient in access to opportunity are truly not. After hearing from the individuals that live in these communities, it brings to light that building community support is an integral part of ensuring equity in the decision-making process in transportation. Small communities need to stop being over looked due to the overall region having a higher score compared to other parts of the country.

RECOMMENDATIONS FOR FUTURE RESEARCH

This research is only the initial efforts in bringing awareness to engineers and practitioners in the field. In addition to this comparative analysis, a further analysis to assess if any statistical relationship exists between index scoring and survey ranking would be beneficial. Another step that can be taken is the additional mapping of existing transit stations overtop the index and survey data. A study could be done to assess whether the higher-ranking scores correlate to locations of public transit. In the case that they don't, this would provide more evidence that the index is not working properly. This would also give insight to the publics perception of the areas with the stations. Ideally, these areas should have a higher index score and a lower survey score indicating a higher level of satisfaction, but is this true? Overall, the impact of further research will show the importance for these performance measures to achieve their intended goal and techniques for validation.

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