NITC

Paper for the National Institute for Transportation and Communities

MARIA FRIAS,
UNIVERSITY OF TEXAS AT ARLINGTON
MARIA.FRIAS@MAVS.UTA.EDU

NICK SOPKO
UNIVERSITY OF TEXAS AT ARLINGTON
NICHOLAS.SOPKO@MAVS.UTA.EDU

Word count: 2972 words text + 12 tables x 250 words (each) = 5972 words

Submission Date 8/01/2018

UNIVERSITY OF TEXAS ARLINGTON | COLLEGE OF ENGINEERING

Sopko, Frias

1   Abstract:

2   The intent of this paper was to evaluate Dallas commuter patterns by comparing driver
3   time versus public transit time to reach destinations from areas of high production to areas of
4   high attractions and commenting on how public transit fails to adequately support the network.
5   With cost of living on the rise, owning a car has become less of an option for those who do not
6   make enough money to pay for a car, including all the expenses that come with it. Their options
7   reduce to public transit and ride sharing, public transit being the cheaper alternative, yet
8   ineffective as seen from this research.

9   Introduction:

10   Public transit is required by many people in the area maneuver around the city not only
11   for work, but also to complete daily tasks. ~~Cities~~ Some cities have put together an impressive
12   transit network like New York and Washington, DC~~,~~; however, for the size of the Dallas-Fort
13   Worth (DFW) area, its public transit system does not compare. With a population of almost 7
14   million people, its public transit system struggles to serve its constituents. The DFW region has
15   two major transit systems, which share a single facility, the Trinity Rail Express, a commuter rail
16   line that connects downtown Dallas and downtown Fort Worth. The historical competition
17   between Dallas and Fort Worth further complicates the challenge of getting Dallas Area Rapid
18   Transit and the Trinity Metro (TM) located to coordinate operations. ~~Partially in fault to its~~
19   ~~divided transit systems, also part to its late development.~~ DFW area contains several counties and
20   cities, each attempting at its own transit system at one point or another. Now the two major
21   transit systems that remain are ~~the Trinity Railway Express (TRE) located~~ in Fort Worth and
22   Dallas Area Rapid Transit (DART) located in the Dallas ~~metroplex~~and some of its suburbs.
23   While it is possible to travel between both systems, it creates a void and lack of service in the
24   Arlington area, which resides in between these two cities, and other cities along the divide.

25   With the late start of the public transit system in the area, growth has been a long and
26   hard struggle for the entities. As the area began to expand and grow, the transit systems could
27   barely keep up. With less and less land becoming accessible, entities like DART and TRE
28   struggle with expanding their light rail lines to adequately serve the area. Land acquisition
29   requires several ropes and lines to cross [SPM1]and take years to accomplish even smaller additions
30   to rail line. The easiest way for them to expand is by including more bus routes, however this
31   method is rarely used due to its lack of profit and use. More often, bus routes are being cut
32   reducing how often buses traverse a particular route as well as the number of stops.

33   Owning a car can be a severe cost burden for those, especially those below the median
34   income level. For these people, public transit is a cheaper alternative, however they needed a
35   well-functioning system to operate with. This requires a well-blended solution of bus and light
36   rail. The need for light rail to mimic the corridors of highways and freeways, and a bus route
37   system that allows users to connect from light rail stations through the major and minor arterials
38   of the city. While the DART has begun to accomplish this, their networks allow more north to
39   south transit, and little east to west.

40   Prior to this project, we both assisted in the Assessment of Fair Housing Study conducted
41   by 21 North Texas entities and observed many people who were not only struggling with a
42   subpar public transit system in DFW, but they were also struggling to find and pay for decent
43   living. After listening to people who solely rely on public transit to get around the area, we were

Sopko, Frias

1. able to get a better perspective of how ineffective the system is. Each day, thousands of people
2. rely on the DART and TRE to go about their daily lives and must suffer with the systems lack
3. connectivity and efficiency.

4. Similar projects have been conducted that access how different income groups benefit
5. from job accessibility. In Lingqian Hu's research in Los Angeles, California[SPM2], it was noted
6. that job accessibility effects medium to low income groups, and with the lowest income group
7. displaying that owning a car significantly improved their chances for being employed. Many low
8. wage-earning jobs in the DFW area demonstrate this by always inquiring if their applicants will
9. have cars to ensure that they will have a reliable means of making it to work. When competing
10. against others for the same position, something like this will easily take you out of the running
11. for the position.[SPM3]

12. A variation in this project from similar ones includes the factors such as age and type of
13. work. Age greatly increases the type of work that one can do as well as what they can get
14. employed for. As individuals get older, finding new jobs becomes a heavy burden on them as
15. they struggle to meet the strength and activity requirements demanded by the position. When it
16. comes to accessing these jobs, older individuals tend to have a harder time getting to them if they
17. do not have a reliable mode of transportation as walking in the various Texas climates can be
18. harsh for anybody. For this reason, it's important to analyze the different age groups as well as
19. different incomes to make sure that this group of people are represented.

20. Materials & Methods:

21. Through the combination of Google Maps and Geographic Information System (GIS)
22. using data, we were able to provide travel times to reach destinations. Using data from the
23. Longitudinal Employer-Household Dynamics (LEHD), which provided data on high areas of
24. work and home for the city of Dallas, concluded results on how the travel network satisfies the
25. needs of certain areas.

26. By looking at LEHD Origin-Destination Employment Statics (LODES), data was
27. observed on high areas of productions and attractions based on certain criteria such as number of
28. jobs based on age, income, trade, race, ethnicity, gender, or education. The main categories that
29. were being analyzed were income, and age across two different modes of transportation.

30. The age and income brackets were distributed between three different categories, all set
31. by the LODES Data received at the start of the project. The age category was broken up between
32. people who are younger than 29, people aged between 30 and 54, and people 55 and older. The
33. income category analyzed people who received earnings of $1250 or less per month, $1251 to
34. $3333 per month or over $3333 per month.

35. This data was used to conclude where those on a lower income would be traveling from
36. and going to by the block level. Data was analyzed using GIS, where the different zones were
37. found for both origin and destinations. The data was able to show that overall, a main community
38. of people were driving to the destination zones mainly east of Interstate 635 in the South garland
39. area, and north of Interstate 20 in the South Grand Prairie area.

40. When analyzing the origins of most people, it was much more decentralized. the top areas
41. that seemed to host the most residents were Garland, Addison, and University Park and North
42. Irving to the north. To the south, Central Dallas and East DeSoto had large areas of residents
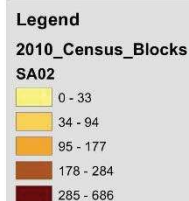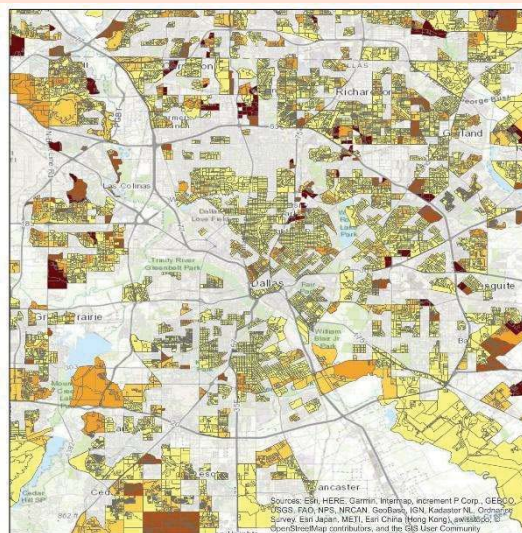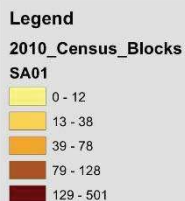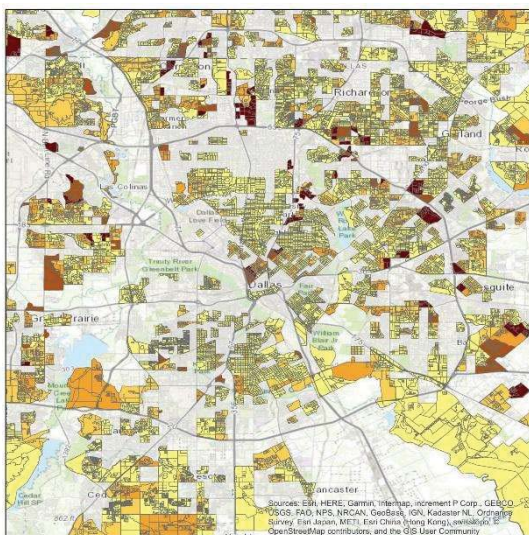
Sopko, Frias

1 living there. These different origins and destinations were based on different factors, such as
2 income and age. Using these origins and destinations, comparisons in the commute time for
3 passenger cars versus public transit needed to be observed. While analyzing results between
4 these values, other measures were explored, such as the travel times between different
5 age/income groups per mode of transportation and what it effects it would produce.

6   The travel data was obtained with the use of Google Maps. The travel origin and
7 destinations were analyzed at the block level, centroids to the block were then determined using
8 latitude and longitudes. These coordinates were then inputted into google maps. Google maps
9 was then able to interpret these coordinate centroids and locate the nearest working address to
10 the coordinate to start the travel time route. This was done for both transit and driving systems
11 for the largest 5 areas in both the working and home categories for Dallas. Travel tables were
12 obtained, and therefore an analysis over these routes could be explored and further analyzed.

13 Results

14   When analyzing the data, different maps were made to observe different parameters.
15 From this information, we were able to see that a majority of people tend to live in the North-
16 East Side of Dallas, or in the case of middle aged group (age 30-54) a mix of the North-East side,
17 North Irving, and the Southern area of Dallas (South of DeSoto). The patterns line up to be
18 similar when analyzing these groups through income groups as well.

19

20
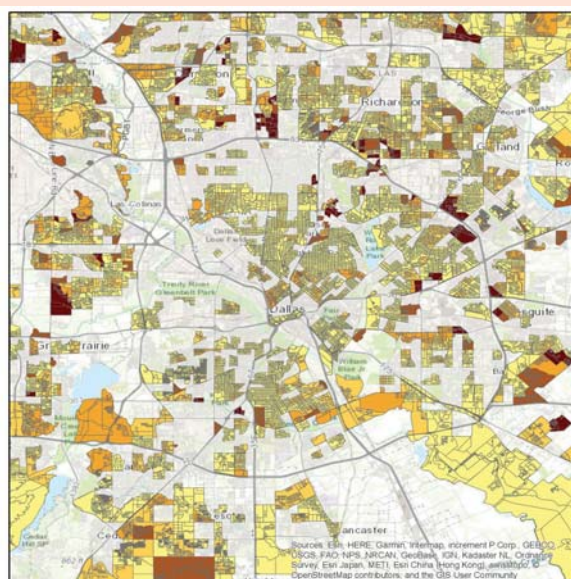21 SA01 – Age Group 29 and Younger Homes   SA02 – Age Group 30-54 Homes
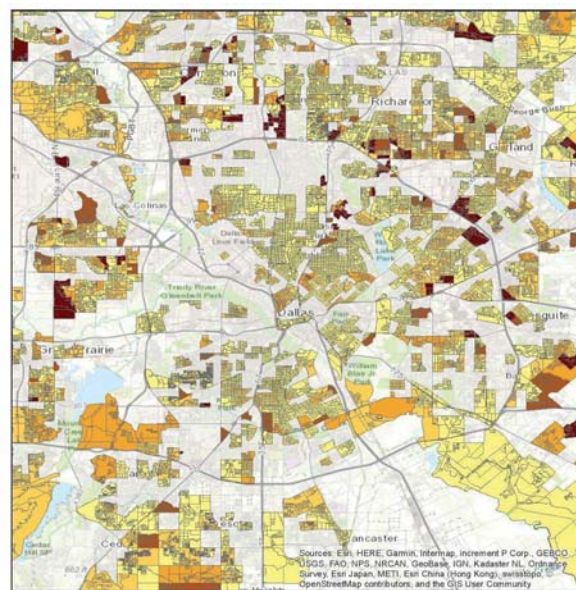
Sopko, Frias
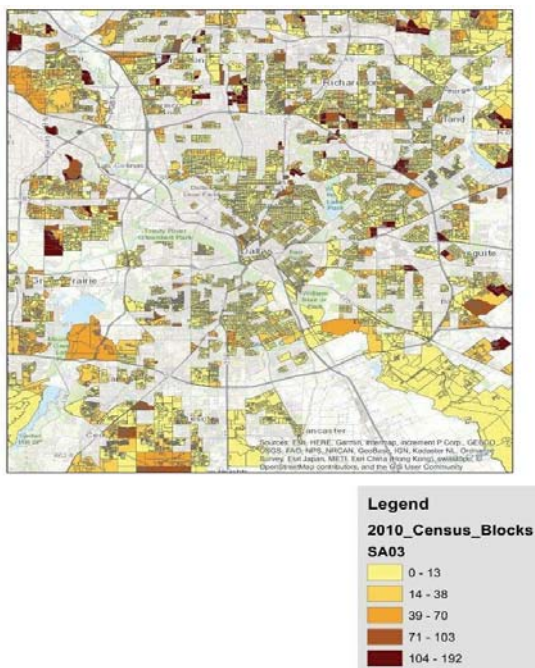
1
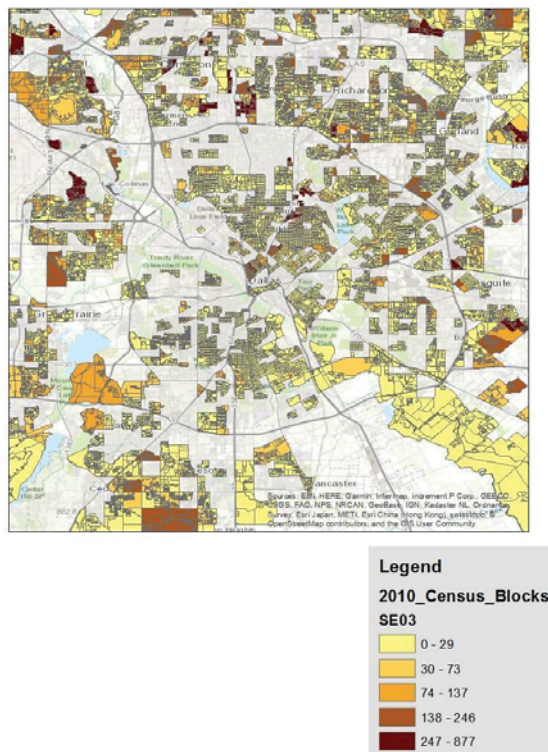2   SA03 – Age Group 55 and Older Homes

3
4   SE01 – Income of less than $1250/month   SE02 – Income of $1251 to $3333/month
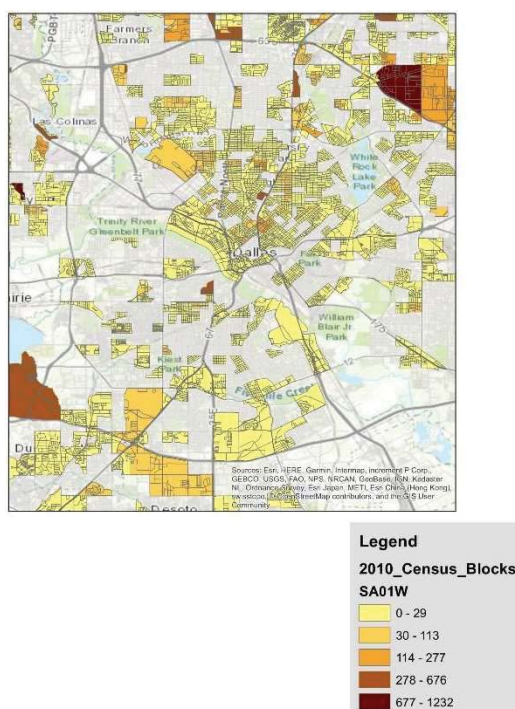
Sopko, Frias

1

2   SE03 – Income group of over $3333 per month.

3   The work locations are more centralized to certain parts of Dallas, Mainly the East
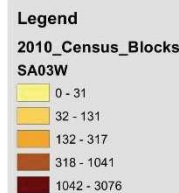4   Richardson/South Garland area as well as the South Grand Prairie area.

5
6   SA01W – Age Group 29 and Younger Work

Sopko, Frias

Legend
2010_Census_Blocks
SA02W
- 0 - 80
- 81 - 308
- 309 - 724
- 725 - 2995
- 2996 - 6334

Legend
2010_Census_Blocks
SA03W
- 0 - 31
- 32 - 131
- 132 - 317
- 318 - 1041
- 1042 - 3076
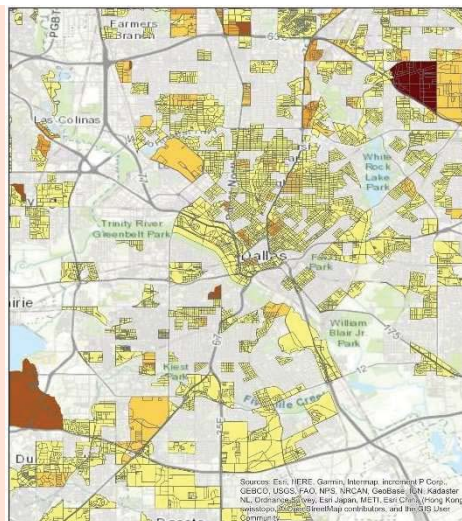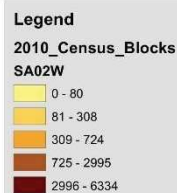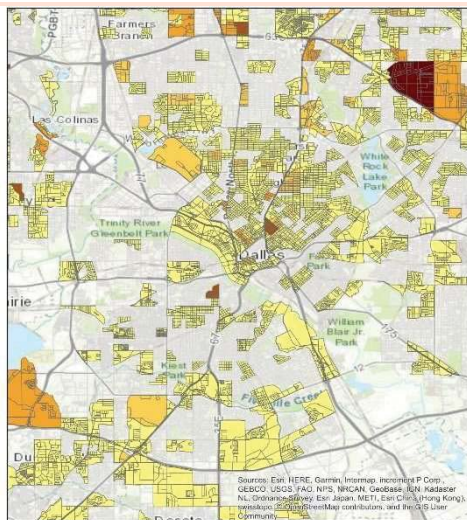
1
2   SA02W – Age Group 29 and Younger Work   SA03W – Age Group 30-54 Work

Legend
2010_Census_Blocks
SE01W
- 0 - 23
- 24 - 72
- 73 - 162
- 163 - 660
- 661 - 1579

Legend
2010_Census_Blocks
SE02W
- 0 - 39
- 40 - 144
- 145 - 431
- 432 - 1401
- 1402 - 2922
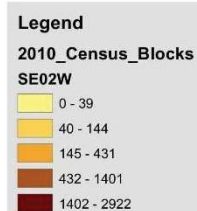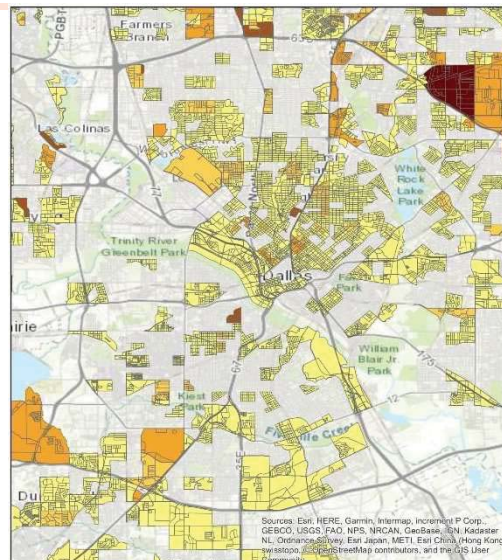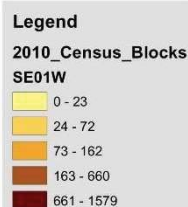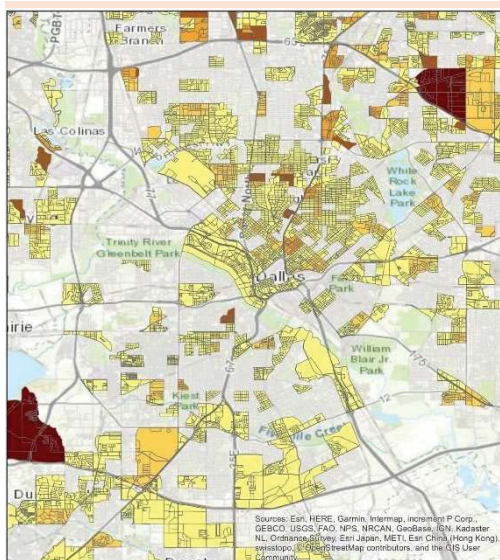
3
4   SE01W – Income less than 1250/Month Work   SE02W – Income less than 1250/Month Work
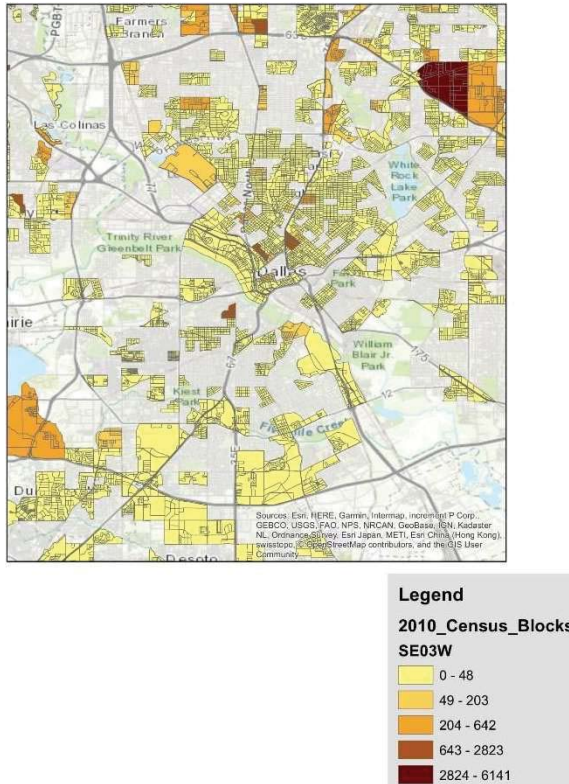
1
2   SE03W – Age Group 30-54 Work[SPM4]

3

4   Once these maps were created and analyzed, the travel times were able to be tabulated.
5 From the tables, it could be clearly seen across the board no matter the age group or the income
6 level, transit was much worse than driving. The differences between the transportation centroid
7 travel time was at times double the amount of time than it would take for someone to drive to
8 their place of work. When analyzing the different places that people lived and worked, trends
9 started to follow.

Table 1: SA01_Driving Travel Times				
	X1	X2	X3	X4	X5
1	8 mins	7 mins	12 mins	15 mins	11 mins
2	17 mins	12 mins	6 mins	15 mins	16 mins
3	17 mins	12 mins	7 mins	16 mins	16 mins
4	22 mins	24 mins	19 mins	12 mins	29 mins
5	24 mins	18 mins	13 mins	12 mins	23 mins

Sopko, Frias

Table 2: SA02_driving Travel Times				
	X1	X2	X3	X4	X5
1	16 mins	20 mins	20 mins	18 mins	25 mins
2	8 mins	7 mins	7 mins	17 mins	23 mins
3	22 mins	24 mins	26 mins	12 mins	22 mins
4	24 mins	18 mins	21 mins	15 mins	8 mins
5	17 mins	12 mins	14 mins	17 mins	18 mins

Table 3: SA03_driving Travel Times				
	X1	X2	X3	X4	X5
1	7 mins	8 mins	23 mins	7 mins	5 mins
2	22 mins	20 mins	19 mins	22 mins	22 mins
3	20 mins	16 mins	25 mins	20 mins	19 mins
4	24 mins	25 mins	40 mins	22 mins	23 mins
5	24 mins	22 mins	22 mins	26 mins	25 mins

Table 4: SE01_driving Travel Times				
	X1	X2	X3	X4	X5
1	12 mins	5 mins	7 mins	8 mins	15 mins
2	13 mins	22 mins	18 mins	24 mins	12 mins
3	15 mins	24 mins	21 mins	27 mins	14 mins
4	22 mins	18 mins	16 mins	21 mins	24 mins
5	15 mins	21 mins	20 mins	20 mins	8 mins

Table 5: SE02_driving Travel Times				
	X1	X2	X3	X4	X5
1	18 mins	24 mins	21 mins	8 mins	23 mins
2	7 mins	8 mins	3 mins	23 mins	11 mins
3	21 mins	27 mins	23 mins	8 mins	25 mins
4	20 mins	16 mins	18 mins	28 mins	25 mins
5	20 mins	20 mins	19 mins	18 mins	25 mins

Table 6: SE03_driving Travel Times				
	X1	X2	X3	X4	X5
1	16 mins	20 mins	20 mins	7 mins	20 mins
2	17 mins	12 mins	14 mins	23 mins	12 mins
3	8 mins	7 mins	7 mins	14 mins	17 mins
4	17 mins	12 mins	14 mins	24 mins	13 mins
5	8 mins	7 mins	9 mins	14 mins	17 mins

1   [SPM5]

Sopko, Frias

1 Taking the travel times from the driving tables it was analyzed that between all five zones
2 there was a 60%-80% increase in travel time as you compared the youngest age group to their
3 older counterparts. The older members of society had decreased travel times in some zones, but
4 overall most of the zones saw an increase in travel time when comparing the driving. For the
5 income, the opposite was seen. As the income in the members of society increased, the travel
6 time over most of the zones decreased. From the lowest income to the highest income, only 32%
7 of the zones saw an increase of travel times, while the rest of the zones saw a reduction in travel
8 times. This is most likely due to the availability for younger/richer people to choose their place
9 of residence and therefore choose a location closer to their job on average.

10

Table 7: SA01_Transit				
	X1	X2	X3	X4	X5
1	31 mins	21 mins	55 mins	41 mins	30 mins
2	58 mins	40 mins	21 mins	58 mins	59 mins
3	1 hour 3 mins	36 mins	25 mins	1 hour 11 mins	58 mins
4	1 hour 37 mins	1 hour 28 mins	1 hour 22 mins	41 mins	1 hour 37 mins
5	1 hour 15 mins	1 hour 1 min	55 mins	49 mins	54 mins

Table 8: SA02_transit				
	X1	X2	X3	X4	X5
1	1 hour 19 mins	1 hour 32 mins	1 hour 28 mins	1 hour 12 mins	2 hours 20 mins
2	31 mins	21 mins	23 mins	55 mins	1 hour 8 mins
3	1 hour 37 mins	1 hour 28 mins	1 hour 30 mins	40 mins	1 hour 15 mins
4	1 hour 15 mins	1 hour 1 min	1 hour 3 mins	57 mins	40 mins
5	58 mins	40 mins	50 mins	1 hour 27 mins	53 mins

Table 9: SA03_transit				
	X1	X2	X3	X4	X5
1	21 mins	31 mins	1 hour 8 mins	23 mins	17 mins
2	1 hour 24 mins	1 hour 40 mins	1 hour 52 mins	1 hour 30 mins	1 hour 5 mins
3	1 hour 32 mins	1 hour 19 mins	2 hours 20 mins	1 hour 28 mins	1 hour 16 mins
4	1 hour 28 mins	1 hour 37 mins	1 hour 15 mins	1 hour 30 mins	1 hour 21 mins
5	NA	NA	NA	NA	NA

Sopko, Frias

Table 10: SE01_transit				
	X1	X2	X3	X4	X5
1	55 mins	17 mins	21 mins	31 mins	41 mins
2	55 mins	58 mins	1 hour 1 min	1 hour 15 mins	49 mins
3	58 mins	40 mins	1 hour 4 mins	1 hour 6 mins	52 mins
4	1 hour 25 mins	44 mins	1 hour 0 mins	1 hour 21 mins	1 hour 35 mins
5	1 hour 4 mins	51 mins	1 hour 6 mins	1 hour 27 mins	29 mins

Table 11: SE02_transit				
	X1	X2	X3	X4	X5
1	1 hour 1 min	1 hour 15 mins	59 mins	40 mins	54 mins
2	21 mins	31 mins	14 mins	1 hour 8 mins	30 mins
3	1 hour 4 mins	1 hour 6 mins	42 mins	38 mins	49 mins
4	1 hour 22 mins	48 mins	1 hour 1 min	1 hour 50 mins	1 hour 32 mins
5	1 hour 6 mins	1 hour 27 mins	54 mins	56 mins	1 hour 15 mins

Table 12: SE03_transit				
	X1	X2	X3	X4	X5
1	1 hour 19 mins	1 hour 42 mins	1 hour 28 mins	44 mins	1 hour 55 mins
2	58 mins	40 mins	50 mins	1 hour 16 mins	56 mins
3	31 mins	21 mins	23 mins	58 mins	1 hour 8 mins
4	1 hour 3 mins	36 mins	50 mins	1 hour 19 mins	56 mins
5	34 mins	29 mins	22 mins	50 mins	1 hour 6 mins

[SPM6]

Transit, on the other hand, demonstrated interesting results. Observing the different travel times, and how they increased, it was shown that the travel times only increased in about 40 percent of the zones for both age and income. This probably enforces that no matter the age or the income, everyone is at a lack of transportation services for the city of Dallas.

Overall, ~~Transit~~ transit across the board was hard to access and delayed the resident by a factor of two, or sometimes even by a factor of three to reach their desired destinations.

Sopko, Frias

Discussion & Conclusion

As described by the results and data, it can be clearly seen that transit creates longer travel times for residents across the board, regardless of age or income. That combined with the discrepancy that lower income and older residents have can cause a big difference in the lives of these target groups when dealing with month to month expenses when accounting for longer commute times that contribute to expenses such as car maintenance and gas expenses. [SPM7]

Author contribution statement:

The authors confirm contribution to the paper as follows: study conception and design: Nick Sopko and Maria Frias, data collection: Maria Frias and Nick Sopko; analysis and interpretation of results: Nick Sopko and Maria Frias. All authors reviewed the results and approved the final version of the manuscript.

Sopko, Frias

1 **REFERENCES:**

2 Dallas Population. (2018-06-12). Retrieved 2018-07-29, from
3 http://worldpopulationreview.com/us-cities/dallas/

4 Hu, Lingquian: Job Accessibility and Employment Outcomes: Which Income Groups Benefit the
5 Most. Springer Science+Business Media New York (2016)