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A Planning Tool of Equity Transit-Oriented Development (ETOD): Evaluating, Classifying, and Optimizing Transit Stop in An Equitable Perspective in Austin, Texas

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A Planning Tool of Equity Transit-Oriented Development (ETOD): Evaluating, Classifying, and Optimizing Transit Stop in An Equitable Perspective in Austin, Texas

by

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Report

Presented to the Faculty of the Graduate School of

The University of Texas at Austin

in Partial Fulfillment

of the Requirements

for the Degree of

Master of Science in Community and Regional Planning

The University of Texas at Austin

August 2022

Acknowledgments

I would like to express my deep and sincere gratitude to my supervisors, Dr. Ming Zhang and Dr. Junfeng Jiao. Without their guidance, I would not be able to complete this report with deep insight into the field of land use and transportation. Thanks to Dr. Zhang for providing me with invaluable guidance and advice throughout the report. Furthermore, his full trust and encouragement greatly helps me in overcoming many challenges, both personally and professionally. Being able to work and study under his guidance was an honor and a privilege for me. Also, I would like to thank Dr. Junfeng Jiao for giving me the opportunity to study in the urban information lab. The study experience helped me to better understand how various techniques can be applied to quantify urban problems.

Also, I need to thank the faculty in the Community and Regional Planning program, especially Dr. Bjorn, Dr. Rosenbloom, and Dr. Karner. Whenever I need their help, they provide it without hesitation, from getting the offer all the way to overcoming language barriers and solving the technical problems I encounter in my research.

Lastly, I wish to express my gratitude to my dear parents for their spiritual and financial support.

Abstract

A Planning Tool of Equity Transit-Oriented Development (ETOD): Evaluating, Classifying, and Optimizing Transit Stop in An Equitable Perspective in Austin, Texas

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The University of Texas at Austin, 2020

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This study develops a set of planning tools for achieving equitable goals at the 133-bus stop of the Project Connect plan in Austin, Texas. This topic is important for Austin is that the upgrading of the city is forcing vulnerable groups to displace them from their original communities. As part of a 7-billion-dollar public transit expansion plan, Project Connect gave 300 million dollars in anti-displacement funding. This report answers the three questions on implementing the anti-displacement: First, whether the neighborhood of stops has issues of inequality funding. The second one, stops are the vulnerable stop. Finally, this report answers how economic, social, and environmental impacts will be brought about by the Project Connect plan. This report uses a node-place-vulnerability model, finding that vulnerable groups have a below-average transportation supply. Continuously, the K-means clustering algorithm identifies the vulnerable bus and rail stops located around the Rundberg stop and Riverside stop. Lastly, this study applies Genetic Algorithms (GA) to optimize land use, finding that the transit system will greatly

benefit accessibility to housing. Besides, the high-intensity development will result in an unproportionally high level of emissions from buildings and traffic.

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Chapter 1: Introduction

Transit-oriented development (TOD) is an urban planning strategy that builds a transit-oriented, compact, mixed-use, and pedestrian-friendly district around transit stations. Transit-oriented development is valued for its ability to increase livability, land value, and transit ridership near transit stations. The growth of investments in public transportation, however, drives up rental prices and drives out residents, resulting in further displacement in Austin.

This report aims to develop a framework, which takes equity into consideration, for evaluating, classifying, and optimizing TOD stops. The study area consists of 133 bus and rail stops for the Project Connect program, a public transit expansion plan in Austin, TX. There are three research questions that can be answered by this report: the first one is to test whether transportation supply and urban resources are heterogeneously distributed between vulnerable stops and non-vulnerable stops in the Project Connect program. Continuously, this report will answer which stops are vulnerable stops that are suffering from insufficient public transportation supply or urban resources. And finally, this report discusses the economic, social, and environmental impacts that Project Connect is likely to bring to the study area.

Firstly, this report incorporates a vulnerability index into Node-Place model to examine the relationship between vulnerability, transportation supply, and land use. Node-place models are classic models used to analyze the integration of transportation and land use at existing stations. Nodes are generally defined as their connectivity to other places, which may be measured by transit frequency or sidewalk accessibility, for example. The place mentioned is the area around the station, which is normally evaluated by the number of employees, population, and land use. In this study, vulnerability is being added as the

third dimension to the node-place model. The vulnerability index includes sub-indicators such as income, race, nationality, age, and car ownership.

This report uses the K-means algorithm to develop a new TOD topology that identifies the most vulnerable bus stops and rail stations. It classifies the 133 stops into five clusters based on transportation, land use, and vulnerability index. The rationale for the K-means algorithm is to maximize the variance between the clusters and minimize the variance within the clusters. K-means algorithm outputs five clusters that reflect heterogeneity among transportation supply, urban activities, and vulnerability. This report then analyzes the attributes of each cluster, which provide a deeper understanding of the local context.

Lastly, this report uses a Genetic Algorithm (GA) optimization model to analyze the economic, social, and environmental impacts of Project Connect. Firstly, planners set different planning strategies by changing the types and density of land use and the supply of affordable housing. The algorithm then calculates the impact of property value increments, accessibility to housing, commercial and office opportunities, and carbon emissions from new developments. There are three scenarios represented in this report, which are maximizing the supply of affordable housing, maximizing the sum of accessibility, and maximizing the sustainable goal.

Chapter 2: Literature Review

The literature review is divided into four sections. The first two sections contained theoretical articles addressing TOD definitions and related equity concerns. In the first section, it discusses the concept of TOD and its impacts such as travel behavior and price premium of property. The second section discusses whether TOD will contribute to gentrification, and its negative impacts on social equity issues, including social upgrading and declining affordability.

The following two sections summarize planning tools for classifying TOD stations and optimizing land use. The third section introduces the Node-Place model and outlines the factors that have been considered in the evaluation. Besides the two dimensions, node and place, a third dimension, such as walkability, travel demand, or built environment is added to the Node-Place model. In the last section, the genetic algorithm is introduced into optimizing land use in small neighborhoods, corridors with transit-oriented development, and at the level of the city.

2.1 Concepts of TOD

Peter Calthorpe first proposed the concept of transit-oriented development (TOD). Calthorpe believed that a transit-oriented, compact, mixed-use, and pedestrian-friendly urban planning strategy would reduce sprawl, traffic congestion, and air pollution (Calthorpe, 1992). He specifically defined the TOD as "a mixed-use community within an average 2,000-foot walking distance of a transit stop and core commercial area. TODs mix residential, retail, office, open space, and public uses in a walkable environment, making it convenient for residents and employees to travel by transit, bicycle, foot, or car" (Calthorpe, 1993).

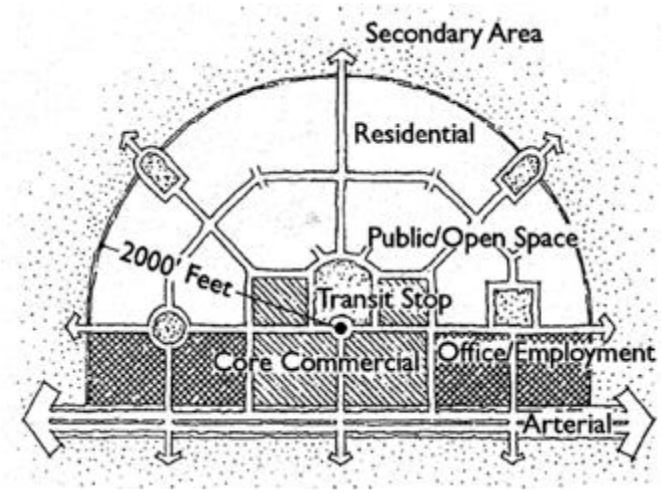


Figure 3.1 The Basic Concept of a TOD Community (Calthorpe 1993)

The concept of TOD was inspired by New Urbanism, which believes that neighborhoods should be diverse, mix-used, and accessible for pedestrians and transit. New Urbanism also emphasizes that the growth of placeless sprawl, social segregation, and environmental deterioration will be a challenge to cities. (Leccese et al., 2000). Nechyba & Walsh has recognized that low-density development modes negatively impact economic, environmental, and social aspects, such as increasing commuting time, air pollution, and unequal provision of public goods (Nechyba & Walsh, 2004). Some studies also have indicated that New Urbanism is an efficient method to address these negative impacts. Gordon and Vipond compared traditional neighborhood development (TND) and conventional suburban development (CSD) in Markham, Ontario. To clarify, TND was an early form of New Urbanism at the beginning of 20 Century, which emphasized mix-uses, walkability, and priority for public space. CSD was opposite the TND, which is a car-oriented and low-density development mode. The results showed that the TND area could accommodate more population and consume less land (Gordon & Vipond, 2005). A considerable amount of research has proved the effects of TOD on travel behavior, real

estate prices, the location of residential properties, urban form, and community life, etc. (Ibraeva et al., 2020).

There are substantial benefits of TOD. Cervero classified them according to the recipient of benefit, such as the public sector or the private sector, and by the class of benefit, such as the primary benefit or the secondary benefit. Among the primary benefits of TOD is the increase in ridership, revitalization of neighborhoods, and promotion of economic development in the public sector. In private sectors, it increased land value, rent, housing demand, and affordable housing opportunities. Secondarily, TOD can benefit the environment and the economy as well, for example, by reducing traffic congestion, increasing land value, curbing sprawl, and reducing road expenditures. The TOD also indirectly reduces crime and fosters a sense of community due to its compact and pedestrian-friendly development strategy Cervero 2004, p.120.

In other empirical studies, some positive effects of TOD have been approved. For travel behaviors, researchers suggest the TOD can promote transformation from the automobile mode to non-auto mobile modes like cycling and walking. Transit-oriented neighborhoods in the Bay Area experience 5.1 percent more journeys to work by transit when income and density are held constant (Cervero & Gorham, 1995). In Toronto, Higgins and Kanaroglou conducted a latent cluster model to compare the different commute mode shares for areas with different densities. It showed that transit stations falling in the denser stations had a higher share of travel modes for walking. In the commercial core area and mixed-use core area, people generated 41%, and 30% of trips were made by foot, which is 619% and 437% greater than the average of 372 rapid transit stations in the Toronto region (Higgins & Kanaroglou, 2016).

Additionally, TOD may increase the value of land. Mathur and Ferrell applied a hedonic regression model to examine the single-family house price in the suburban TOD

of Ohlone-Chenyoweth in San Jose. According to the study, distance to stations had a significant impact on house prices. Within 1/8 miles of the TOD, housing prices were 18.5% higher than those more than 1/8 mile away (Mathur & Ferrell, 2013). Additionally, a study conducted in Austin examines the price premium associated with commercial properties located near bus and rail stations. The results of a hedonic price model indicate that TOD planning can significantly boost economic growth. In comparison to properties located within 0.25 miles of non-TOD stations, properties located within 0.25 miles of TOD stations tend to command a price premium of about $9.0 per square foot. In catchments of 0.25–0.5 miles and 0.5–0.75 miles, the price premiums for commercial property are $8.6/ft2 and $5.3/ft2, respectively (Yu et al., 2018).

2.2 TOD AND GENTRIFICATION

Although New Urbanism has been widely regarded as a panacea to solve urban sprawl, it also has long been criticized as a tool for elitists, being judged by its affordability for middle and lower-income families (Bohl, 2000). In some empirical studies, it has been examined that TOD may cause gentrification and eventual displacement of low-income residents (Rayle, 2014; Revington, 2015a). Gentrification is defined as "a process of changing the character of a neighborhood through the influx of more affluent residents and businesses" (Lees et al., 2010). Grier proposed one definition of displacement, which is "displacement occurs when any household is forced to move from its residence by conditions which affect the dwelling or immediate surroundings." (Grier and Grier 1978, 8)

In Denver, Bardaka examined whether transit-induced gentrification was contributing to gentrification. It has been found that the installation of light rail stations in neighborhoods up to one mile from the stations significantly increases household income

and housing values (Bardaka et al., 2018). In Seattle, Hess found that transit infrastructure affected residential segregation patterns near transit lines. It increased percentages of Whites and decreased percentages of minorities near light-rail stations (Hess, 2020).

The rent gap theory can explain why gentrification would occur in the TOD area. The newly built transportation infrastructure increased the locational advantage and mobility in TOD areas. With the increase in spatial mobility capital, real estate investments were drawn to these developments, resulting in a decrease in affordability and the displacement of low-income households (Revington, 2015b).

The process of gentrification has been widely viewed as having a negative impact on social equity. A number of studies have criticized its potential to increase housing affordability, foster class segregation, and undermine a sense of community. (Clagett, 2015).

2.3 TOD TOPOLOGIES

Classifying TOD aims to improve the efficiency and effectiveness of station planning by attributing transit stations and their adjunct areas with common features. Calthorpe (1993) first distinguished between “Urban TOD” and “Neighborhood TOD” based on the location, density, and surrounding land uses. He also pointed out that the urban TOD and the neighborhood TOD have different planning goals. The goal of urban TOD is to create more jobs. As a result, the areas were required to be developed in a high-density mode for office, residential, and commercial uses, which in turn will result in an increase in the number of transit trips. A neighborhood TOD focuses on a moderate density of residential, commercial, and public service uses, which are in turn equipped with a lower level of transit service (Calthorpe, 1993).

Later, Bertolini coined the node-place model to classify transit stations in a more systemic and quantitative way. Generally, a node was defined as its connectedness to other places, which can be measured by transit frequency, sidewalk connectivity, etc. The place is the diversity of activities around the station, which is normally measured by the number of employees, population, and land use. An XY diagram (Figure 2) can be used to visualize the model. The value of the Y-axis represented the accessibility to a node, and the value of X represented as characteristics of a place. All stations are classified into five groups, including Accessibility, Stress, Dependency, and two unbalanced clusters, namely an unsustained node and an unsustained place. Nodes and places are balanced in the area along the diagonal with slope =1 were defined as balanced groups. It includes three types of areas, which are accessibility, dependency, and stress. Stops located in the middle of the diagonal were named accessible stops, which maintains a moderate balance between the supply of transit services and the diversity of land uses. Stops located at the top of the diagonal were named stressed stops, which have the maximum transportation flow and most intensive urban activities in the region. Stops located at the bottom of the diagnosis areas were classified as dependent stops, which have a minimum land use intensity and a supply for public transportation. Then, stops with rich transportation supply but limited urban activities were defined as “unsustained nodes”. Reversely, stops with intense urban activities but limited public transportation service were defined as “unsustained places” (Bertolini, 1999).

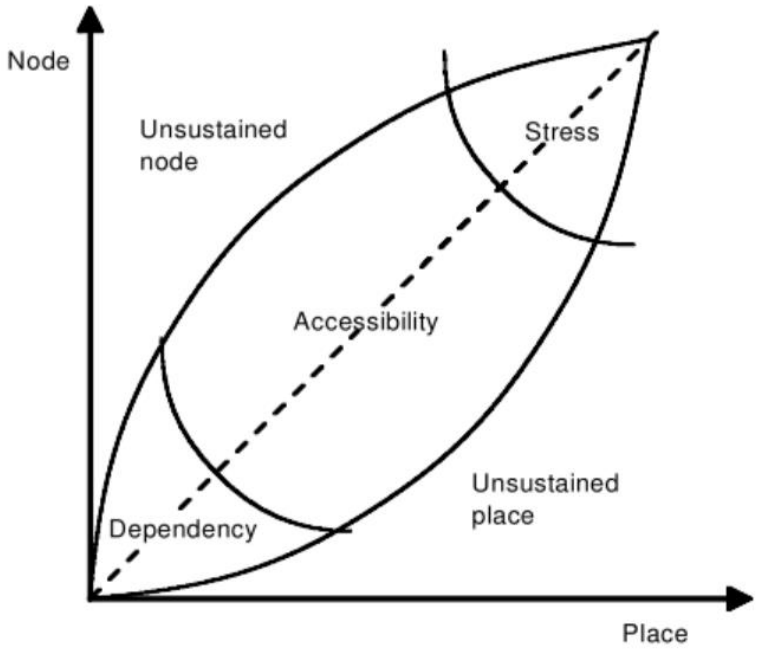


Figure 2. The node-place model (Bertolini, 1999)

The node-place model has been widely applied in recent articles over the last decade. Previous studies considered the built environment, walkability, accessibility, travel demand, and network as the third dimension of the node-place model (Dou et al., 2021; Kamruzzaman et al., 2014; Liao & Scheuer, 2022; Lyu et al., 2016; Vale, 2015; Zhang et al., 2019). For example, in an empirical study in London, researchers considered the design, including the pedestrian's shed ratio, intersection density, and accessible network length, as the third dimension in the TOD classification (Zhang et al., 2019). The study revealed that there is a relatively low correlation between node and design index, suggesting that transportation-intensive stations may lack a walkable environment.

2.4 LAND USE OPTIMIZATION OF TOD PLANNING

Some studies have shown that land use optimization involved the distribution of urban resources among multiple conflicting objectives with different stakeholders, which concerns economic development, social equity, and environmental protection (Liu et al., 2020). The conflicts of different objects will eventually transform into conflicts of type and the intensity of land uses.

In the Netherlands, Stewart used the Genetic Algorithm to optimize the land of Jisperveld, a 400-hectare meadow. Within the region, an optimization unit is arranged in a grid of 20 by 20 (Stewart et al., 2004). As part of the optimization process, she set three incompatible goals: maximization of the natural value of the area, maximization of its recreational value, and minimization of the value of changing its land use.

In the empirical study of Tongzhou, China, Cao optimized the core area of the city by using 'NSGA-II-MOLU' (non-dominated sorting genetic algorithm-II for multi-objective optimization of land use'). He set three conflicting optimization goals, which are minimizing conversion costs, maximizing accessibility, and maximizing compatibilities between land uses. This study aimed to decrease social capital, improve social equity, and decrease carbon emissions, enhance the connection between different land uses respectively (Cao et al., 2011).

By using a Genetic Algorithm model, Liu optimized land use at 21 transit stops and its adjudicated area of Metro line #2 in Wuhan. She aimed to achieve a sustainable goal with optimization of maximizing the the economicthe economic effect, maximizing social effect, and minimizing the environmental effect. In this paper, economic effect is measured by property value capture in the TOD catchment. The social effect is evaluated by the accessibility of kinds of opportunities such as jobs, services, education, etc. The

environmental effect is evaluated by the energy consumption and emission that come from human activities (Liu et al., 2020).

Chapter 3: Methodology

3.1 NODE-PLACE-VULNERABILITY MODEL

The Node-Place model is a conceptual and methodological framework for identifying and classifying TODs in a metropolitan area. This model places station areas as both the 'nodes' of the transportation network and 'places' of urban activity (Bertolini, 1999). Transit supply (node) in a station area will in turn improve land use intensity and diversity (place) through improved transit supply. It can be plotted in a two-dimensional graph, with the 'node' index as the y-axis, and the 'place' index as the x-axis. In this two-dimensional plane, all stops are divided into three balanced clusters and two unbalanced clusters according to the value of the node and place. In recent studies, scholars have induced the built environment, travel demand, and walkability as the third dimension in the node-place-X model (Dou et al., 2021; Kamruzzaman et al., 2014; Liao & Scheuer, 2022; Lyu et al., 2016; Vale, 2015; Zhang et al., 2019). However, few studies considered the equitable factors in the Node-Place model.

To develop a new TOD topology incorporating equity factors, this report introduces vulnerability as the third dimension in the node-place model in this report. There has been little research related to how subfactors are weighted within each dimension of the node-place model. This report adopts the Shannon entropy theory to weight each subfactor according to its entropy. What's more, for classifying with a new TOD topology for the Project Connect program, this report uses the K-means algorithms to classify the 133 stops according to their node, place, and vulnerability index.

Classifying TOD stations can help in developing goals and setting planning strategies for different types of TOD stations in Austin's future development of public transit. By integrating the vulnerability index into the TOD topology, policymakers can

better adjust investment strategies and/or provide affordable services in housing and transportation for those vulnerable stations.

3.1.1 Study Area

This study area of the node-place-vulnerability model selects the blocks within 1/2-mile 133 rail and bus stops of the Project Connect program as the study area., which is shown in the figure below:

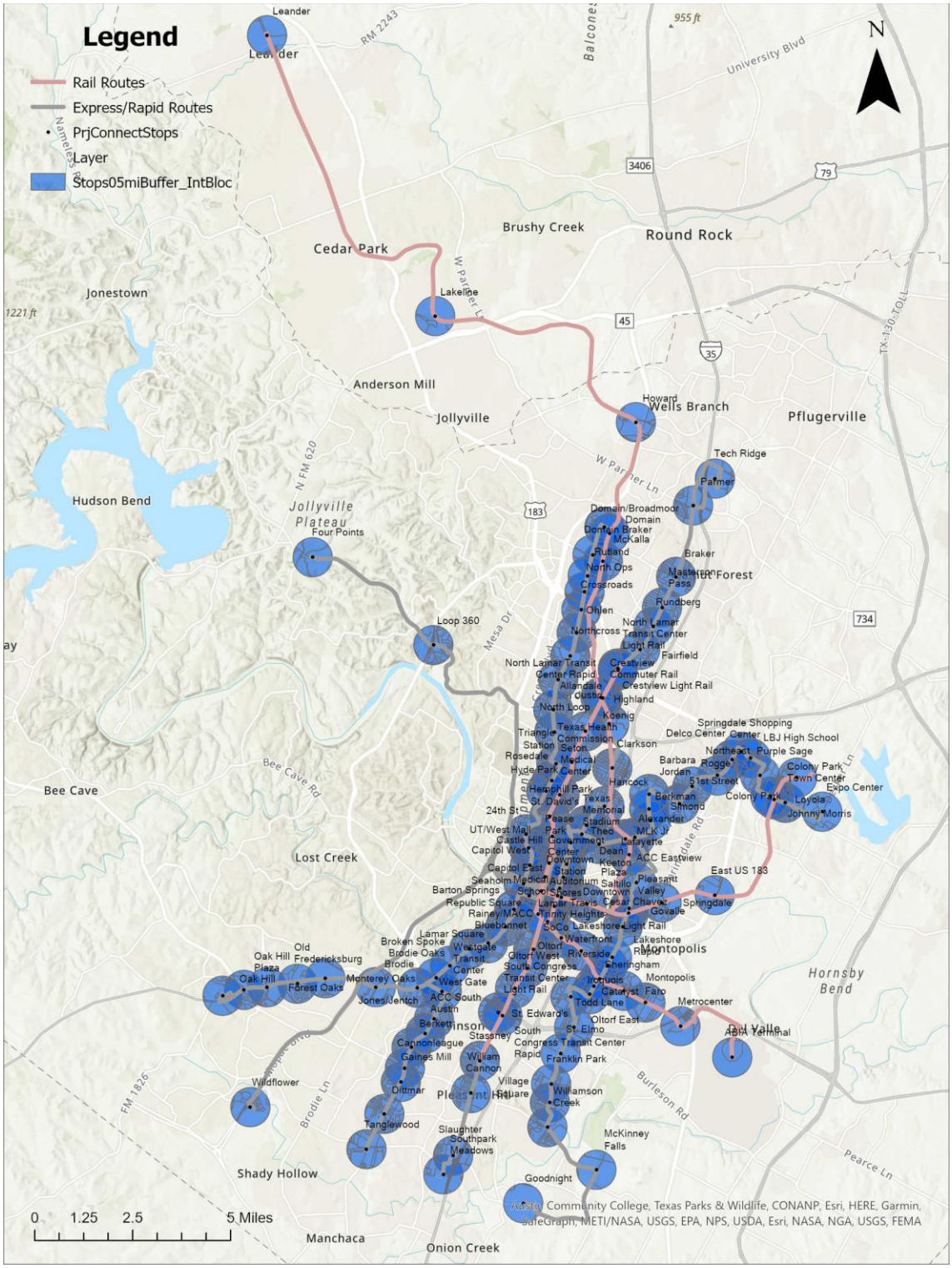


Figure 3. Study Area of Node-Place Model

3.1.2 Data Source and Data Preparation

The data source for the node-place-vulnerability model is shown in Table 1. The software ArcGIS is applied to incorporate data into the boundary at the stop level. It summarizes the demographic and socioeconomic data from different borders, such as TAZ level, census tract level, and block group level.

Type	Factors	Data Source
Node Indicators	1) # of rail routes	Project Connect
	2) # of bus routes	Project Connect
	3) Daily frequency of trains	DART system schedule
	4) Daily frequency of buses	Data from Class of Transportation Equity Analysis
	5) # of vehicles per household	ACS 5-year estimation (2016-2020), block group level
	6) Total street length	RoadsCAPCOG
	7) Total sidewalk length	CoASidewalk2021
	8) Average street length	CoASidewalk2021
Place Indicators	1) # of persons	ACS 5-year estimation (2016-2020), block group level
	2) # of jobs	Longitudinal Employer-Household Dynamics 2019
	6) Acres of residential land use	Landuse2022CoA
	7) Acres of commercial and office land use	Landuse2022CoA
	8) Acres of land for civic, open space, and water	Landuse2022CoA
People indicators	1) Persons of ethnic minority	ACS 5-year estimation (2016-2020), block group level
	2) Persons age 65+	ACS 5-year estimation (2016-2020), block group level
	3) Persons foreign-born	ACS 5-year estimation (2016-2020), census tract level
	4) Households below 60% medium household income	ACS 5-year estimation (2016-2020), block group level

	5) Households with zero car	ACS 5-year estimation (2016-2020), block group level

Table 1: Data source of Node-Place-Vulnerability model

After the data was processed, the next step was normalizing the data. This model is working with many different forms of data that exist on differing scales, and normalizing provides a way to balance these factors against each other. Below is the normalization formula that we used to balance all the factors. In the formula, the *i* indicates the *i*th variable, like the number of rail routes, and the population. The *j* indicates the *j*th transit stop in 133 total transit stops. x_{ij} indicates the observed values in *j*th variable, and $x_{ij}$is the normalized value of x_{ij}.

$$x'_{ij} = \frac{x_{ij} - \min(x_{ij})}{\max(x_{ij}) - \min(x_{ij})}$$

3.1.3 Entropy Weighting Method

In order to assign different weights to the sub-factors in the Node, People and Vulnerability indices, this report adopts the entropy weight method (EMW) to weight sub-factors of three dimensions in the node-place-vulnerability model. EWM is chosen because it is based on measuring the dispersion in decision-making. If each sample in a data set has an equal value, then the entropy value will be larger, and therefore the weight will be less. In the opposite direction, if each sample in a data set are more different with each other, then the entropy value will be smaller, and therefore the weight will be larger. The process of calculating the shown as below:

The first step of the EMW is also to standardize the measured value. In this step, the n indicates that there are n samples in total. The $p_{ij}$is the standardized value of *i*th variable in the *j*th transit stop.

$$p_{ij} = \frac{x_{ij}}{\sum_{j=1}^{n} x_{ij}}$$

The next step is calculating the entropy value E_i of *i*th variable. The range of E_i is [0,1]. The larger the E_i is, the more even that x_{ij}distributed. In the context of urban planning, it can be described as the more even allocation of urban sources like transportation investment and supplement of jobs. Vice versa, the smaller the E_i is, the more condensed that x_{ij} distributed with. As well, in the context of the urban source, it may distribute in certain areas.

Taking examples with two extreme situations can be better explain this rationale. There are two set of data with 3 samples, the observed values of the first set is even distributed, which are 1/3,1/3, and 1/3. The second set of data is concentrated distributed, which are 1/10000, 9998/10000, and 1/10000. After calculating, the first set of data reach to the maximum level of entropy, which is $E_1 = 1$. On the contrary, the second sets of data almost reach to the minimum level of entropy, which is $E_2 \approx 0$.

$$E_i = -\frac{\sum_{j=1}^{n} p_{ij} \cdot ln\, p_{ij}}{\ln n}$$

The final step is to calculate the weight w_i of each variable under node, place and vulnerability dimension. The *m* indicates that there are *m* variables under one dimension of node, place, and vulnerability dimension. The higher weight corresponds to the lower entropy. For distribution of urban resources, a denser distribution of urban sources is given a greater weight.

$$w_i = \frac{1 - E_i}{\sum_{i-1}^{m}(1 - E_i)}$$

3.2 K-MEANS CLUSTERING

There are many clustering methods has been used into the node-place model, which includes two steps clustering (Reusser et al., 2008; Zemp et al., 2011), K-means clustering

(Liao & Scheuer, 2022; Zhang et al., 2019), and hierarchical clustering (Lyu et al., 2016; Vale, 2015). There are two advantages of

K-means clustering is used in this report because the number of clusters can be selected, and the results of K-means clustering are easily interpreted. The benefits of K-means clustering can be attributed to its rationale, which is to maximize the variance between clusters while minimizing the variance within clusters (Zhang et al., 2019).

Data should be preprocessed before running the K-means cluster. All sub-factors are firstly weighted according to the weights result of EMW and then synthesis to the corresponding dimensions (dimensions of the nodes, people, and vulnerability) and then each dimension should be normalized into the range of [0,1]. Based on the familiarity with the research area, it has been decided that five clusters can be used to classify the 133 transit stops in a reasonable and interpretable manner. Finally, this report applies the clustering result into the node-place-vulnerability model to analyze the heterogeneity of five clusters.

3.3 GENETIC ALGORITHM

The genetic algorithm (GA) is intended to solve problems with multiple conflicting optimization goals (Stewart et al., 2004). The linear programming model has been used in optimizing land use since 1965. However, when the problem becomes more complex, it usually includes multiple objectives, which makes the problem nonlinear and often difficult to solve by the traditional linear programming model (Cao et al., 2011). Due to its good performance in solving multi-objective optimization, the GA model has been widely used in land use planning in small neighborhoods, stations, and city levels (Cao et al., 2011; Liu et al., 2020; Schlager, 1965; Stewart et al., 2004).

In this report, the GA model is used to estimate the economic, social, and environmental impacts of TOD planning of Project Connect on newly developed land, as

well as the affordability of new developments. For practical purposes, it is assumed that all vacant and industrial land will be converted into residential, commercial, or office space in the future.

This GA model application to the Austin case considered three objects and one constraint, and each of them will be explained in the following sections. Firstly, the economic index measures the value of the original and newly developed residential, commercial, and office buildings. Second, the social index is evaluated by the sum of accessibility to housing, retail, and job opportunities. Thirdly, the environmental index is measured by the emission of buildings in residential, commercial, and office use, and travel emissions generated by residents and employees on these types of land use. To realize the affordable aim, there is one more constraint that must be met within the model, which is the amount of affordable housing that can be provided in the future at a level that a household with a 60%median family income (MFI) can afford. Based on this analysis, six scenarios are presented in the chapter on results, which discuss the economic, social, and environmental effects of different planning strategies. This GA model can provide a guideline for transportation organizations, planning practitioners, and transportation decision-makers to help them decide on the development types and intensity of each region.

3.3.1 Study Area

This study area of the GA model selects the parcels within 1/2-mile from 41 rail stations and ¼-mile from 92 bus stops of all rails, metro, and express lines of the Project Connect program as the study area., which is shown in the figure below:

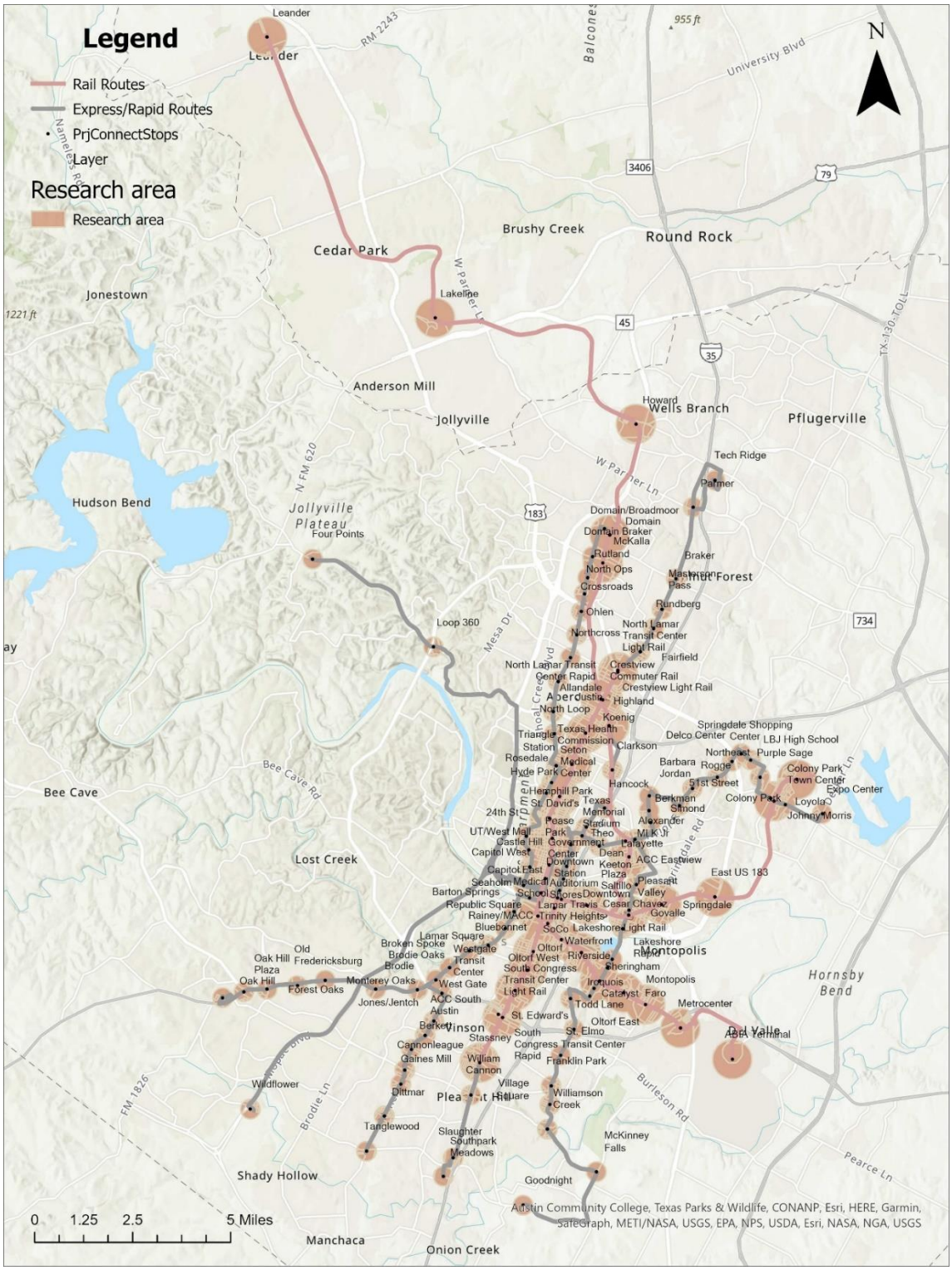


Figure 4. Study Area of GA Model

3.2.2 Maximizing Price Premium

The economic objective is to maximize the capture value of the residential, commercial, and office land. The following formula expresses the method, to sum up all the economic benefits generated by land for residential, commercial, and office use:

$$Y_1 = \sum_{i,m} A_{im} P_{im}$$

Which,

Y_1: Total economic effect, which sums up all the price premium for all newly built property in residential, commercial and office use.

A_{im}: Total floor area of property in i_{th} parcel with m_{th} type of land use among residential, commercial and office use.

P_{im}: Price of property in i_{th} parcel with m_{th} type of land use among residential, commercial and office use.

i: The i_{th} city parcel

m: The m_{th} type of land use among residential, commercial and office use.

3.2.3 Maximizing Accessibility

The social objective is to maximize the accessible opportunity generated by the residential, commercial, and office land. A gravity model is applied in this formulation to calculate the accessibility with different land use types. The following formula expressed the method of summing up all the social benefits of opportunities generated by land for residential, commercial, and office use:

$$Y_2 = \sum_{k} \sum_{k,i,j} O_j \cdot e^{-b \cdot t_{ij}}$$

Which,

Y_2 : Total social impact, which calculated the sum of all accessible opportunities generated by all newly transformed land used for residential, commercial, or office purposes.

O_j: Amount of opportunity in j_{th} parcel destination.

e: Natural logarithm with a value of 2.718

t_{ij}: Travel time by using the transit from the i_{th} to the j_{th} parcel

b : Parameter empirically estimated indicating sensitivity to spatial separation

k: The k_{th} type of opportunity among residential, commercial and office.

3.2.4 Minimizing Emission

The environmental objective is to minimize all emissions generated by buildings and travel activities on residential, commercial, and office land. The following formula expresses the method of summing all the buildings and travel emissions of land with residential, commercial, and environmental use:

$$Y_3 = \sum_{i,m} v_{i,m} \cdot \alpha_m + \sum_{i,m} v_{i,m} \cdot g_m$$

Which,

Y_3: Total environmental impact, which calculated the sum of all emissions generated by building and travel activity on residential, commercial, and office land.

$v_{i,m}$: Volume of building stocks measured in floor area in i_{th} parcel with m_{th} type of land use among residential, commercial, and office use.

α_m: Emission rate for m_{th} type of land use among residential, commercial, and office use.

$v_{i,m}$: Floor area of building stocks in i_{th} parcel with m_{th} type of land use among residential, commercial, and office use.

g_m: Average annual travel distance by household and employment with m_{th} type of land use among residential, commercial, and office use.

i: The i_{th} city parcel

m: The m_{th} type of land use among residential, commercial, and office use.

3.2.5 Objects Normalized

Before running the genetic algorithm, data used in the three objectives shown above comes from various scales. The following normalization process is used to unify the three objects in the range of [0,1]

Normalization of economic value:

$$Y_1' = \frac{Y_{1,j} - \min\,(Y_{1,min})}{\max(Y_{1,max}) - \min\,(Y_{1,min})}$$

Normalization of social value:

$$Y_2' = \frac{Y_{2,j} - \min\,(Y_{2,min})}{\max(Y_{2,max}) - \min\,(Y_{2,min})}$$

Normalization of environmental value:

$$Y_3' = \frac{Y_{3,j} - \min\,(Y_{3,min})}{\max(Y_{3,max}) - \min\,(Y_{3,min})}$$

The w_1, w_2, and w_3 specify the weight an analyst or decision maker may assign to each objective.

$$Z = w_1 \cdot Y_1' + w_2 \cdot Y_2' + w_3 \cdot Y_3'$$

3.2.6 Constraints of affordable housing

A further constraint is the need to provide affordable housing for future vulnerable groups. The amount of affordable housing based on the total housing units can be provided on the newly converted parcels. To obtain the additional housing units in the future, this model sorts the original vacant and industrial parcels, then converts them into residential parcels. Land use classification document provided by the City of Austin in 2022. Using ArcGIS, it indicates that, within a quarter mile and a half mile of the transit station, 847 parcels are vacant and in industrial use.

Next, the amount of housing units can be calculated based on the room area per housing unit and the floor area ratio (FAR) for different development intensities. The U.S. Department of Housing and Urban Development (HUD) reports that the most common household size is two people, and the average area for two people is 935 square feet. Accordingly, the housing units discussed in this research are those that can accommodate two people. The value of FAR for different scenarios will be discussed in the following section.

To determine how much affordable housing there is in different levels of affordability, the model is based on the appraised value of each property in the Travis Central Appraisal District (TCAD), and HUD's share of income for different income levels in Austin. There are three levels of affordability set in this model, which are 30% median family income (MFI), 60% MFI, and 80%MFI. The table1 shows different levels of annual median income (30%MFI, 60%MFI, and 80%MFI) with the four sizes of household.

HUD 2021 Austin Median Income Limit	1 Person Household	2 Person Household	3 Person Household	4 Person Household
30%MFI	$20,800	$23,750	$26,700	$29,650
60%MFI	$41,580	$47,520	$53,460	$59,340

80%MFI	$55,400	$63,300	$71,200	$79,100

Table 2. 2021 Median Income Limits in Austin (per year)

To determining the amount of income that can be spent on renting, 25% of income was determined to be a reasonable amount for mortgage or rent payments, and the monthly mortgage or rent payment can be calculated using this formula: $(x\%MFI * 0.25)/12$. The result of the equation shows in the Table.3:

Mortgage/Rent	1 Person Household	2 Person Household	3 Person Household	4 Person Household
30%MFI	$433	$495	$556	$618
60%MFI	$866	$990	$1,114	$1,236
80%MFI	$1,154	$1,319	$1,483	$1,648

Table 3 Affordable Mortgage/Rent (per month)

In the next step, the present value of a house is determined over a 30-year period at an annual rate of 4.50% interest with a share of 25% income level for different social groups. The present value is calculated by the "PV" function in Excel. The Table.4 shows the present value of a property if a household paid 25% income in mortgage in 30 years with an annual interest of 4.5%.

Total Cost of Homes Payable	1 Person Household	2 Person Household	3 Person Household	4 Person Household
30%MFI	$85,523	$97,653	$109,782	$121,912
60%MFI	$170,964	$195,388	$219,811	$243,988
80%MFI	$227,788	$260,270	$292,752	$325,235

Table 4. Present Value of Homes Payable (per sqft)

For determining whether a parcel is affordable at a particular income level, the averaged property value (per square foot) of each parcel is compared to the present value (per square foot) of the home payable. An affordable home is one whose average appraised value exceeds its current value, and vice versa.

Chapter 4: Results and Discussion

This chapter will be divided into two parts. The first part analyses whether the existing condition of all 133 bus stops has a balanced development among transportation supply, the urban activities, and the vulnerable level. Then, it analyzes attributes of the transportation, land use, and vulnerability of five clusters, which are classified by K-means algorithms.

The second part optimizes types and density of land use by genetic algorithm. Specifically, it discusses and compares the impact on supply of affordable housing, value improvement of vacant and industrial land, destination accessibility, and greenhouse gas emissions generated by buildings and travels.

4.1 NODE-PLACE-VULNERABILITY MODEL

4.1.1 Analysis of Distribution of Node, Place, Vulnerability Index

As discussed in the previous chapter, weighting subfactors will be conducted first. The entropy weight method based on that entropy can quantify the intensity of urban sources. When entropy is high, urban sources are more evenly distributed, while when entropy is low, urban sources are more intensely distributed. In this method, lower entropy subfactors are given a higher weight since they are more unequally distributed and require more attention by the planner. Table 5 reports the entropy and weights for each subfactor in accordance with their corresponding dimensions. As well, the appendix contains the distribution of normalized values of each subfactor and the compounded indexes of vulnerability, place, and node index for these weighted subfactors in 133 metro stops.

Index	Variables	E_j	$1 - E_j$	W_j
Vulnerability	Persons of ethnic minority	0.95	0.05	0.19

	Persons aged 65+	0.96	0.04	0.15
	Persons foreign-born	0.95	0.05	0.18
	Households below 60% MHI	0.95	0.05	0.18
	Households with zero car	0.92	0.08	0.31
Place	Total Employment	0.80	0.20	0.52
	Total Population	0.97	0.03	0.08
	Residential land use	0.96	0.04	0.09
	Commercial and office land use	0.94	0.06	0.16
	Civic, open space, and water	0.95	0.05	0.13
	Land Use Entropy	0.99	0.01	0.02
Node	Rail routes	0.83	0.17	0.27
	Bus routes	0.91	0.09	0.14
	Daily frequency of trains	0.75	0.25	0.38
	AMPK frequency of bus	0.95	0.05	0.07
	Vehicles per household	0.99	0.01	0.01
	Total street length	0.98	0.02	0.03
	Total sidewalk length	0.98	0.02	0.03
	Average street length	0.96	0.04	0.07

Table 5. Entropy Weights Method for Sub-factors Contributing to Node-Place-Vulnerability Model

Figure 5 illustrates the distribution of vulnerability values, which were primarily concentrated at Rundberg, UT/West Mall, and Riverside stops. Typically, these three areas are characterized by a high minority population, a high proportion of foreign-born residents, and households earning less than 60% of the median income. As one of the most vulnerable areas in the city, Rundberg is located far from the downtown area, yet there are fewer households in the area. It can be concluded that employment in the Rundberg area may suffer from unproportionally higher vehicle ownership expenses. The Riverside is a good location for young and vulnerable people as it is located near downtown where there are many job opportunities concentrated. Nevertheless, as the central city continues to expand, the Riverside area has the highest potential for displacement among the three.

UT/West Mall is a special stop due to its proximity to the University of Texas at Austin, which has a high percentage of foreign-born students and low-income students.

In Figure 6, it can be seen that the downtown area enjoys an extremely high place index, which is mainly due to the distribution of job opportunities. The factor of employment holds almost half of the weight of all six sub-factors of the place dimension due to its intense concentration of clustering at the downtown area. In contrast, the weight of the population is only 0.08, which indicates that the population is distributed more evenly throughout all stops. This job-housing mismatch may generate long distance or long-time commuting issues; therefore, the factor of employment should be given more weight and further got more attention by planning practitioners.

In figure 7, it can also be seen that the node index is concentrated in the downtown area. As a result of their higher weight, service level of planned train routes, as well as the operating frequency heavily determine node dimensions. The stops in downtown area like Downtown station and Rainey/MACC enjoy the much more bus routes and rails routes. However, the frequency of bus use is more evenly distributed around in the urban area of Austin. Some situations with the street and pedestrian facilities are evenly distributed almost on all stops. Yet in some terminal stops, such as Four Point, Leander, and ABIA Terminals, the walkability may not satisfy the need for developing a pedestrian-friendly TOD.

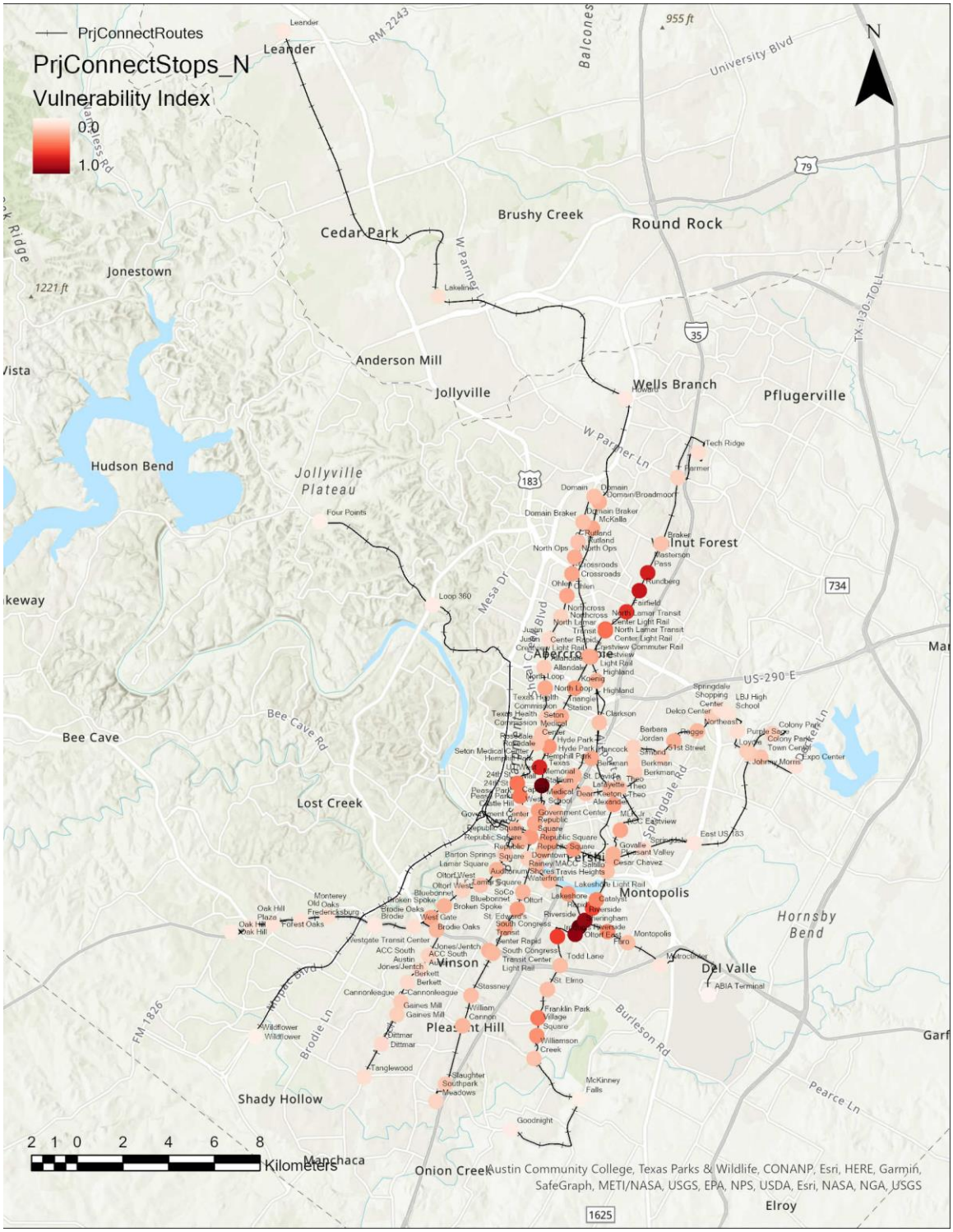


Figure 5. the distribution of vulnerability index

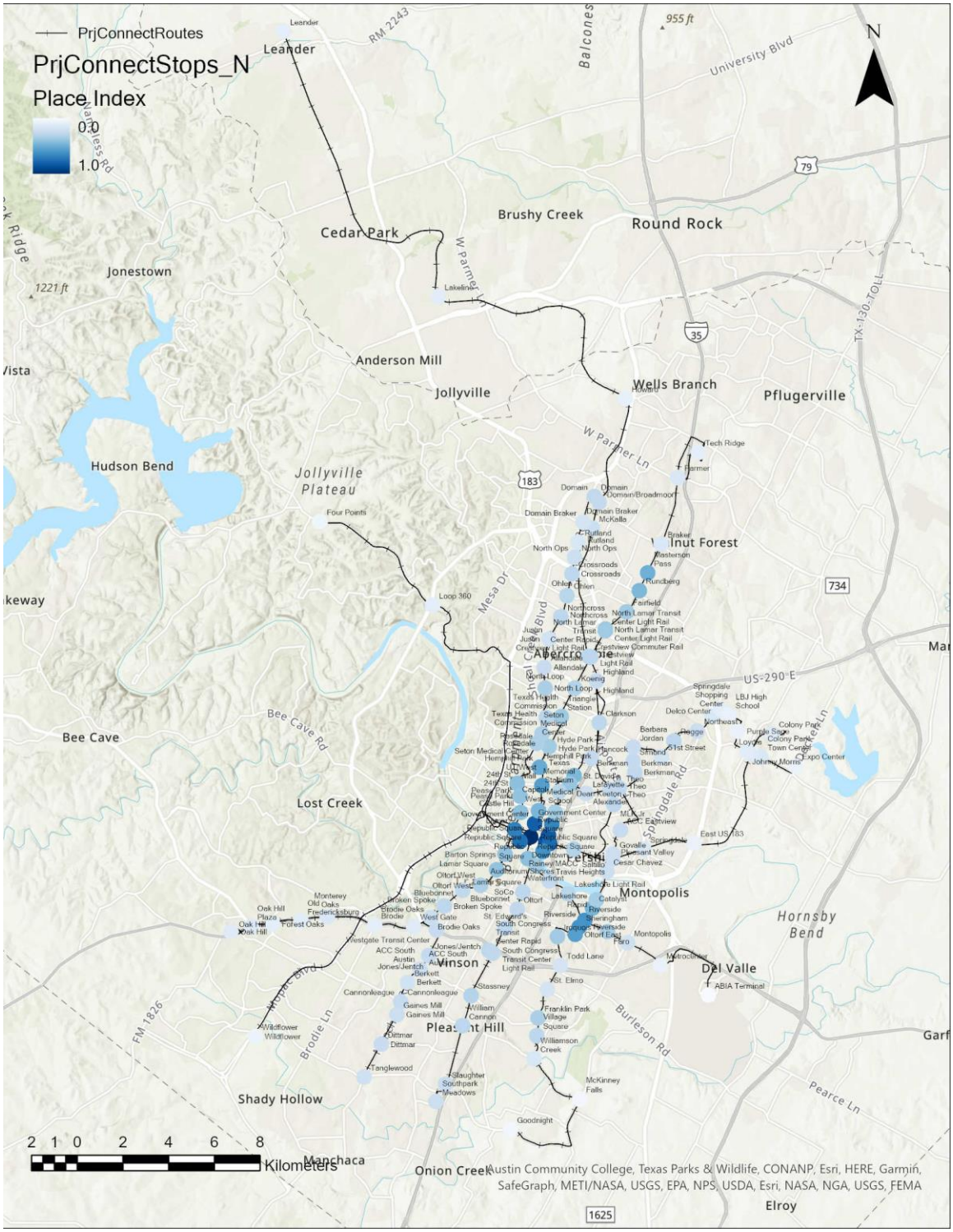


Figure 6. The Distribution of Place Index

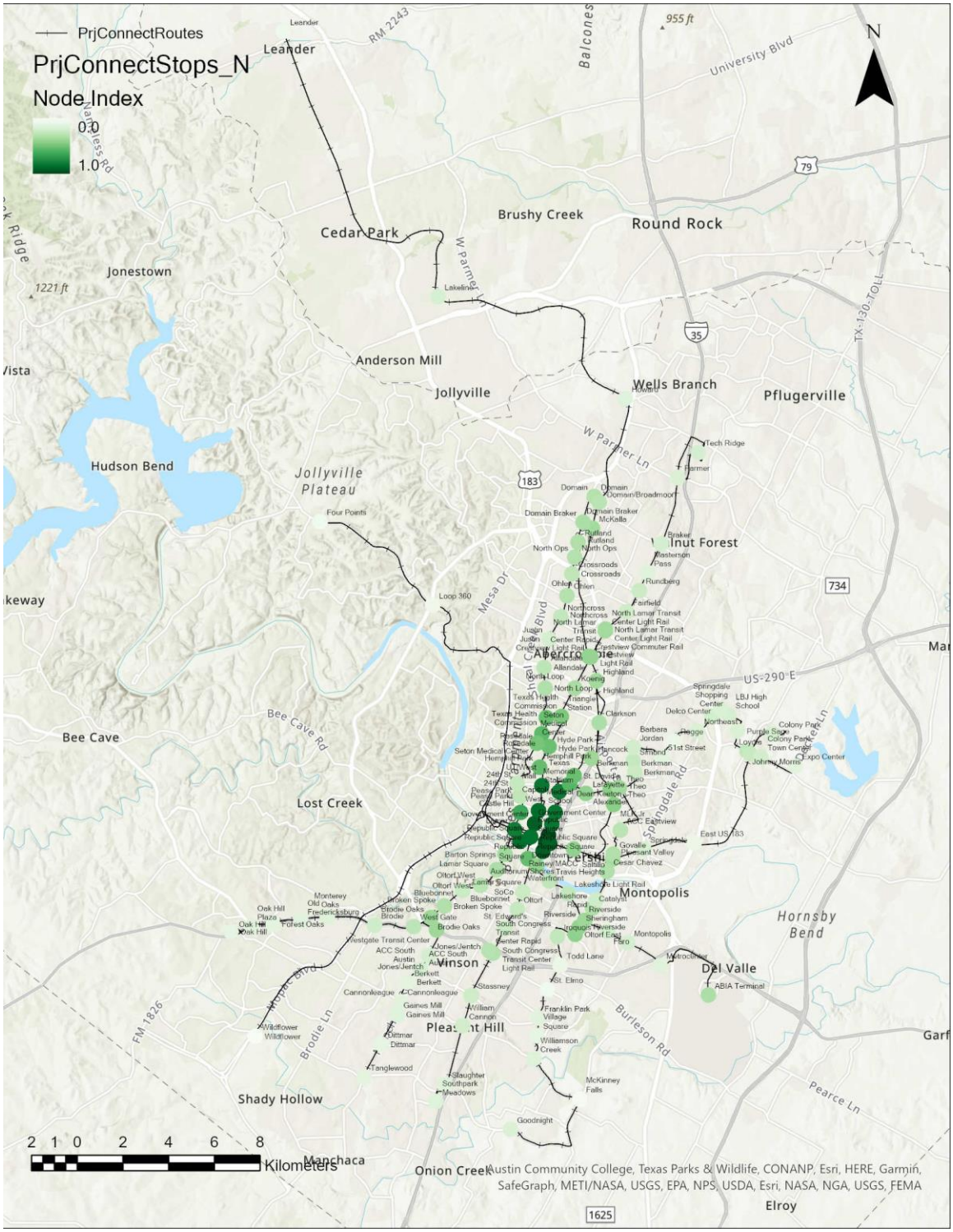


Figure 7. The Distribution of Node Index

4.1.2 Clustering Analysis

Following this, K-means cluster analysis is applied to the combined node, place, and vulnerability indices. This section divides the 133 metro stops into five types, which are downtown TOD (cluster 1), vulnerable TOD (cluster 2), suburban TOD (cluster 3), urban TOD (cluster 4), and central TOD (cluster 5). Table 6 shows the amount, type of stations, and average values of the three dimensions. Table 7 summarizes the average score of each subfactor, allowing for an in-depth analysis of which subfactor contributes to the value of each dimension of node, place, and vulnerability. The classification of TOD can assist planners and policy makers to understand which clusters should be targeted for what type of investment.

Downtown TOD (cluster 1) located at the core central of the city, with the highest place and node index, but relative high index of vulnerability. It enjoys the most intense of urban activities, which is mainly due to the highest score of normalized employment and commercial/office land use among the five clusters. As well, it enjoys the most resourceful public transportation service and transportation facilities in Austin. Specifically, this area has the highest number of bus and train routes, and it has one of the best walkable built environments, as well as the highest frequency of rail service in the future. From the perspective of vulnerability, it has a higher level of vulnerability than the average due to the higher percentage of senior citizens and those without a vehicle. This suggests that resourceful urban activities, convenient public transportation service, and a walkable built environment may provide a good quality of life for senior residents. Besides, the high number of households without a car implies that good public services and intense land use can lessen the dependence of private cars.

Central TOD area (cluster 5) is located near the periphery of the downtown area, corresponding to a relatively high index on node place and node index and average value

of vulnerability. This cluster has similar features as the Downtown TOD. It has relatively high intense job opportunities, resourceful public transportation facilities, and a walkable built environment. For the vulnerability index, all subfactors almost keep the same levels as the average.

Urban TOD area (cluster 4) distributed at the third ring of downtown (the first ring is constituted by the area in the downtown TOD, which is the second ring is constituted by the area in the central TOD). From the third ring to the outskirts of Austin, the value of node and place index are below average and decline gradually. For the intensity of land use, it allocated more residential use land and much lower commercial or office land than average. The difference indicates that there is an unbalance between the job supply and the demand for housing starting at the third ring. For the node index, it still enjoys a walkable built environment, but less bus and train routes distribute there. For the vulnerability index, it is slightly higher than the average, which is mainly due to the concentration of two clusters of elderly people. The first distributes at metro stops that lie north of the 803-extension route, such as Northcross, and the second distributes at metro stops on the south side of the Colorado river, such as Lamar Square and Soco.

Vulnerable TOD area (cluster 2) inserts in the urban TOD area. This cluster has the extremely high vulnerability index, moderate place index, and lower node index. Most of the people living in the vulnerable TOD tend to be minority, foreign-born, and their households have incomes below 60% of the median, and they do not own cars. There exists the greatest unbalance between the amount of total employment and population, which is 0.03 and 0.79, respectively. For the transportation resource, it enjoys less rail service but more bus frequency. The walkability of vulnerable TOD also keeps the same as the average.

Suburban TOD area (cluster 3) locates at the outskirts of Austin, which has the lowest node, place and vulnerability index. It has the lowest vulnerability due to it has the lowest percentage of ethnic minority, senior residents, foreign-born person and most less percentage of households earning below 60% MFI and without cars among five clusters. This type of TOD is developed in a low-density mode, which has a low population, but enjoys a moderate amount of residential property. Also, it is the most car-dependent region of the five clusters, which has the lowest public transportation service, but also has the highest number of households that own cars.

Cluster	# of stations	Types of Stations	Example of stations	Avg. Vulnerability	Avg. Place	Avg. Node
1	8	Downtown TOD	Downtown Station, Government Center, Republic Square	0.51	0.8	0.77
2	8	Vulnerable TOD	Riverside, Rundberg, Hemphill Park	0.78	0.3	0.16
3	52	Suburban TOD	Leander, Domain, Four Points, Oak Hill, ABIA Terminal, Expo Center	0.17	0.22	0.08
4	47	Urban TOD	MLK Jr, Mc Kalla, Faro, Stassney, Pleasant Valley	0.37	0.28	0.16
5	18	Central TOD	Highland, Crestview, Waterfront, Auditorium Shores	0.35	0.48	0.39
All stops	133	-	-	0.32	0.32	0.2

Table 6. The Average Value of Node, Place, and Vulnerability Index in Five Clusters

Cluster	1	2	3	4	5	All stops
Types of Stations	Downtown TOD	Vulnerable TOD	Suburban TOD	Urban TOD	Central TOD	-
Normalized Vulnerability	0.51	0.78	0.17	0.37	0.35	0.32
Persons of ethnic minority	0.27	0.63	0.13	0.24	0.19	0.21
Persons aged 65+	0.56	0.40	0.29	0.52	0.43	0.41
Persons foreign-born	0.31	0.71	0.14	0.22	0.21	0.22
Households below 60% MHI	0.27	0.72	0.14	0.28	0.29	0.25

Households with zero car	0.60	0.64	0.06	0.28	0.30	0.24
Normalized Place	0.8	0.3	0.22	0.28	0.48	0.32
Total Employment	0.72	0.03	0.02	0.05	0.29	0.11
Total Population	0.50	0.79	0.21	0.42	0.39	0.36
Residential land use	0.13	0.83	0.40	0.56	0.34	0.46
Commercial & office land use	0.46	0.22	0.20	0.24	0.30	0.24
Civic, open space, and water	0.28	0.10	0.30	0.24	0.41	0.28
Land Use Entropy	0.76	0.46	0.63	0.65	0.75	0.65
Normalized Node	0.77	0.16	0.08	0.16	0.39	0.2
Rail routes	0.89	0.09	0.04	0.11	0.38	0.16
Bus routes	0.93	0.23	0.09	0.18	0.51	0.24
Daily frequency of trains	0.61	0.10	0.06	0.10	0.27	0.14
AMPK frequency of bus	0.37	0.48	0.18	0.42	0.51	0.34
Vehicles per household	0.39	0.60	0.72	0.60	0.49	0.62
Total street length	0.84	0.45	0.36	0.56	0.67	0.51
Total sidewalk length	0.85	0.56	0.41	0.64	0.71	0.57
Average street length	0.02	0.22	0.38	0.24	0.13	0.27

Table 7. The Average Value of Sub-factors in Node-Place-Vulnerability Model

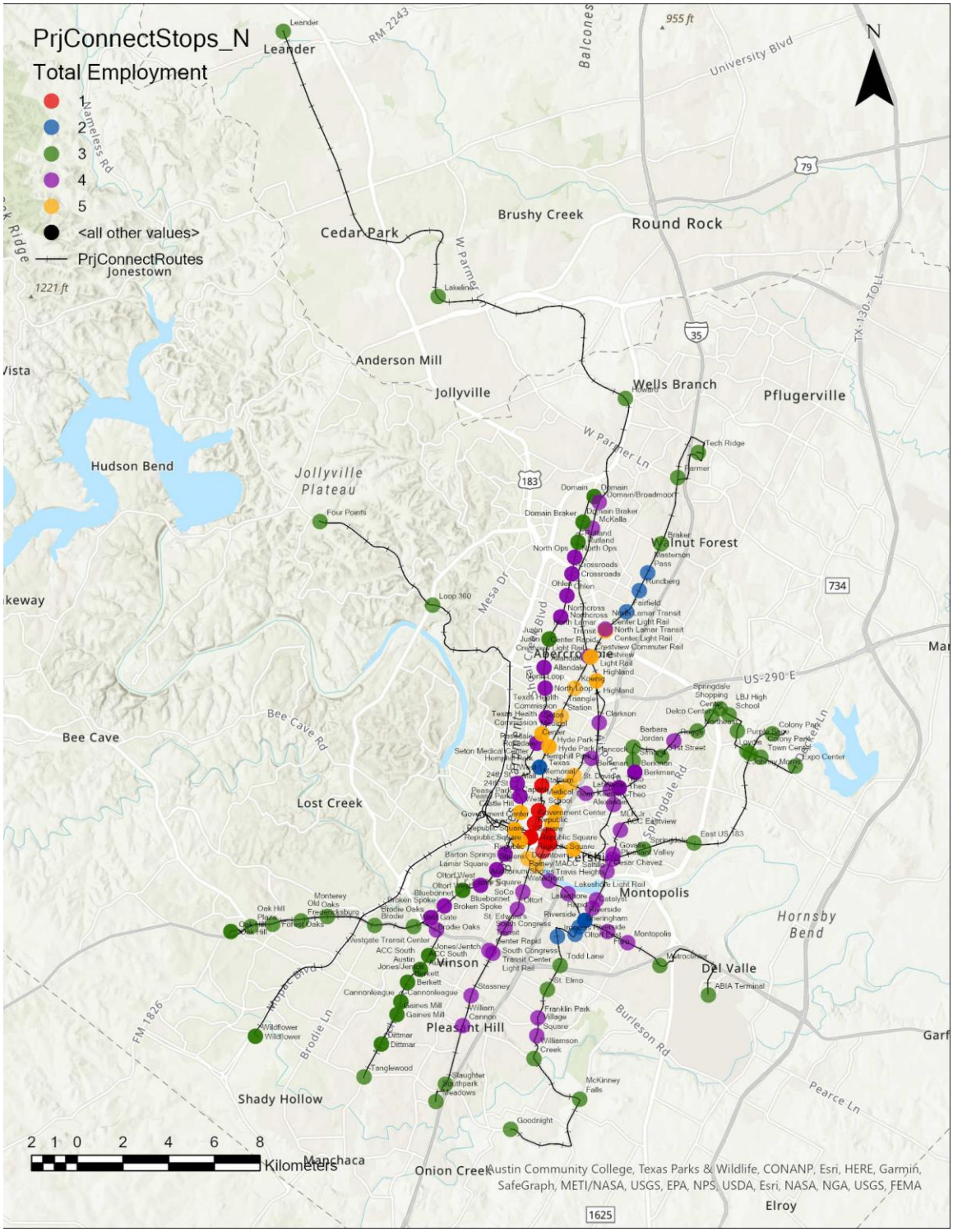


Figure 8. The Classification of Bus and Rail Stops of Project Connect Program

4.1.3 Analysis of Nodes, Places, and Vulnerabilities

After analyzing the attributes of clusters, in this section, the relation between each dimension will be discussed. In order to present them in a clearly understandable manner, they are presented as one three-dimensional node-place-vulnerability scatter plot and three two-dimensional scatter plots, node-place, node-vulnerability, and place-vulnerability, projected via the three-dimensional scatter plot.

A local regression is applied to the scatter plots showing node-place, place-vulnerability, and node-vulnerability, which aims to smooth the scatter plots and enhance the understanding of trends in the variables. It has been added as a blue dash line in the Figure 10, Figure 11, and Figure 12.

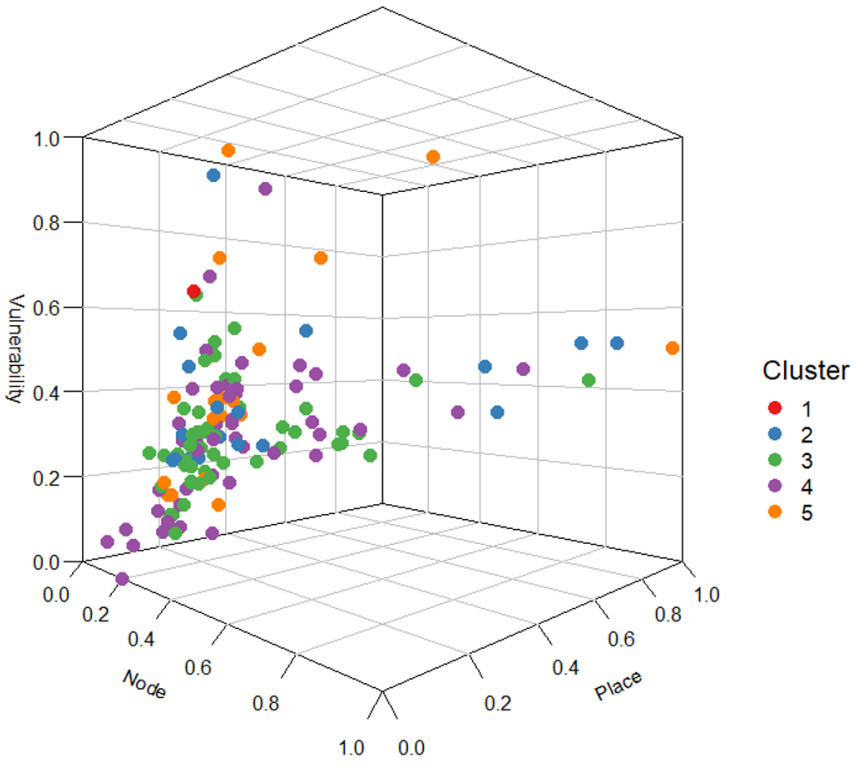


Figure 9. Node-Place-Vulnerability Scatter Plots

Figure 10 depicts a generally healthy relationship between land use intensity and transportation supply. The average node and place index is 0.2 and 0.32, respectively. For stops with higher nodes and place index, the local regression line (blue line) can almost collapse along the diagonal with slope =1, which showed in a balance relationship. UT/West Mall is an exception due to it near to a university, the employment and commercial/office land use are significantly less than other stops. For those stops with the node and place index below the average, which mainly are Suburban TOD (cluster 3) and Urban TOD (cluster 4). The transportation supply in Urban TOD and Suburban TOD is generally lower than in those urban areas which are more car dependent.

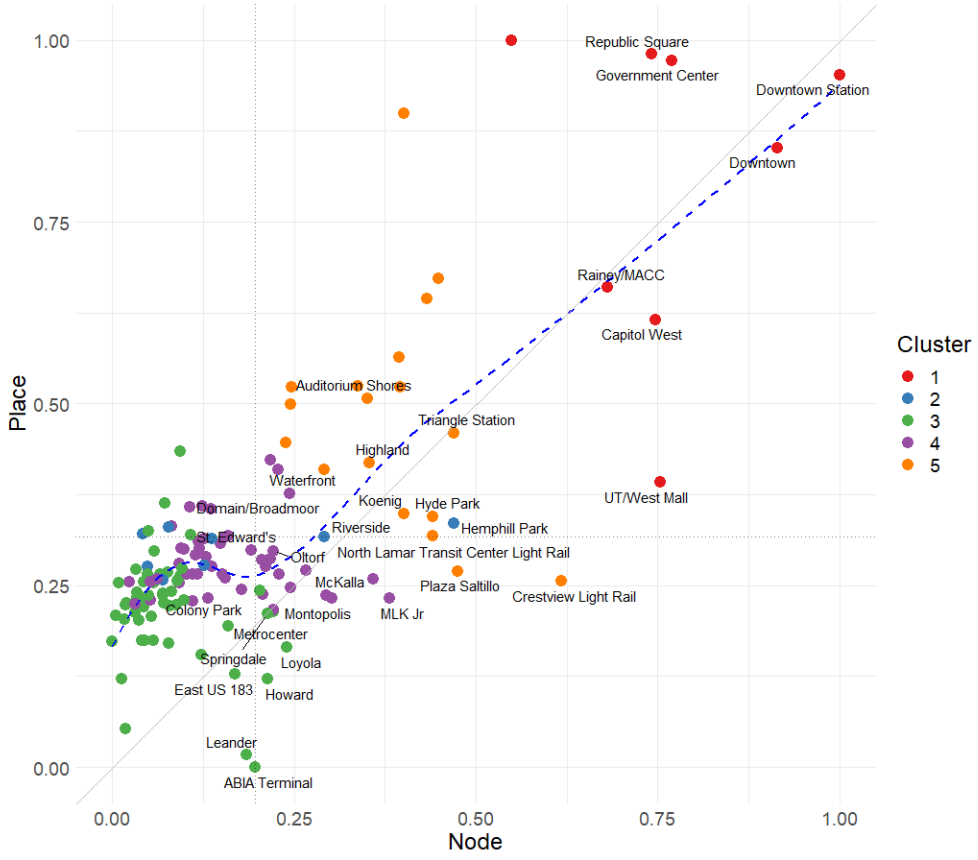


Figure. 10 Node-Place Scatter Plots

Figure 11 represents a slightly more diverse spread between transportation supply and vulnerability. There are two types of unbalanced stops between nodes and vulnerabilities, which mainly distribute at the third ring (urban TOD and vulnerable TOD) and the downtown area. The first type of unbalance stop locates at the third ring (urban TOD and vulnerable TOD) have a higher vulnerability index than average. Another type of unbalance is allocated in the downtown TOD, which has a low vulnerability index with a high node index. Therefore, people who are affluent have access to affluent transportation facilities, while those who are vulnerable have less access to these facilities.

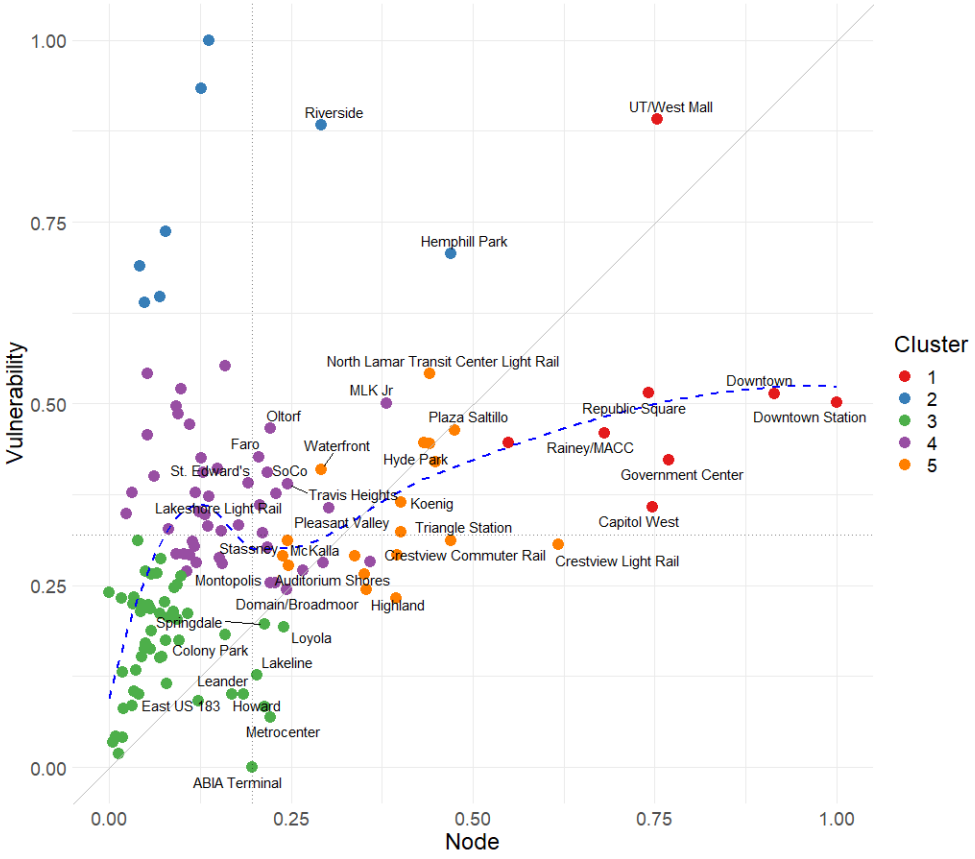


Figure. 11 Node-Vulnerability Scatter Plots

The Figure 12 shows the relationship between place and vulnerability. There also exist two types of unbalances. The one is a high vulnerability index with a moderate place index, which is allocated at Vulnerable TOD and UT/West Mall. Another type of unbalanced relationship exists between the moderate vulnerability index and the high place index, which allocates some of Downtown TOD area, such as Government Center, Republic Square, and Downtown Station.

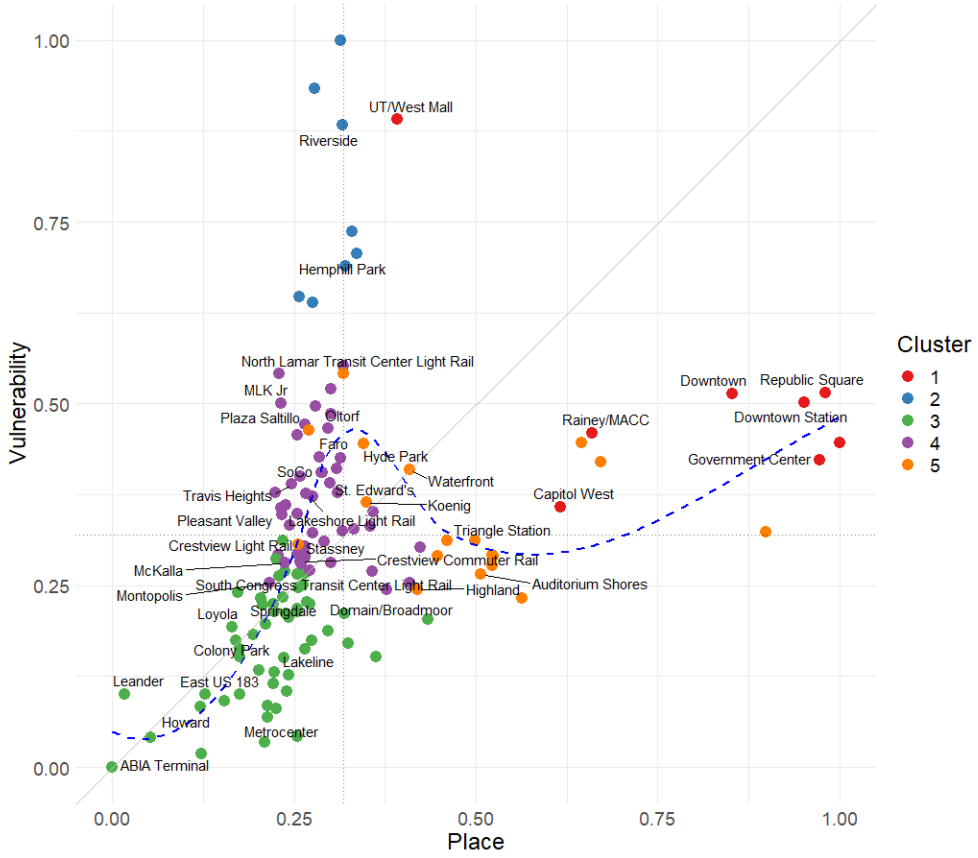


Figure. 12 Place-Vulnerability Scatter Plots

Overall, Project Connect has a healthy relationship when just considering Node and Place. However, while considering the vulnerability, the node index and place index are not balanced with the vulnerability index. The local regression line and the scatter plots

clearly reflect this problem. Especially, the bus stops with the highest vulnerability index equipped with an insufficient transportation supply.

4.2 Implementation of Land Use Optimization

The aims of setting the different scenarios compare the different outcomes by the different planning goals. This section will discuss how the different optimization goals will affect the priced premium of land, accessibility to various opportunities, emission, and affordable housing.

The unit of the GA optimization model is based on the parcel level, and the result will be present as a cluster level. To be more specific, the GA model converts 847 vacant and industrial parcels into residential, commercial, or office space in accordance with the optimization goal. Afterwards, the converted parcels and their effects on the price premium, accessibility, emission, and contribution to affordable housing are summarized at the cluster level.

The first scenario aims to examine how many affordable housing units can be provide along the Project Connect at 60% median family income level. Therefore, the first scenario converts all vacant and industrial land into residential use and sets the optimization goals as maximizing 60% MFI affordable housing.

The second scenario aims to test the maximum level of increasing access to housing, retail, and jobs. Therefore, this scenario converts all vacant and industrial land into residential, commercial, and office use, and sets the optimization goals as maximizing the accessibility index. Additionally, the program set a constraint to require that at least 30,000 affordable housing units be provided with 60% MFI.

The third scenario aims to achieve a sustainable goal when providing 50,000 affordable housing at 60% MFI level. Therefore, this scenario converts all vacant and industrial land

into residential, commercial, and office use, and set the optimization goals as maximizing sustainable index with the weight of 0.3,0.4, and 0.3 to economic index, social index, and environmental index, respectively. Additionally, the program set a constraint to require that at least 50,000 affordable housing units be provided with 60% MFI.

Scenarios	Types of concerted land	FAR		Optimization goal	Weight			Constraints
		TOD Core area	TOD Non-Core area		Economic Index	Social Index	Environmental Index	
Scenario 1	Residential	[0.4,0.8]	[0.4,0.8]	Maximize the total 60% MFI affordable housing units	N/A	N/A	N/A	N/A
Scenario 2	Residential, Commercial, and Office	[0.4,0.8]	[0.4,0.8]	Maximize total accessibility	0	1	0	60% MFI affordable housing units >=30,000
Scenario 3	Residential, Commercial, and Office	[1.0,2.0]	[0.6,1.0]	Maximize total price premium Maximize total accessibility Minimize total emission	0.3	0.4	0.3	60% MFI affordable housing units >=40,000

Table 8. Scenarios for TOD Land Use Optimization Model

* The TOD core area mentioned here is the area located in 1/8-mile of bus stops or 1/4-mile of rail stations.

* The TOD non-core area mentioned here is the area located within [1/8,1/4] mile of bus stops or [1/4,1/2] mile of rail stations.

4.2.1 Scenarios 1: Maximum total affordable housing

Table 9 illustrates the impact of maximizing total affordable housing at the 60% MFI level. Overall, all 847 parcels can provide 42,455 affordable housing units in 60% MFI, which is the maximum level. The suburban TOD has the highest average number of affordable housing units among both bus and rail stops. It can provide an average of 1,535 and 400 units of 60%MFI affordable housing at rail and bus TOD stops. As a result, there are 49743 housing units available at all bus and rail stops, which is also at the maximum level among the three scenarios. Due to its high percentage of vacant and industrial land, suburban TODs have the most housing units per rail stop, with an average of 2692 housing units.

Accessible affordable housing is defined as the amount of affordable housing that can be reached by light rail, bus, and foot in 45 minutes. Accessible housing is calculated at the parcel level, which calculates the average affordable housing available in each parcel of a stop. Afterwards, in table X, it calculates the average of parcel-level accessible affordable housing for stops that are classified in the same cluster. In this scenario, parcels in Downtown TOD, Central TOD and Vulnerable TOD enjoy the most accessibility to affordable housing, due to its dense rail and bus routes.

4.2.2 Scenarios 2: Maximum total accessibility

Table 10 illustrates the impact of maximizing total accessibility to all housing stock, commercial service, and office opportunities. all 847 vacant and industrial land converts to residential, commercial, and office use. In this scenario, accessibility reaches to the highest level, which are 36651.5, 19627.7, and 22305.0 to housing stock, commercial services, and office opportunities. The downtown TODs have the best access to all types of destinations,

while suburban TODs have the least access. Vulnerable rail TOD stations such as Riverside and Heyday Park are located close to the central city, which is serviced by the largest number of bus and rail routes. Therefore, they have better access to kind of opportunities. However, vulnerable bus stops, which are normally located at Rundberg, which are located on the periphery of urban TOD, have much less opportunity for all kinds of housing, commercial, or office development.

The objective of this scenario is to provide at least 30000 affordable housing units at a 60% MFI level. As a result of the scenario, there is a total of 30052 affordable housing units. In five clusters, Suburban TOD is still the one that enjoys the most units of affordable housing.

4.2.3 Scenarios 3: Maximum the Sustainable Goals

Table 11 shows the impact of the sustainable goals, which are maximizing the value increment, maximizing the total accessibility, and minimizing the emission that comes from building and travel. Therefore, in this scenario, vacant and industrial land can be converted into residential, commercial, and office use land.

There is one more constraint that it is required to provide at least 40,000 affordable housing units. As a result of this setting, it can provide 45,154 housing units, and 40,016 affordable housing units at 60%MFI level. Suburban TOD still enjoys the highest level of affordable housing units, which reaches to the 1409 per suburban rail stops average. In this scenario, the floor area ration increases to the [0.6,1.0] in the non-core TOD area, and [1.0,2.0] in the core TOD area, which greatly increases the density of development. Therefore, the emission increment is much larger than in other scenarios.

Names of Clusters	Types of stops	Housing					Value Increment	FAR Increment (FAR)	Destination accessibility to			Emissions Increment
		Total	Affordable Housing		Accessible Affordaable Housing				Housing Stock	Commercial Service	Office Opportunity	
			30%MFI	60%MFI	30%MFI	60%MFI						
Downtown TOD	Bus	0	0	0	0	20869	0	N/A (2.76)	641.8	360.4	452.8	0.0
Vulnerable TOD	Bus	24	0	15	229	14665	159	0.75 (0.76)	175.6	74.7	69.1	37.5
Suburban TOD	Bus	417	11	400	32	5760	2313	0.73 (0.37)	62.3	30.7	25.8	555.0
Urban TOD	Bus	72	0	61	8	11683	498	0.66 (0.46)	249.6	123.4	124.5	120.2
Central TOD	Bus	11	0	0	3	17162	96	0.68 (0.6)	431.3	240.6	279.4	23.0
Downtown TOD	Rail	7	0	0	74	19848	41	0.52 (3.07)	871.8	478.3	591.1	9.8
Vulnerable TOD	Rail	50	0	47	94	16121	215	0.66 (0.94)	770.5	373.6	414.8	49.2
Suburban TOD	Rail	2077	0	1535	0	7855	15088	0.72 (0.15)	139.4	53.1	59.1	3545.6
Urban TOD	Rail	701	0	662	16	12866	4390	0.69 (0.39)	539.3	247.7	266.6	1050.4
Central TOD	Rail	62	0	0	172	14954	376	0.68 (0.62)	644.1	342.7	352.5	87.6
Sum		49743	457	42455	N/A	N/A	319045	N/A	38739.4	19492.5	21003.4	75835.0
Average		N/A	N/A	N/A	41	10926	N/A	0.69 (0.6)	N/A	N/A	N/A	N/A

Table 9. Impacts of Maximizing the Amount of Affordable Housing Units

Names of Clusters	Types of stops	Housing					Value Increment	FAR Increment (FAR)	Destination accessibility to			Emissions Increment
		Total	Affordable Housing		Accessible Affordaable Housing				Housing Stock	Commecial Service	Office Opportunity	
			30%MFI	60%MFI	30%MFI	60%MFI						
Downtown TOD	Bus	0	0	0	0	12971	0	N/A (2.76)	610.3	362.3	472.7	0.0
Vulnerable TOD	Bus	16	0	11	0	9033	87	0.5 (0.76)	166.8	75.3	74.1	23.4
Suburban TOD	Bus	314	0	309	0	3924	1799	0.61 (0.37)	58.9	30.9	28.0	520.9
Urban TOD	Bus	43	0	39	0	6967	263	0.6 (0.45)	235.5	124.3	133.5	100.9
Central TOD	Bus	8	0	0	0	10400	44	0.54 (0.6)	411.1	241.9	292.3	21.0
Downtown TOD	Rail	3	0	0	0	12140	17	0.68 (3.07)	831.6	480.9	616.2	9.1
Vulnerable TOD	Rail	24	0	23	0	9682	133	0.55 (0.93)	737.9	375.7	434.8	24.5
Suburban TOD	Rail	1487	0	1242	0	5043	10029	0.58 (0.14)	125.7	54.1	67.7	3108.9
Urban TOD	Rail	315	0	299	0	7686	2079	0.6 (0.37)	508.6	249.6	285.1	835.3
Central TOD	Rail	25	0	0	0	8385	148	0.58 (0.62)	609.9	345.2	374.0	91.5
Sum		33151	0	30052	N/A	N/A	208089	N/A	36651.5	19627.7	22305.0	66670.4
Average		N/A	N/A	N/A	0	6708	N/A	0.6 (0.59)	N/A	N/A	N/A	N/A

Table 10. Impacts of Maximum Total Accessibility in Five Clusters.

Names of Clusters	Types of stops	Housing					Value Increment	FAR Increment (FAR)	Destination accessibility to			Emissions Increment
		Total	Affordable Housing		Accessible Affordaable Housing				Housing Stock	Commecial Service	Office Opportunity	
			30%MFI	60%MFI	30%MFI	60%MFI						
Downtown TOD	Bus	0	0	0	0	17501	0	N/A (2.76)	634.0	360.4	480.8	648105.6
Vulnerable TOD	Bus	19	0	19	286	13599	108	1.00 (0.76)	173.3	74.7	76.7	867276.2
Suburban TOD	Bus	444	13	426	40	5295	2463	0.82 (0.39)	61.4	30.7	29.1	468016.4
Urban TOD	Bus	51	0	42	10	10222	367	0.98 (0.46)	246.1	123.4	137.0	498689.2
Central TOD	Bus	7	0	0	4	14810	75	0.87 (0.6)	426.2	240.6	297.7	477205.0
Downtown TOD	Rail	5	0	0	92	16663	30	0.89 (3.07)	861.1	478.3	627.6	1105159.4
Vulnerable TOD	Rail	43	0	41	117	14166	240	1.01 (0.94)	760.9	373.6	445.1	895599.6
Suburban TOD	Rail	1761	0	1409	0	6961	13137	0.84 (0.17)	135.6	53.1	71.7	1053670.5
Urban TOD	Rail	548	0	532	20	11356	3437	0.9 (0.4)	530.9	247.7	293.5	1041356.2
Central TOD	Rail	65	0	0	215	12404	390	1.2 (0.63)	634.4	342.7	385.0	1023814.9
Sum		45154	572	40016	N/A	N/A	289908	N/A	38181.0	19492.6	22894.5	89531727.6
Average		N/A	N/A	N/A	52	9591	N/A	0.93 (0.61)	N/A	N/A	N/A	N/A

Table 11. Impacts of Maximum Sustainable Goals in Five Clusters.

Chapter 5: Conclusion

This report aims to develop a set of planning tools that take equity factors into account when evaluating, classifying, and optimizing the bus and rail stops of Project Connect. In general, vulnerable stops are normally allocated to ethnic minorities, foreign-born individuals, and households earning less than the 60% median income, which mainly cluster at the Rundberg and Riverside. Urban activities are primarily concentrated in the downtown area, which in general has a greater number of employment opportunities and commercial and office space. Transport is less intensely distributed than urban activities, such as those in the downtown and central city, which have a greater number of bus routes and rail routes, as well as a higher frequency of trains.

In order to answer the second research question, whether transportation supply and urban resources are heterogeneously distributed between vulnerable and non-vulnerable stops. The nodeThe node-vulnerability graph indicates that vulnerable bus stops have lower transportation supplies than average, while vulnerable rail stops, such as Riverside and Hemphill Park, have higher public transportation services than average. Accordingly, the place-vulnerability graph indicates that vulnerable bus and rail stops have an average amount of jobs and commercial service in their neighborhood among all bus and rail stops in Project Connect program.

Regarding the third question, what economic, social, and environmental impacts will Project Connect have on the neighborhood in the vicinity of the bus stops and rail stations. Firstly, due to the limited vacant and industrial land with the urban area, the housing supply mainly distributed at the suburban TOD area. However, Project Connect metro system greatly increased accessibility to the affordable housing. Additionally, the

current appraised price of a property is too high for a household with a 30% MFI income level, even if they cannot own a property in the suburban TOD area. Thirdly, intense development of high FAR buildings can provide more access to affordable housing and increase the value of a piece of land, but it will also result in an unproportionally high amount of building and travel emissions.

This report can help planning practitioners better identify, classify, and make the corresponding strategies for implementing then Transportation Investment Project Connect program, especially on achieving equitable objects.

Appendices

APPENDIX A: TABLE OF NORMALIZED NODE ATTRIBUTES IN ALL BUS AND RAIL STOPS OF PROJECT CONNECT PROGRAM

ID	Stop Name	Rail routes	Bus routes	Daily frequency of trains	AMPK frequency of bus
1	24th St	0.10	0.16	0.00	0.17
2	51st Street	0.00	0.05	0.00	0.21
3	ABIA Terminal	0.00	0.03	0.36	0.02
4	ACC Eastview	0.10	0.16	0.00	0.48
5	ACC South Austin	0.00	0.08	0.00	0.52
6	Alexander	0.20	0.24	0.00	0.99
7	Allandale	0.10	0.13	0.00	0.42
8	Auditorium Shores	0.30	0.55	0.31	0.43
9	Barbara Jordan	0.00	0.11	0.00	0.31
10	Barton Springs	0.10	0.29	0.00	0.64
11	Berkett	0.00	0.08	0.00	0.27
12	Berkman	0.10	0.13	0.00	0.25
13	Bluebonnet	0.10	0.13	0.00	0.25
14	Braker	0.00	0.08	0.00	0.51
15	Brodie	0.20	0.08	0.00	0.06
16	Brodie Oaks	0.10	0.26	0.00	0.43
17	Broken Spoke	0.10	0.13	0.00	0.45
18	Cannonleague	0.00	0.08	0.00	0.37
19	Capitol East	0.60	0.92	0.00	0.38
20	Capitol West	0.80	0.84	0.64	0.38
21	Castle Hill	0.60	0.55	0.00	0.36
22	Catalyst	0.10	0.29	0.00	0.37
23	Cesar Chavez	0.20	0.18	0.00	0.19
24	Clarkson	0.10	0.24	0.00	0.49
25	Colony Park	0.00	0.05	0.35	0.12
26	Colony Park Town Center	0.10	0.11	0.00	0.40
27	Crestview Commuter Rail	0.20	0.24	0.37	0.74
28	Crestview Light Rail	0.20	0.24	0.94	0.68
29	Crossroads	0.20	0.13	0.00	0.14
30	Dean Keeton	0.30	0.61	0.00	0.37
31	Delco Center	0.00	0.11	0.00	0.16
32	Dittmar	0.00	0.03	0.00	0.16
33	Domain	0.20	0.16	0.00	0.11

34	Domain Braker	0.20	0.16	0.00	0.26
35	Domain/Broadmoor	0.20	0.11	0.35	0.14
36	Downtown	0.90	0.97	0.89	0.35
37	Downtown Station	1.00	1.00	1.00	0.37
38	East US 183	0.00	0.00	0.35	0.00
39	Expo Center	0.00	0.08	0.00	0.22
40	Fairfield	0.00	0.11	0.00	0.52
41	Faro	0.00	0.16	0.36	0.17
42	Forest Oaks	0.10	0.05	0.00	0.00
43	Four Points	0.00	0.00	0.00	0.00
44	Franklin Park	0.00	0.08	0.00	0.25
45	Gaines Mill	0.00	0.08	0.00	0.32
46	Goodnight	0.00	0.03	0.00	0.06
47	Govalle	0.20	0.16	0.00	0.27
48	Government Center	0.80	0.87	0.64	0.60
49	Hancock	0.10	0.26	0.00	0.38
50	Hemphill Park	0.40	0.53	0.43	0.31
51	Highland	0.30	0.24	0.37	0.37
52	Howard	0.00	0.13	0.35	0.11
53	Hyde Park	0.30	0.39	0.43	0.72
54	Iroquois	0.00	0.13	0.00	0.32
55	Johnny Morris	0.10	0.11	0.00	0.42
56	Jones/Jentch	0.00	0.08	0.00	0.49
57	Justin	0.10	0.08	0.00	0.24
58	Koenig	0.10	0.18	0.60	0.54
59	Lafayette	0.00	0.37	0.00	0.73
60	Lakeline	0.00	0.18	0.35	0.13
61	Lakeshore Light Rail	0.00	0.29	0.36	0.07
62	Lakeshore Rapid	0.00	0.18	0.00	0.17
63	Lamar	0.80	0.79	0.00	0.42
64	Lamar Square	0.10	0.13	0.00	0.70
65	LBJ High School	0.00	0.11	0.00	0.22
66	Leander	0.00	0.13	0.35	0.06
67	Loop 360	0.00	0.00	0.00	0.00
68	Loyola	0.10	0.11	0.35	0.39
69	Masterson Pass	0.00	0.08	0.00	0.18
70	McKalla	0.20	0.21	0.35	0.31
71	McKinney Falls	0.00	0.00	0.00	0.00
72	Medical School	0.60	0.95	0.00	0.34
73	Metrocenter	0.00	0.08	0.36	0.17
74	MLK Jr	0.20	0.24	0.37	1.00

75	Monterey Oaks	0.10	0.05	0.00	0.12
76	Montopolis	0.00	0.13	0.36	0.27
77	North Lamar Transit Center Light Rail	0.20	0.16	0.60	0.57
78	North Lamar Transit Center Rapid	0.20	0.13	0.00	0.57
79	North Loop	0.10	0.13	0.00	0.63
80	North Ops	0.20	0.13	0.00	0.12
81	Northcross	0.10	0.18	0.00	0.36
82	Northeast	0.00	0.08	0.00	0.25
83	Oak Hill	0.10	0.08	0.00	0.08
84	Oak Hill Plaza	0.10	0.08	0.00	0.08
85	Ohlen	0.20	0.21	0.00	0.37
86	Old Fredericksburg	0.10	0.05	0.00	0.11
87	Oltorf	0.00	0.13	0.31	0.48
88	Oltorf East	0.10	0.26	0.00	0.66
89	Oltorf West	0.10	0.16	0.00	0.54
90	Parmer	0.00	0.11	0.00	0.08
91	Pease Park	0.10	0.08	0.00	0.34
92	Plaza Saltillo	0.10	0.29	0.67	0.67
93	Pleasant Valley	0.20	0.18	0.35	0.32
94	Purple Sage	0.00	0.11	0.00	0.22
95	Rainey/MACC	1.00	1.00	0.36	0.24
96	Republic Square	0.80	0.89	0.64	0.33
97	Riverside	0.10	0.29	0.36	0.59
98	Rogge	0.00	0.03	0.00	0.13
99	Rosedale	0.30	0.37	0.00	0.85
100	Rundberg	0.00	0.16	0.00	0.54
101	Rutland	0.20	0.13	0.00	0.11
102	Seaholm	0.80	0.84	0.00	0.60
103	Seton Medical Center	0.30	0.34	0.00	0.65
104	Sheringham	0.10	0.26	0.00	0.74
105	Simond	0.10	0.16	0.00	0.25
106	Slaughter	0.00	0.13	0.00	0.19
107	SoCo	0.00	0.13	0.31	0.35
108	South Congress Transit Center Light Rail	0.10	0.16	0.31	0.46
109	South Congress Transit Center Rapid	0.10	0.16	0.00	0.49
110	Southpark Meadows	0.00	0.13	0.00	0.11
111	Springdale	0.00	0.11	0.35	0.34
112	Springdale Shopping Center	0.00	0.11	0.00	0.25
113	St. David's	0.30	0.55	0.00	0.36
114	St. Edward's	0.00	0.11	0.31	0.34
115	St. Elmo	0.00	0.00	0.00	0.00

116	Stassney	0.00	0.13	0.31	0.33
117	Tanglewood	0.00	0.08	0.00	0.29
118	Tech Ridge	0.00	0.21	0.00	0.19
119	Texas Health Commission	0.30	0.26	0.00	0.90
120	Texas Memorial Stadium	0.60	0.92	0.00	0.45
121	Theo	0.20	0.21	0.00	0.71
122	Todd Lane	0.00	0.00	0.00	0.00
123	Travis Heights	0.00	0.29	0.36	0.17
124	Triangle Station	0.30	0.24	0.60	0.68
125	Trinity	1.00	1.00	0.00	0.43
126	UT/West Mall	0.80	0.89	0.67	0.29
127	Village Square	0.00	0.08	0.00	0.24
128	Waterfront	0.10	0.47	0.36	0.33
129	West Gate	0.10	0.18	0.00	0.16
130	Westgate Transit Center	0.10	0.26	0.00	0.61
131	Wildflower	0.00	0.00	0.00	0.00
132	William Cannon	0.00	0.13	0.00	0.27
133	Williamson Creek	0.00	0.08	0.00	0.20

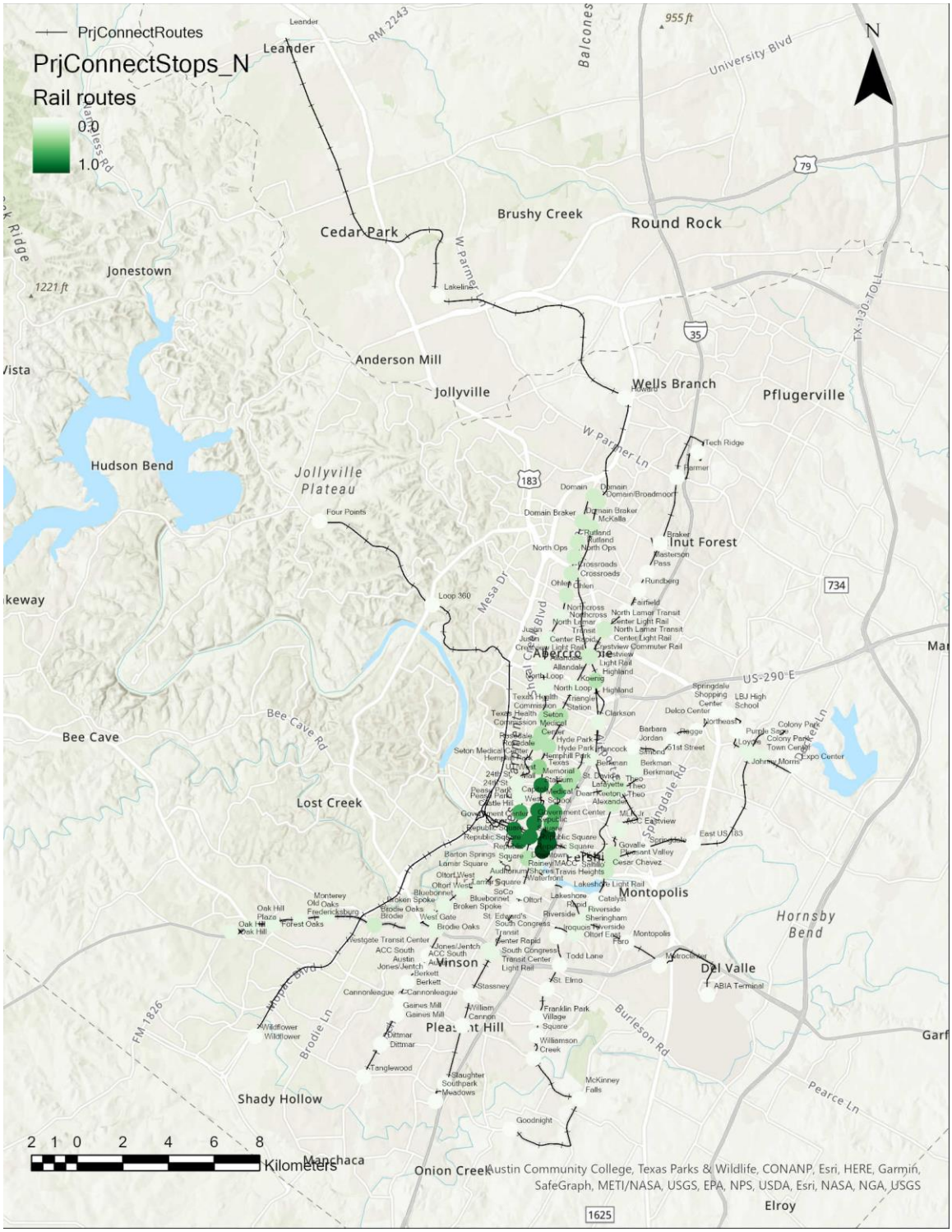
Continued:

ID	Stop Name	vehicles per household	Total street length	Total sidewalk length	Average street length
1	24th St	0.58	0.73	0.85	0.13
2	51st Street	0.77	0.40	0.61	0.24
3	ABIA Terminal	0.00	0.08	0.00	1.00
4	ACC Eastview	0.65	0.50	0.66	0.22
5	ACC South Austin	0.80	0.51	0.61	0.19
6	Alexander	0.65	0.65	0.83	0.14
7	Allandale	0.61	0.64	0.81	0.30
8	Auditorium Shores	0.53	0.27	0.43	0.06
9	Barbara Jordan	0.68	0.58	0.62	0.21
10	Barton Springs	0.62	0.46	0.58	0.14
11	Berkett	0.82	0.43	0.58	0.22
12	Berkman	0.67	0.71	0.79	0.13
13	Bluebonnet	0.67	0.54	0.74	0.22
14	Braker	0.78	0.46	0.62	0.36
15	Brodie	0.68	0.57	0.19	0.77
16	Brodie Oaks	0.44	0.50	0.31	0.42
17	Broken Spoke	0.51	0.21	0.39	0.24
18	Cannonleague	0.87	0.46	0.64	0.25
19	Capitol East	0.28	1.00	0.87	0.04

20	Capitol West	0.31	0.90	0.94	0.02
21	Castle Hill	0.48	0.84	0.94	0.04
22	Catalyst	0.63	0.22	0.28	0.23
23	Cesar Chavez	0.52	0.40	0.59	0.17
24	Clarkson	0.62	0.93	0.94	0.26
25	Colony Park	0.54	0.15	0.29	0.19
26	Colony Park Town Center	0.82	0.38	0.53	0.23
27	Crestview Commuter Rail	0.60	0.64	0.80	0.18
28	Crestview Light Rail	0.60	0.65	0.81	0.17
29	Crossroads	0.59	0.66	0.50	0.34
30	Dean Keeton	0.42	0.82	0.68	0.15
31	Delco Center	0.68	0.45	0.41	0.31
32	Dittmar	0.74	0.60	0.73	0.31
33	Domain	0.48	0.29	0.17	0.36
34	Domain Braker	0.49	0.30	0.22	0.34
35	Domain/Broadmoor	0.50	0.16	0.21	0.32
36	Downtown	0.42	0.93	0.87	0.01
37	Downtown Station	0.39	0.89	0.85	0.01
38	East US 183	0.78	0.25	0.33	0.45
39	Expo Center	0.79	0.11	0.22	0.46
40	Fairfield	0.75	0.47	0.65	0.18
41	Faro	0.65	0.26	0.31	0.34
42	Forest Oaks	0.76	0.29	0.38	0.36
43	Four Points	0.87	0.00	0.12	0.62
44	Franklin Park	0.78	0.67	0.78	0.17
45	Gaines Mill	0.80	0.49	0.64	0.20
46	Goodnight	0.57	0.05	0.32	0.60
47	Govalle	0.55	0.65	0.85	0.17
48	Government Center	0.32	0.89	0.95	0.01
49	Hancock	0.41	0.89	0.74	0.24
50	Hemphill Park	0.54	0.85	0.98	0.07
51	Highland	0.63	0.53	0.60	0.24
52	Howard	0.73	0.35	0.20	0.61
53	Hyde Park	0.54	0.70	0.89	0.08
54	Iroquois	0.50	0.49	0.50	0.18
55	Johnny Morris	0.66	0.29	0.42	0.19
56	Jones/Jentch	0.77	0.55	0.75	0.21
57	Justin	0.75	0.55	0.77	0.34
58	Koenig	0.53	0.51	0.69	0.29
59	Lafayette	0.52	0.98	0.87	0.12
60	Lakeline	0.71	0.20	0.21	0.42

61	Lakeshore Light Rail	0.54	0.53	0.52	0.25
62	Lakeshore Rapid	0.64	0.04	0.17	0.29
63	Lamar	0.48	0.64	0.76	0.05
64	Lamar Square	0.61	0.61	0.80	0.16
65	LBJ High School	0.67	0.33	0.33	0.30
66	Leander	1.00	0.22	0.21	0.30
67	Loop 360	0.85	0.40	0.47	0.44
68	Loyola	0.71	0.31	0.45	0.22
69	Masterson Pass	0.70	0.45	0.64	0.30
70	McKalla	0.50	0.25	0.32	0.44
71	McKinney Falls	0.97	0.32	0.36	0.44
72	Medical School	0.29	0.88	0.74	0.07
73	Metrocenter	0.75	0.48	0.31	0.56
74	MLK Jr	0.67	0.67	0.86	0.13
75	Monterey Oaks	0.76	0.35	0.24	0.61
76	Montopolis	0.69	0.44	0.47	0.32
77	North Lamar Transit Center Light Rail	0.54	0.72	0.54	0.35
78	North Lamar Transit Center Rapid	0.56	0.70	0.52	0.36
79	North Loop	0.59	0.56	0.77	0.25
80	North Ops	0.45	0.49	0.30	0.37
81	Northcross	0.71	0.52	0.65	0.24
82	Northeast	0.69	0.40	0.62	0.21
83	Oak Hill	0.88	0.11	0.29	0.28
84	Oak Hill Plaza	0.79	0.28	0.45	0.32
85	Ohlen	0.70	0.56	0.75	0.22
86	Old Fredericksburg	0.80	0.43	0.49	0.42
87	Oltorf	0.63	0.54	0.74	0.21
88	Oltorf East	0.45	0.30	0.40	0.27
89	Oltorf West	0.67	0.49	0.68	0.20
90	Parmer	0.64	0.42	0.37	0.69
91	Pease Park	0.52	0.80	0.93	0.09
92	Plaza Saltillo	0.50	0.88	1.00	0.10
93	Pleasant Valley	0.50	0.64	0.85	0.17
94	Purple Sage	0.73	0.19	0.31	0.17
95	Rainey/MACC	0.48	0.66	0.65	0.02
96	Republic Square	0.41	0.72	0.84	0.00
97	Riverside	0.57	0.32	0.38	0.22
98	Rogge	0.88	0.55	0.76	0.18
99	Rosedale	0.50	0.56	0.75	0.10
100	Rundberg	0.76	0.43	0.56	0.22
101	Rutland	0.42	0.21	0.21	0.29

102	Seaholm	0.48	0.57	0.66	0.03
103	Seton Medical Center	0.53	0.61	0.80	0.08
104	Sheringham	0.51	0.30	0.40	0.28
105	Simond	0.65	0.75	0.77	0.15
106	Slaughter	0.77	0.45	0.36	0.63
107	SoCo	0.63	0.73	0.91	0.13
108	South Congress Transit Center Light Rail	0.56	0.56	0.45	0.46
109	South Congress Transit Center Rapid	0.62	0.57	0.47	0.40
110	Southpark Meadows	0.74	0.42	0.27	0.53
111	Springdale	0.74	0.34	0.54	0.28
112	Springdale Shopping Center	0.63	0.54	0.56	0.31
113	St. David's	0.52	0.91	0.80	0.15
114	St. Edward's	0.60	0.37	0.56	0.21
115	St. Elmo	0.88	0.10	0.26	0.45
116	Stassney	0.62	0.45	0.60	0.36
117	Tanglewood	0.85	0.41	0.48	0.32
118	Tech Ridge	0.74	0.30	0.23	0.73
119	Texas Health Commission	0.49	0.57	0.72	0.16
120	Texas Memorial Stadium	0.38	0.74	0.59	0.14
121	Theo	0.71	0.65	0.81	0.15
122	Todd Lane	0.73	0.38	0.39	0.49
123	Travis Heights	0.58	0.72	0.67	0.17
124	Triangle Station	0.51	0.42	0.55	0.17
125	Trinity	0.33	0.98	0.92	0.01
126	UT/West Mall	0.43	0.74	0.81	0.07
127	Village Square	0.87	0.66	0.72	0.18
128	Waterfront	0.52	0.36	0.44	0.08
129	West Gate	0.53	0.69	0.42	0.37
130	Westgate Transit Center	0.53	0.71	0.57	0.36
131	Wildflower	1.00	0.21	0.35	0.44
132	William Cannon	0.66	0.44	0.58	0.37
133	Williamson Creek	0.73	0.43	0.41	0.27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Hudson Bend
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Four Points
Bee Cave
Lost Creek
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Manchaca
Onion Creek
Montopolis
Del Valle
Hornsby Bend
Pleasant Hill
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Austin Community College, Texas Parks & Wildlife, CONANP, Esri, HERE, Garmin, SafeGraph, METI/NASA, USGS, EPA, NPS, USDA, Esri, NASA, NGA, USGS
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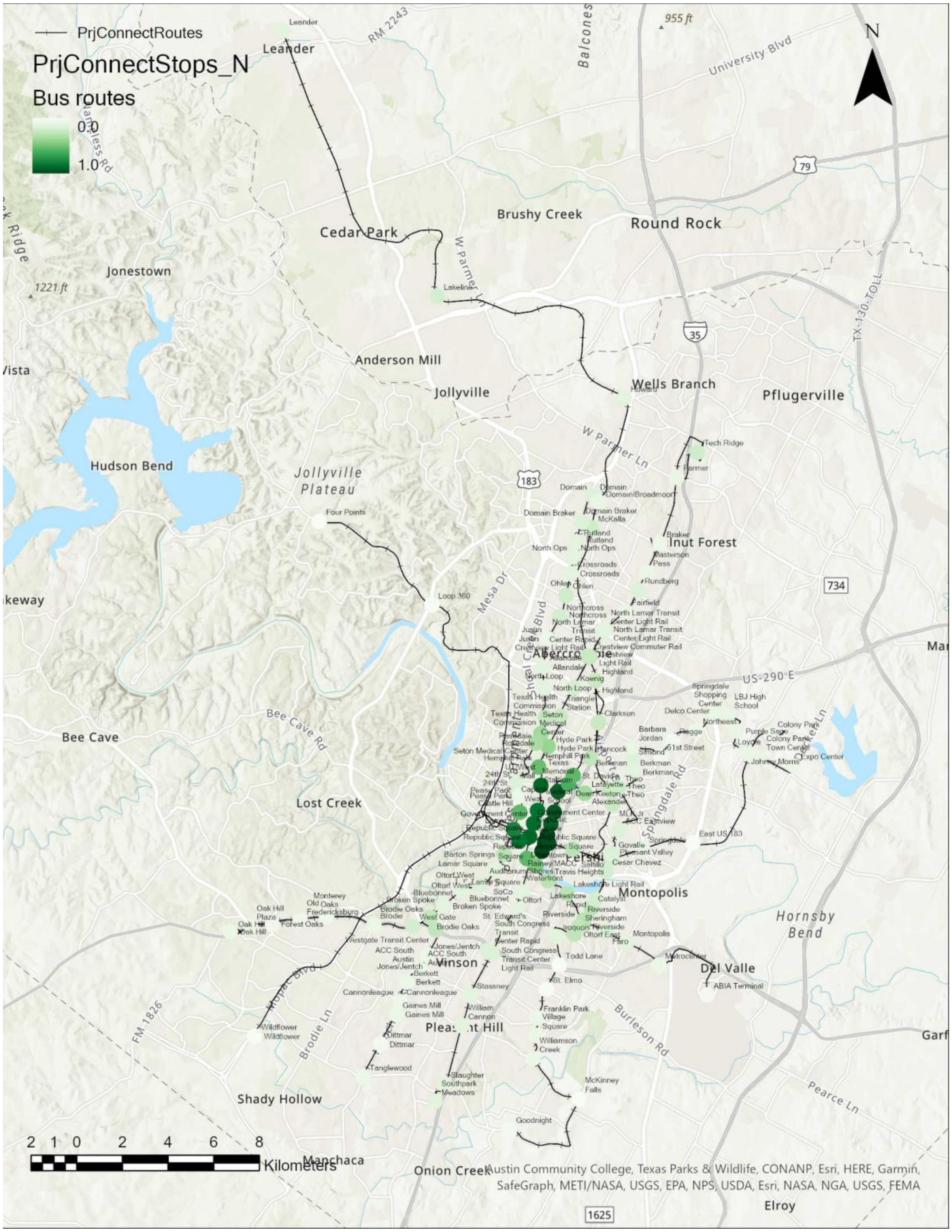
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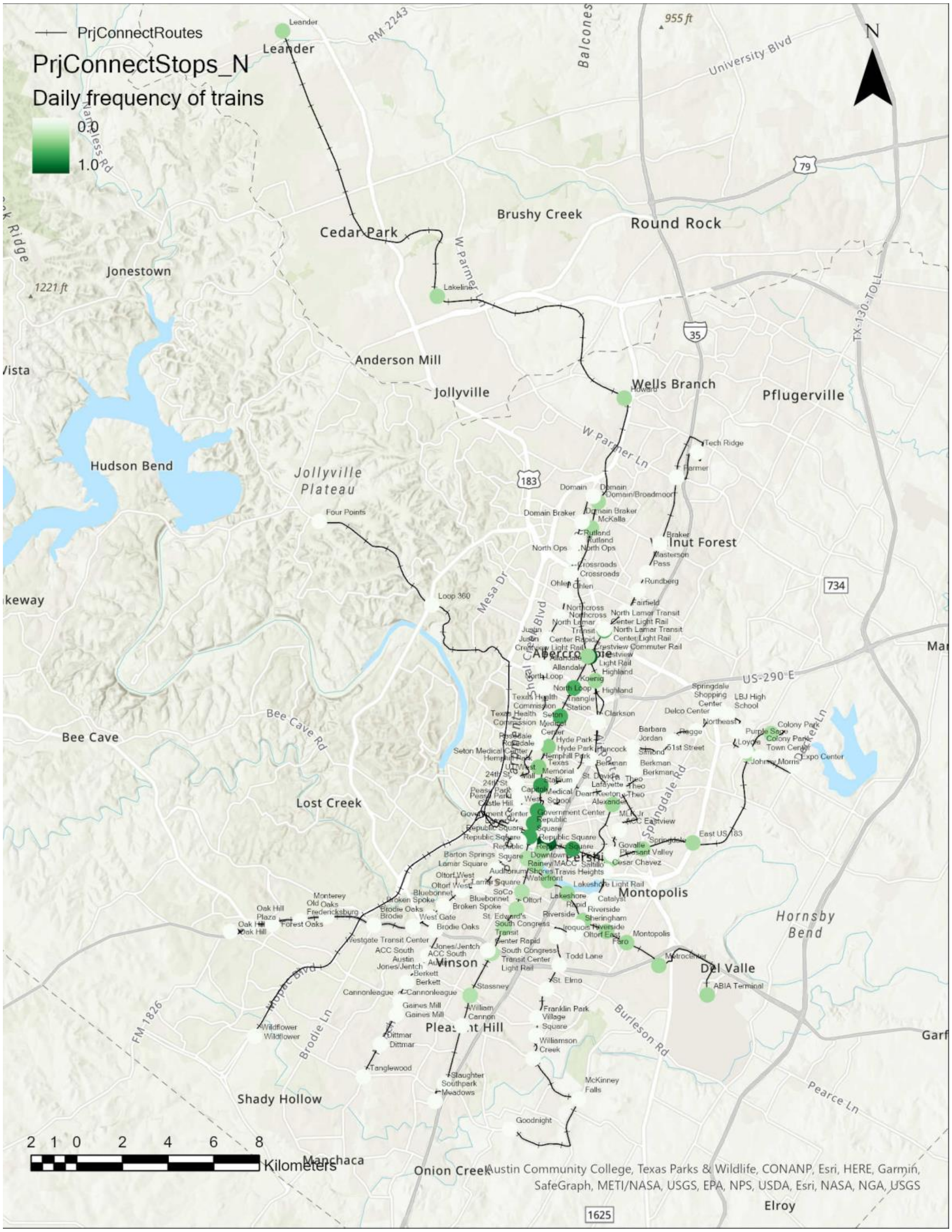
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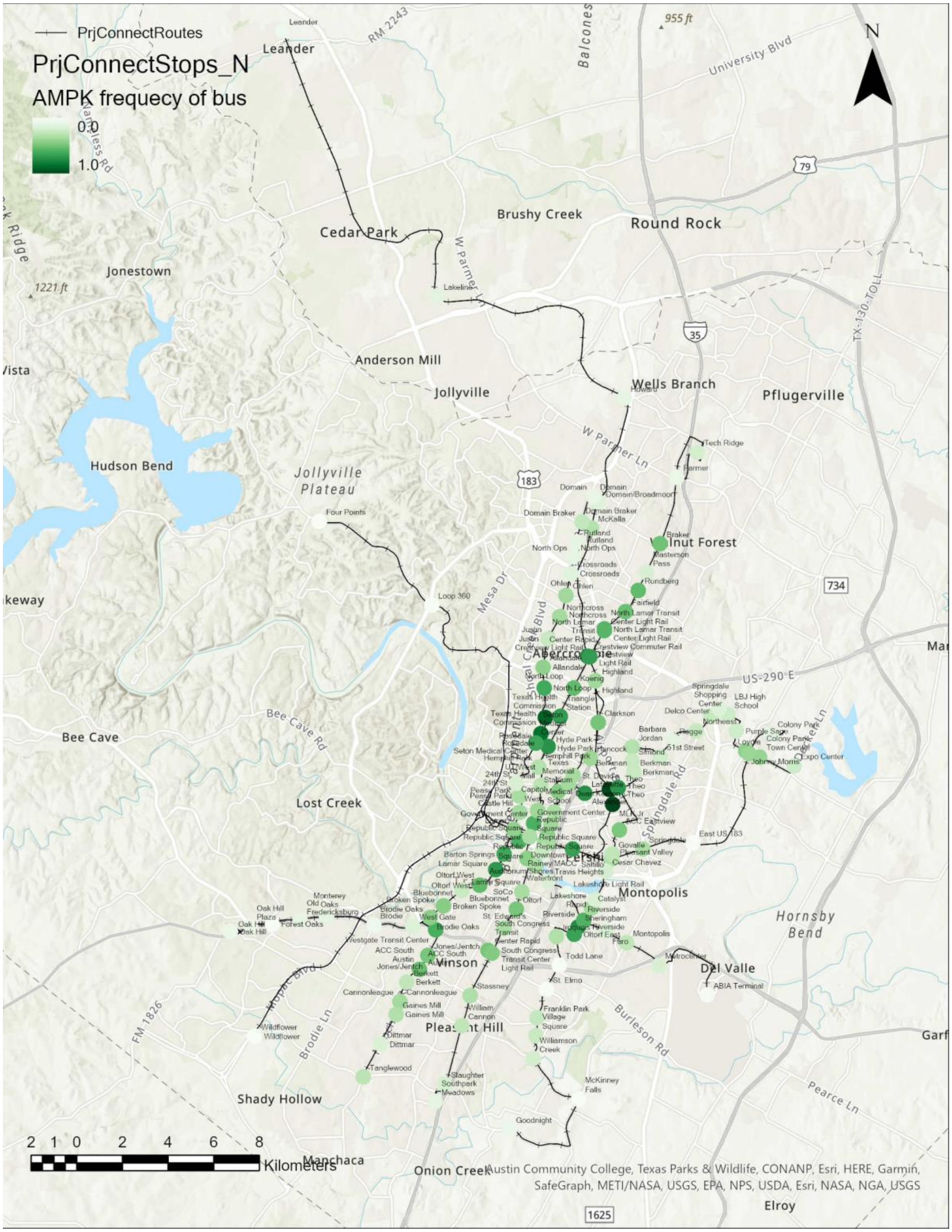
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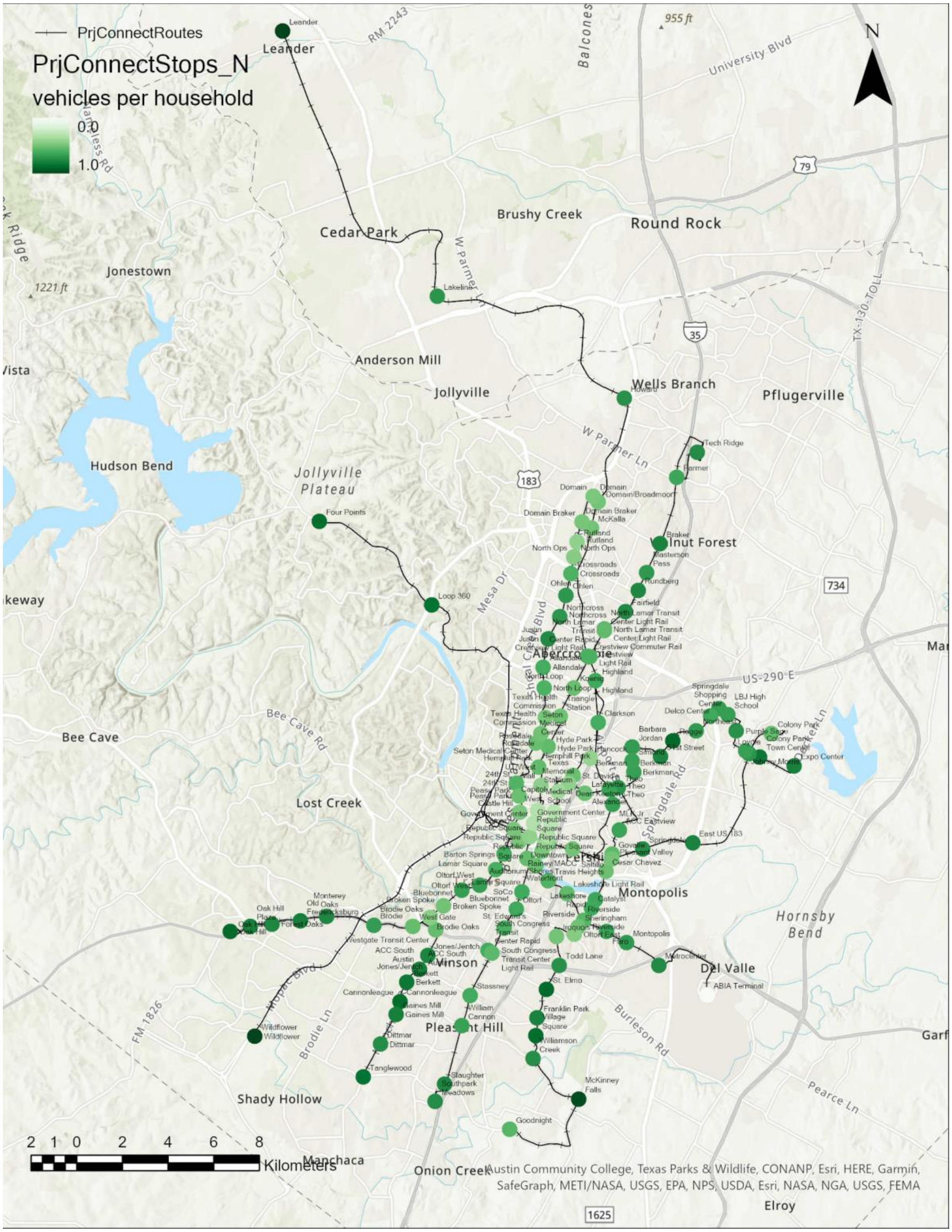
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Jollyville
Wells Branch
Pflugerville
Hudson Bend
Jollyville Plateau
Four Points
Loop 360
Walnut Forest
Tech Ridge
Parmer
Domain
Abercrombie
Bee Cave
Lost Creek
Montopolis
Hornsby Bend
Del Valle
ABIA Terminal
Pleasant Hill
Shady Hollow
Manchaca
Onion Creek
Elroy
Wildflower
Tanglewood
Goodnight
McKinney Falls
2 1 0 2 4 6 8
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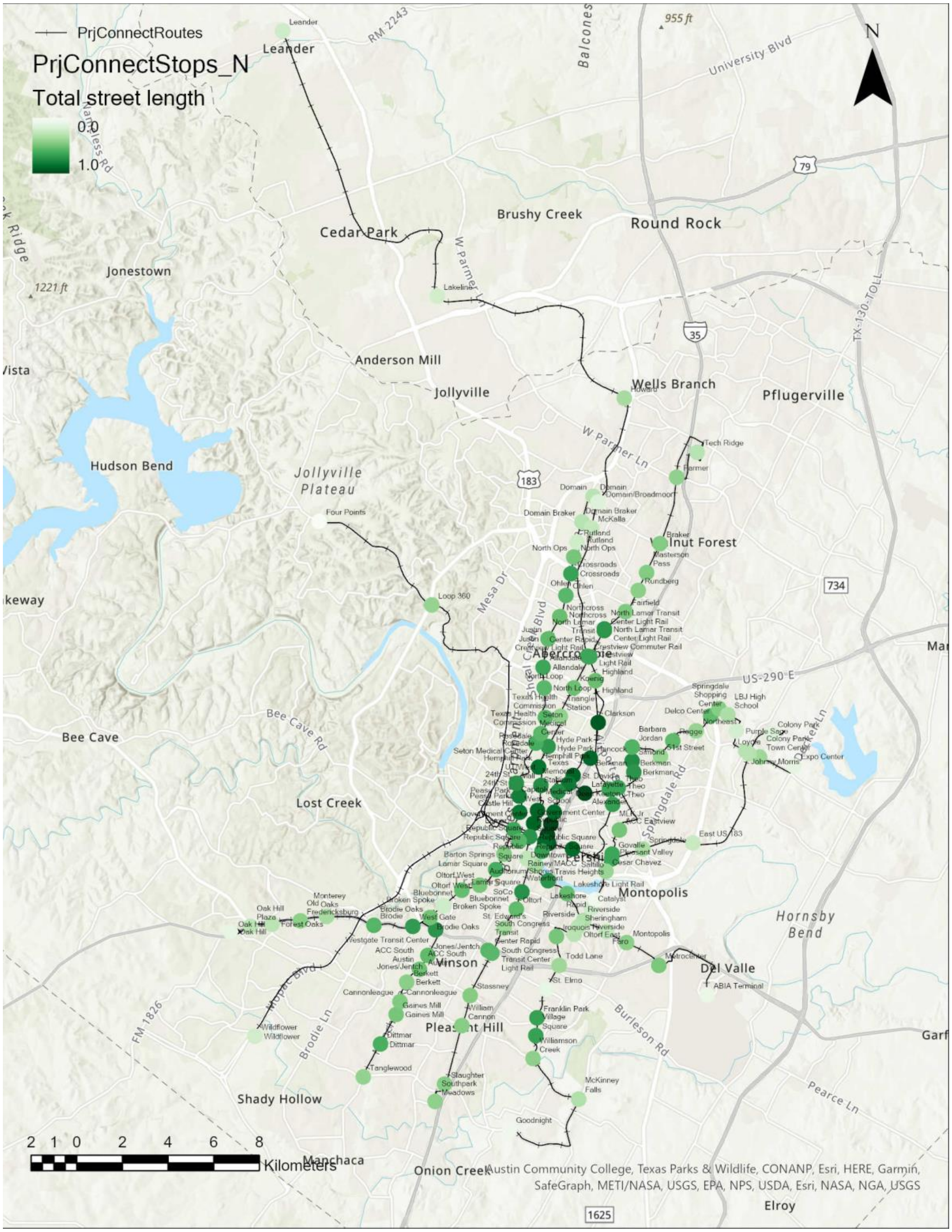
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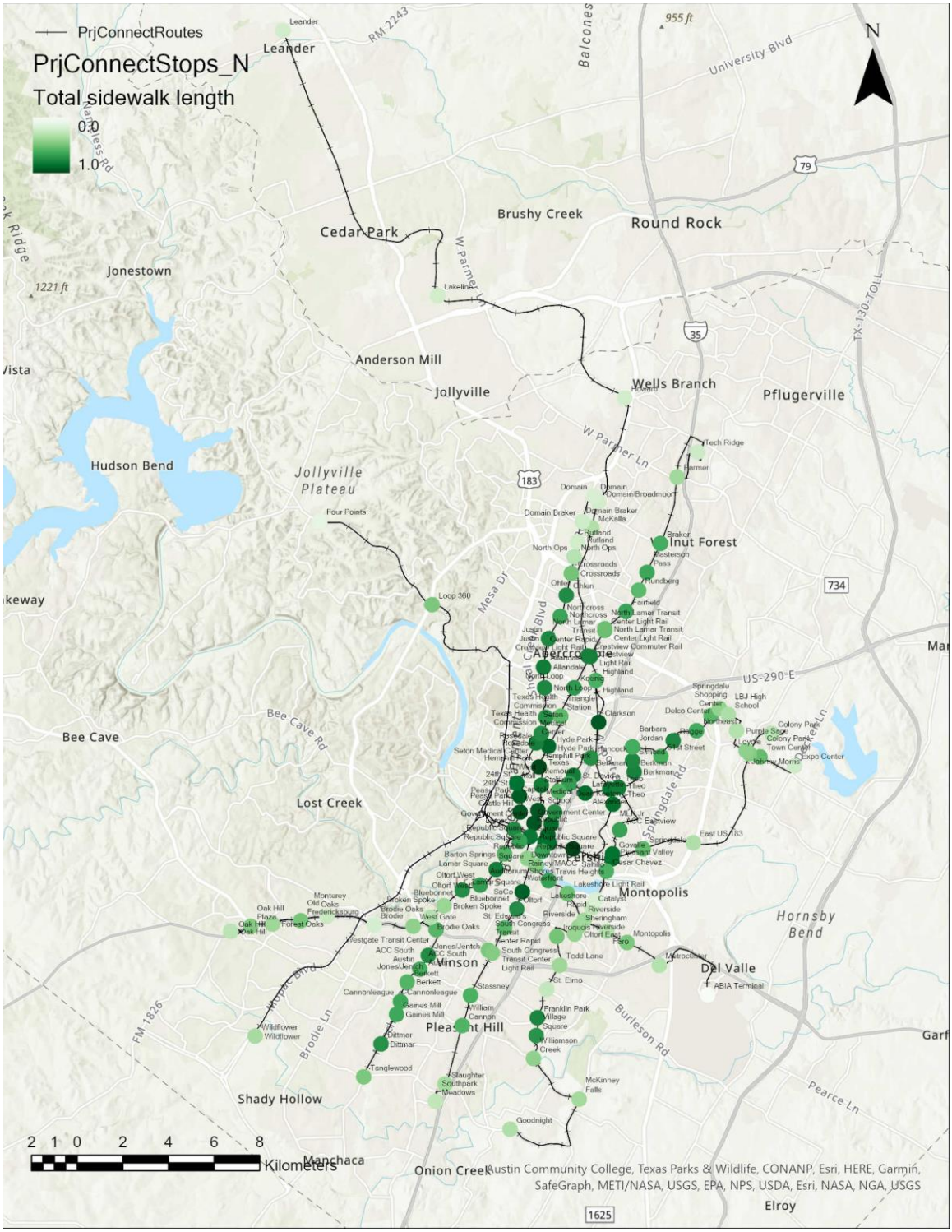
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Brushy Creek
Round Rock
Jonestown
Anderson Mill
Jollyville
Wells Branch
Pflugerville
Hudson Bend
Jollyville Plateau
Four Points
Bee Cave
Lost Creek
Shady Hollow
Austin
Montopolis
Del Valle
Pleasant Hill
Vinson
Hornsby Bend
Onion Creek
Manchaca
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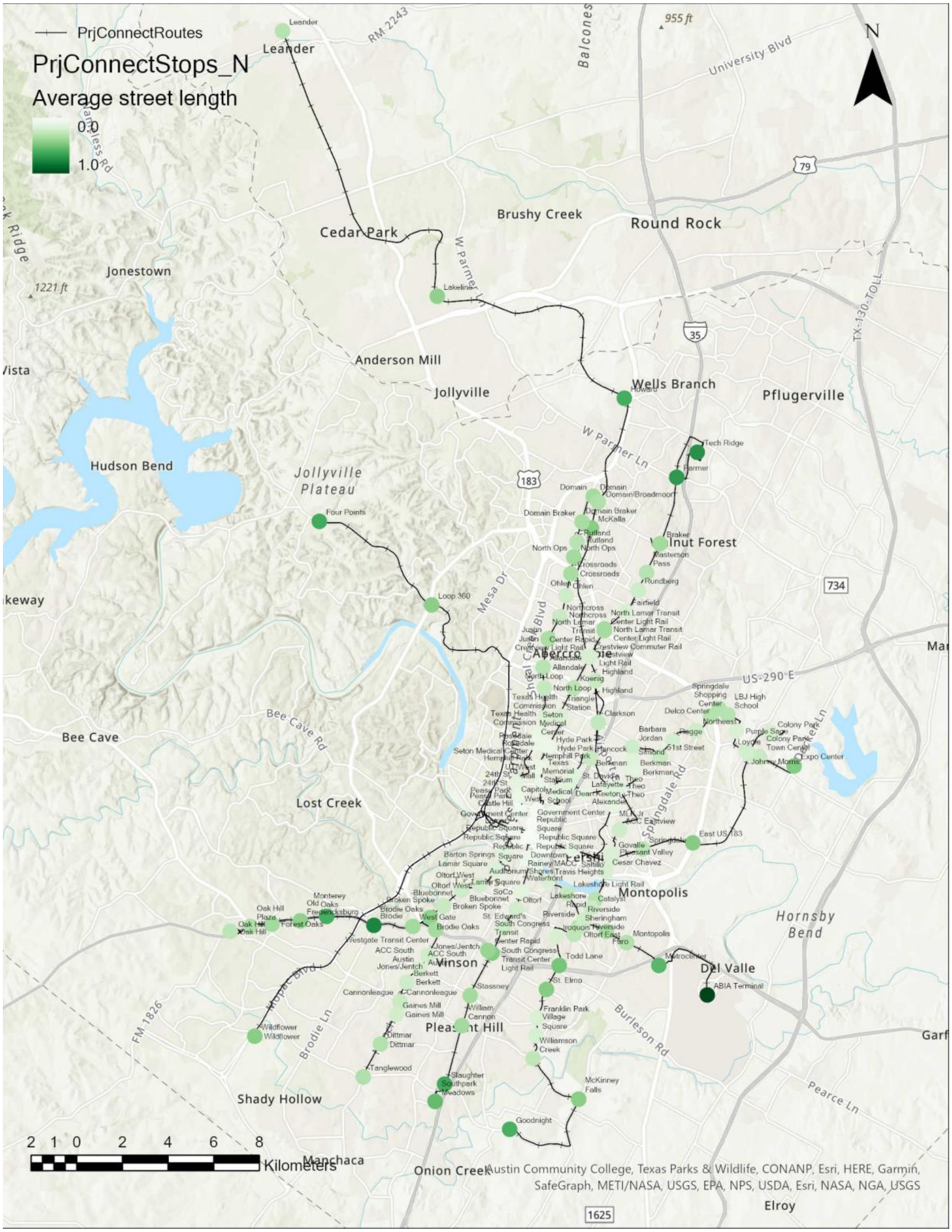
Kilometers
Austin Community College, Texas Parks & Wildlife, CONANP, Esri, HERE, Garmin, SafeGraph, METI/NASA, USGS, EPA, NPS, USDA, Esri, NASA, NGA, USGS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Kilometers
Austin Community College, Texas Parks & Wildlife, CONANP, Esri, HERE, Garmin, SafeGraph, METI/NASA, USGS, EPA, NPS, USDA, Esri, NASA, NGA, USGS

APPENDIX B: TABLE OF NORMALIZED PLACE ATTRIBUTES IN ALL BUS AND RAIL STOPS OF PROJECT CONNECT PROGRAM

ID	Stop Name	Total Employment	Total Population	Residential land use	Commercial and office land use	Civic, open space, and water	Land Use Entropy
1	24th St	0.04	0.66	0.81	0.07	0.22	0.43
2	51st Street	0.01	0.29	0.61	0.13	0.32	0.68
3	ABIA Terminal	0.00	0.00	0.00	0.00	0.00	0.00
4	ACC Eastview	0.01	0.39	0.60	0.09	0.47	0.73
5	ACC South Austin	0.01	0.36	0.69	0.08	0.44	0.68
6	Alexander	0.02	0.40	0.72	0.13	0.16	0.54
7	Allandale	0.03	0.34	0.80	0.24	0.10	0.53
8	Auditorium Shores	0.30	0.39	0.23	0.35	0.49	0.92
9	Barbara Jordan	0.04	0.34	0.36	0.17	0.39	0.82
10	Barton Springs	0.10	0.56	0.43	0.27	0.35	0.85
11	Berkett	0.01	0.31	0.82	0.07	0.33	0.57
12	Berkman	0.03	0.40	0.40	0.08	0.49	0.76
13	Bluebonnet	0.02	0.41	0.84	0.23	0.06	0.47
14	Braker	0.02	0.22	0.58	0.42	0.10	1.00
15	Brodie	0.04	0.11	0.04	0.22	0.21	0.57
16	Brodie Oaks	0.08	0.29	0.33	0.50	0.41	0.90
17	Broken Spoke	0.05	0.40	0.67	0.26	0.38	0.77
18	Cannonleague	0.02	0.38	0.85	0.19	0.13	0.50
19	Capitol East	0.86	0.25	0.07	0.49	0.37	0.80
20	Capitol West	0.47	0.29	0.15	0.52	0.32	0.81
21	Castle Hill	0.35	0.35	0.43	0.41	0.20	0.83
22	Catalyst	0.02	0.76	0.69	0.25	0.15	0.78
23	Cesar Chavez	0.05	0.29	0.32	0.11	0.34	0.68
24	Clarkson	0.04	0.42	0.65	0.34	0.02	0.51
25	Colony Park	0.00	0.20	0.28	0.00	0.56	0.84
26	Colony Park Town Center	0.00	0.24	0.47	0.00	0.59	0.62
27	Crestview Commuter Rail	0.03	0.44	0.72	0.22	0.11	0.52
28	Crestview Light Rail	0.03	0.43	0.73	0.21	0.10	0.51
29	Crossroads	0.06	0.39	0.38	0.50	0.15	0.79
30	Dean Keeton	0.36	0.29	0.30	0.08	0.71	0.66
31	Delco Center	0.01	0.15	0.24	0.07	0.55	0.74
32	Dittmar	0.01	0.38	0.76	0.02	0.27	0.49

33	Domain	0.14	0.30	0.19	1.00	0.07	0.71
34	Domain Braker	0.12	0.16	0.02	0.40	0.46	0.73
35	Domain/Broadmoor	0.13	0.28	0.21	0.79	0.07	0.68
36	Downtown	0.84	0.44	0.12	0.40	0.20	0.76
37	Downtown Station	0.95	0.46	0.06	0.45	0.22	0.75
38	East US 183	0.01	0.11	0.27	0.03	0.25	0.61
39	Expo Center	0.00	0.10	0.23	0.06	0.72	0.58
40	Fairfield	0.02	0.58	0.82	0.15	0.09	0.43
41	Faro	0.01	0.55	0.64	0.05	0.51	0.63
42	Forest Oaks	0.03	0.14	0.27	0.21	0.17	0.68
43	Four Points	0.01	0.06	0.15	0.14	0.62	0.79
44	Franklin Park	0.01	0.54	0.82	0.06	0.13	0.40
45	Gaines Mill	0.01	0.35	0.86	0.11	0.17	0.44
46	Goodnight	0.00	0.05	0.13	0.03	0.06	0.40
47	Govalle	0.05	0.32	0.53	0.17	0.16	0.64
48	Government Center	0.92	0.42	0.06	0.68	0.21	0.75
49	Hancock	0.03	0.38	0.60	0.24	0.27	0.73
50	Hemphill Park	0.07	0.78	0.62	0.16	0.28	0.71
51	Highland	0.16	0.24	0.37	0.63	0.22	0.88
52	Howard	0.03	0.11	0.32	0.10	0.05	0.47
53	Hyde Park	0.16	0.44	0.49	0.21	0.21	0.69
54	Iroquois	0.02	0.58	0.85	0.14	0.15	0.49
55	Johnny Morris	0.00	0.18	0.40	0.00	0.39	0.62
56	Jones/Jentch	0.01	0.41	0.93	0.05	0.14	0.36
57	Justin	0.02	0.30	0.74	0.26	0.18	0.59
58	Koenig	0.09	0.43	0.54	0.24	0.41	0.79
59	Lafayette	0.06	0.31	0.51	0.11	0.36	0.65
60	Lakeline	0.01	0.18	0.37	0.47	0.15	0.79
61	Lakeshore Light Rail	0.02	0.46	0.43	0.21	0.34	0.74
62	Lakeshore Rapid	0.00	0.58	0.56	0.07	0.39	0.64
63	Lamar	0.47	0.67	0.21	0.43	0.29	0.84
64	Lamar Square	0.06	0.60	0.73	0.17	0.12	0.55
65	LBJ High School	0.01	0.11	0.24	0.05	0.81	0.75
66	Leander	0.00	0.16	0.00	0.00	0.00	0.00
67	Loop 360	0.06	0.11	0.62	0.20	0.13	0.57
68	Loyola	0.00	0.20	0.44	0.00	0.34	0.61
69	Masterson Pass	0.02	0.79	0.80	0.37	0.04	0.49
70	McKalla	0.14	0.22	0.02	0.25	0.18	0.54
71	McKinney Falls	0.00	0.03	0.30	0.05	0.24	0.67
72	Medical School	0.41	0.16	0.13	0.34	0.58	0.80
73	Metrocenter	0.02	0.09	0.23	0.55	0.04	0.68

74	MLK Jr	0.02	0.44	0.68	0.11	0.19	0.56
75	Monterey Oaks	0.03	0.20	0.14	0.75	0.49	1.00
76	Montopolis	0.02	0.31	0.55	0.04	0.33	0.70
77	North Lamar Transit Center Light Rail	0.07	0.54	0.47	0.42	0.10	0.72
78	North Lamar Transit Center Rapid	0.07	0.55	0.48	0.42	0.09	0.70
79	North Loop	0.08	0.47	0.85	0.22	0.10	0.50
80	North Ops	0.11	0.24	0.06	0.41	0.16	0.65
81	Northcross	0.08	0.38	0.59	0.58	0.12	0.68
82	Northeast	0.00	0.36	0.69	0.10	0.29	0.61
83	Oak Hill	0.00	0.19	0.56	0.07	0.22	0.53
84	Oak Hill Plaza	0.02	0.19	0.48	0.17	0.09	0.55
85	Ohlen	0.05	0.43	0.72	0.37	0.10	0.57
86	Old Fredericksburg	0.02	0.17	0.55	0.20	0.30	0.75
87	Oltorf	0.04	0.40	0.66	0.25	0.28	0.73
88	Oltorf East	0.01	0.92	1.00	0.09	0.03	0.20
89	Oltorf West	0.06	0.48	0.73	0.22	0.14	0.59
90	Parmer	0.02	0.22	0.37	0.58	0.23	0.80
91	Pease Park	0.06	0.60	0.66	0.15	0.23	0.64
92	Plaza Saltillo	0.08	0.43	0.40	0.20	0.22	0.70
93	Pleasant Valley	0.06	0.31	0.47	0.19	0.14	0.63
94	Purple Sage	0.00	0.12	0.30	0.00	0.74	0.89
95	Rainey/MACC	0.55	0.47	0.11	0.44	0.24	0.81
96	Republic Square	0.93	0.72	0.06	0.52	0.25	0.77
97	Riverside	0.02	0.98	0.89	0.26	0.02	0.32
98	Rogge	0.01	0.45	0.88	0.07	0.12	0.37
99	Rosedale	0.26	0.28	0.30	0.32	0.42	0.84
100	Rundberg	0.03	0.72	0.74	0.33	0.18	0.69
101	Rutland	0.10	0.15	0.02	0.16	0.50	0.49
102	Seaholm	0.50	0.73	0.06	0.41	0.43	0.84
103	Seton Medical Center	0.23	0.30	0.38	0.35	0.28	0.85
104	Sheringham	0.01	1.00	0.91	0.24	0.02	0.36
105	Simond	0.03	0.39	0.35	0.13	0.32	0.75
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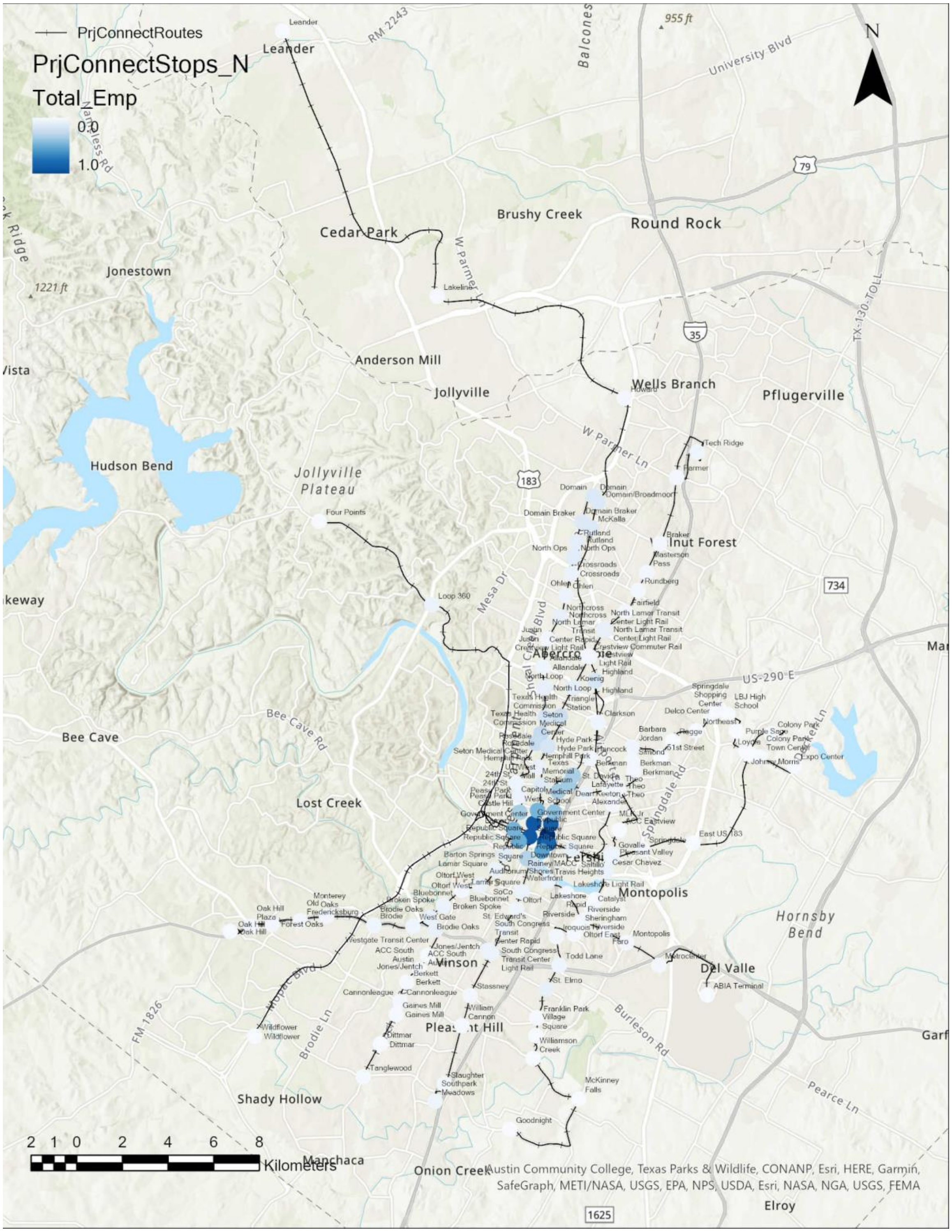
107	SoCo	0.06	0.39	0.67	0.17	0.26	0.66
108	South Congress Transit Center Light Rail	0.06	0.38	0.26	0.44	0.13	0.72
109	South Congress Transit Center Rapid	0.06	0.41	0.30	0.50	0.14	0.80
110	Southpark Meadows	0.04	0.32	0.35	0.71	0.12	0.74
111	Springdale	0.02	0.23	0.50	0.14	0.25	0.70
112	Springdale Shopping Center	0.01	0.25	0.48	0.11	0.33	0.67
113	St. David's	0.33	0.41	0.52	0.09	0.46	0.73
114	St. Edward's	0.05	0.40	0.57	0.13	0.47	0.64

115	St. Elmo	0.08	0.21	0.26	0.12	0.07	0.49
116	Stassney	0.02	0.48	0.77	0.25	0.15	0.57
117	Tanglewood	0.02	0.31	0.64	0.41	0.08	0.60
118	Tech Ridge	0.04	0.12	0.11	0.54	0.12	0.57
119	Texas Health Commission	0.18	0.30	0.37	0.18	0.66	0.74
120	Texas Memorial Stadium	0.36	0.12	0.15	0.06	1.00	0.48
121	Theo	0.02	0.41	0.64	0.14	0.22	0.63
122	Todd Lane	0.05	0.23	0.30	0.09	0.32	0.69
123	Travis Heights	0.05	0.36	0.58	0.13	0.21	0.59
124	Triangle Station	0.22	0.39	0.34	0.09	0.85	0.58
125	Trinity	1.00	0.38	0.05	0.52	0.26	0.77
126	UT/West Mall	0.12	0.82	0.41	0.12	0.56	0.67
127	Village Square	0.00	0.47	0.75	0.03	0.38	0.63
128	Waterfront	0.20	0.40	0.33	0.35	0.32	0.89
129	West Gate	0.05	0.15	0.36	0.46	0.21	0.82
130	Westgate Transit Center	0.07	0.31	0.55	0.45	0.14	0.75
131	Wildflower	0.00	0.08	0.30	0.10	0.82	0.69
132	William Cannon	0.02	0.45	0.77	0.23	0.12	0.51
133	Williamson Creek	0.00	0.25	0.38	0.01	0.89	0.58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Lost Creek
Montopolis
Hornsby Bend
Del Valle
Pleasant Hill
Shady Hollow
Manchaca
Onion Creek
Elroy
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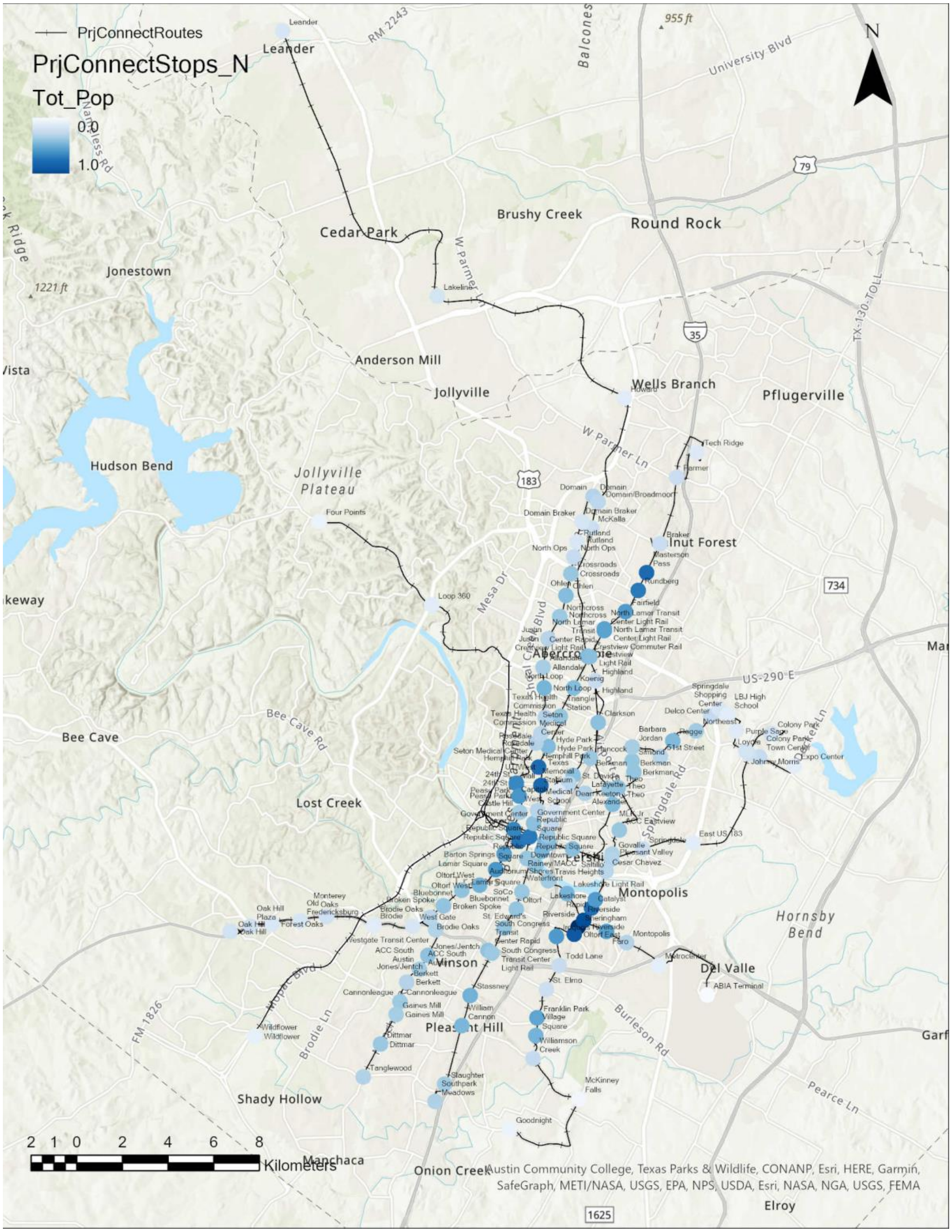
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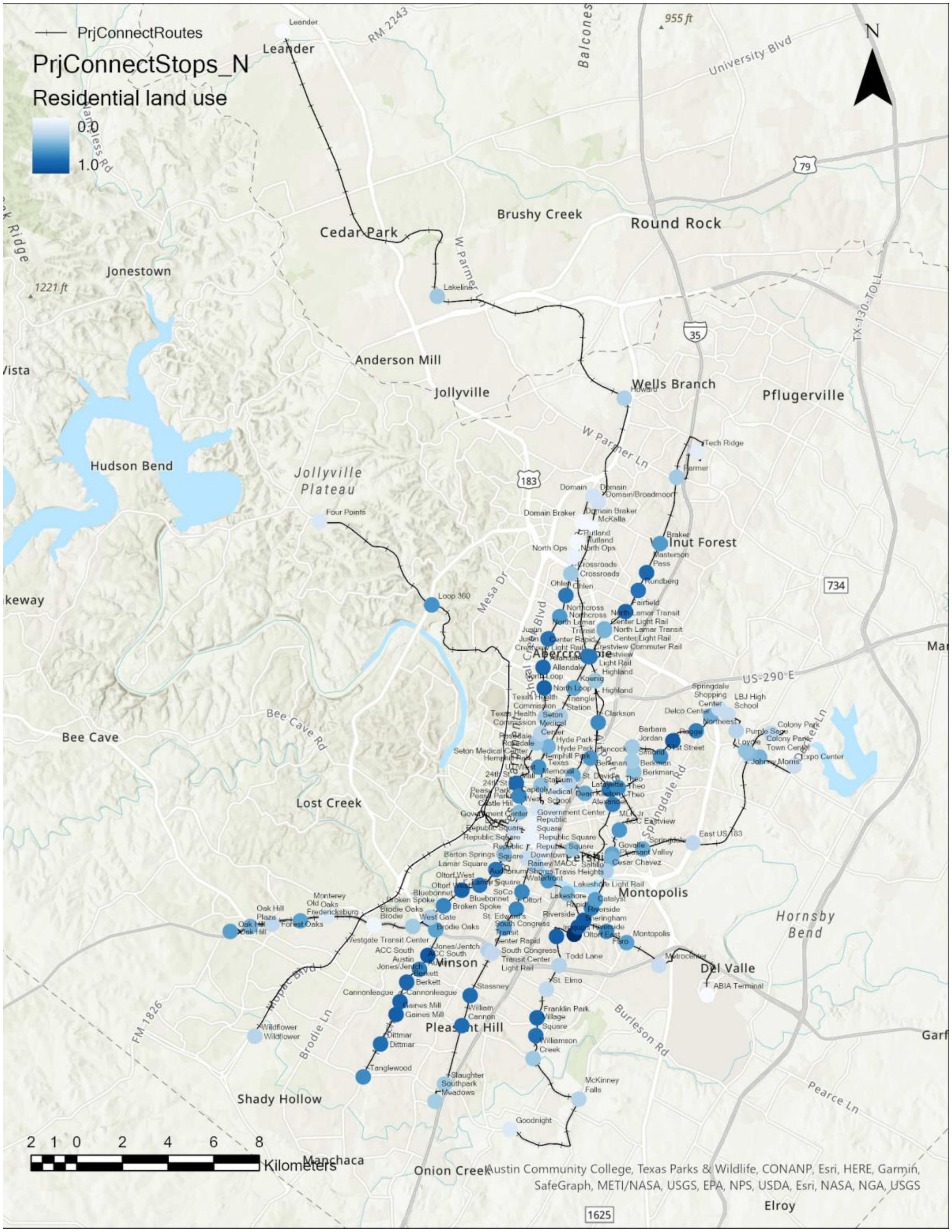
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Bee Cave
Lost Creek
Montopolis
Hornsby Bend
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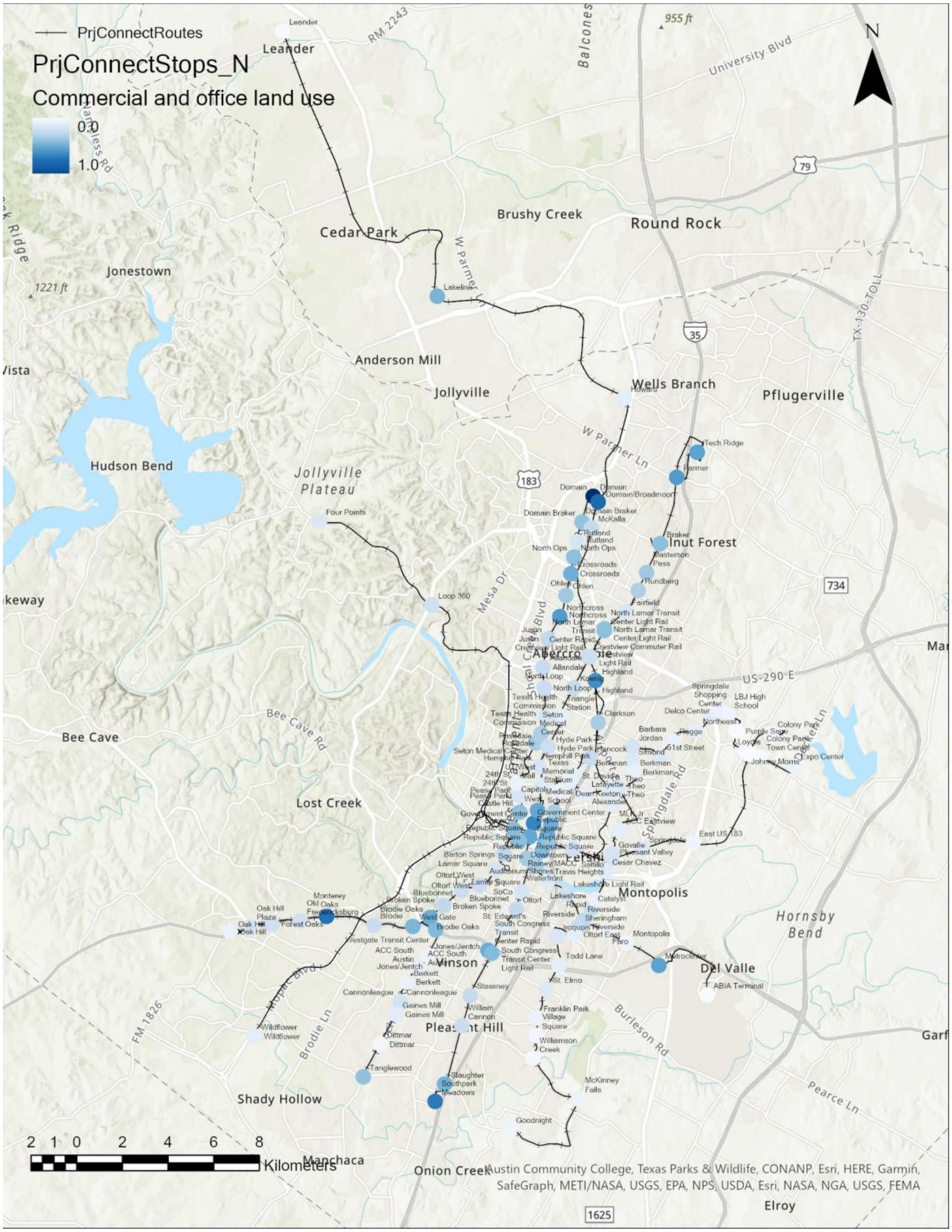
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Wells Branch
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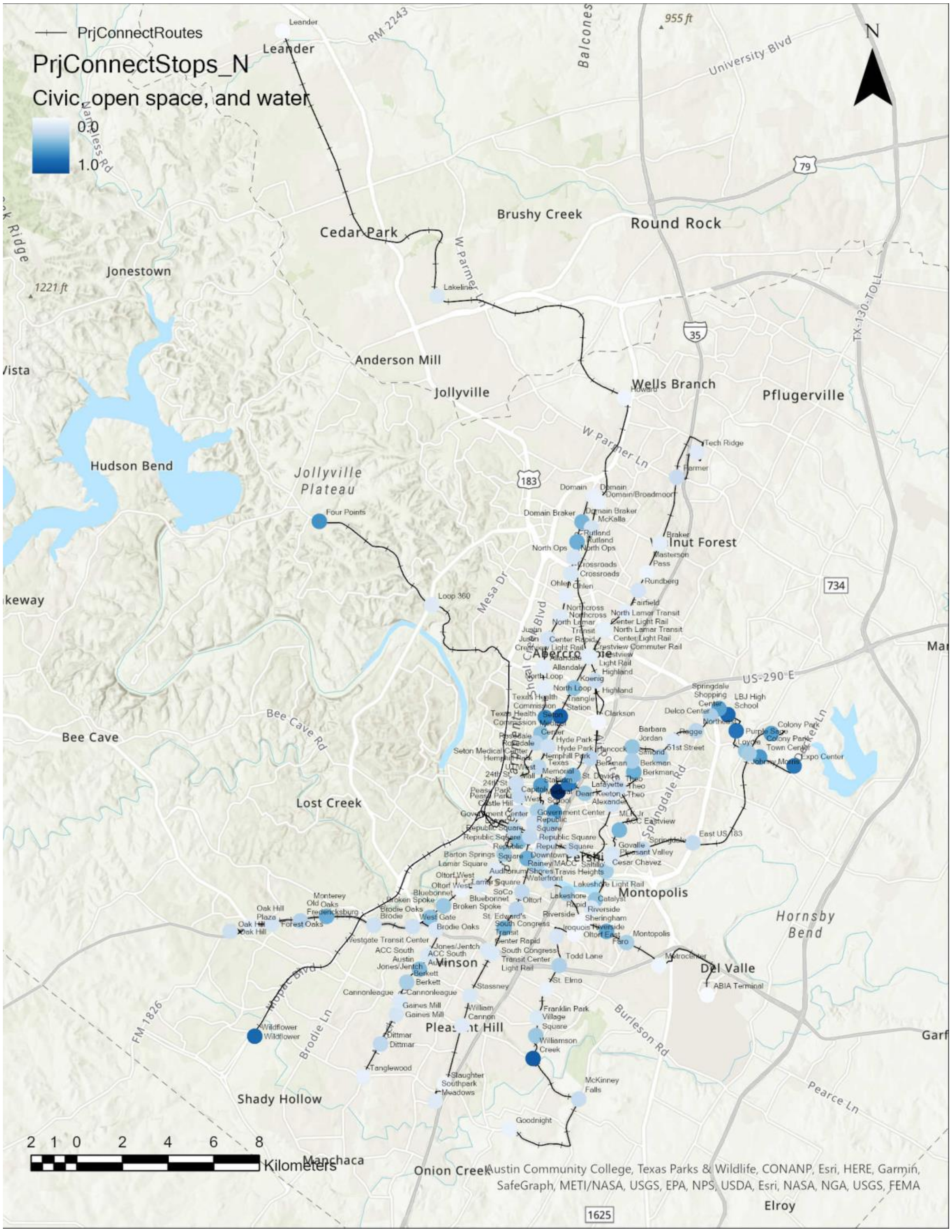
Hudson Bend
Jollyville Plateau
Bee Cave
Lost Creek
Montopolis
Hornsby Bend
Del Valle
Pleasant Hill
Shady Hollow
Manchaca
Onion Creek
Elroy
2 1 0 2 4 6 8
Kilometers
Austin Community College, Texas Parks & Wildlife, CONANP, Esri, HERE, Garmin, SafeGraph, METI/NASA, USGS, EPA, NPS, USDA, Esri, NASA, NGA, USGS, FEMA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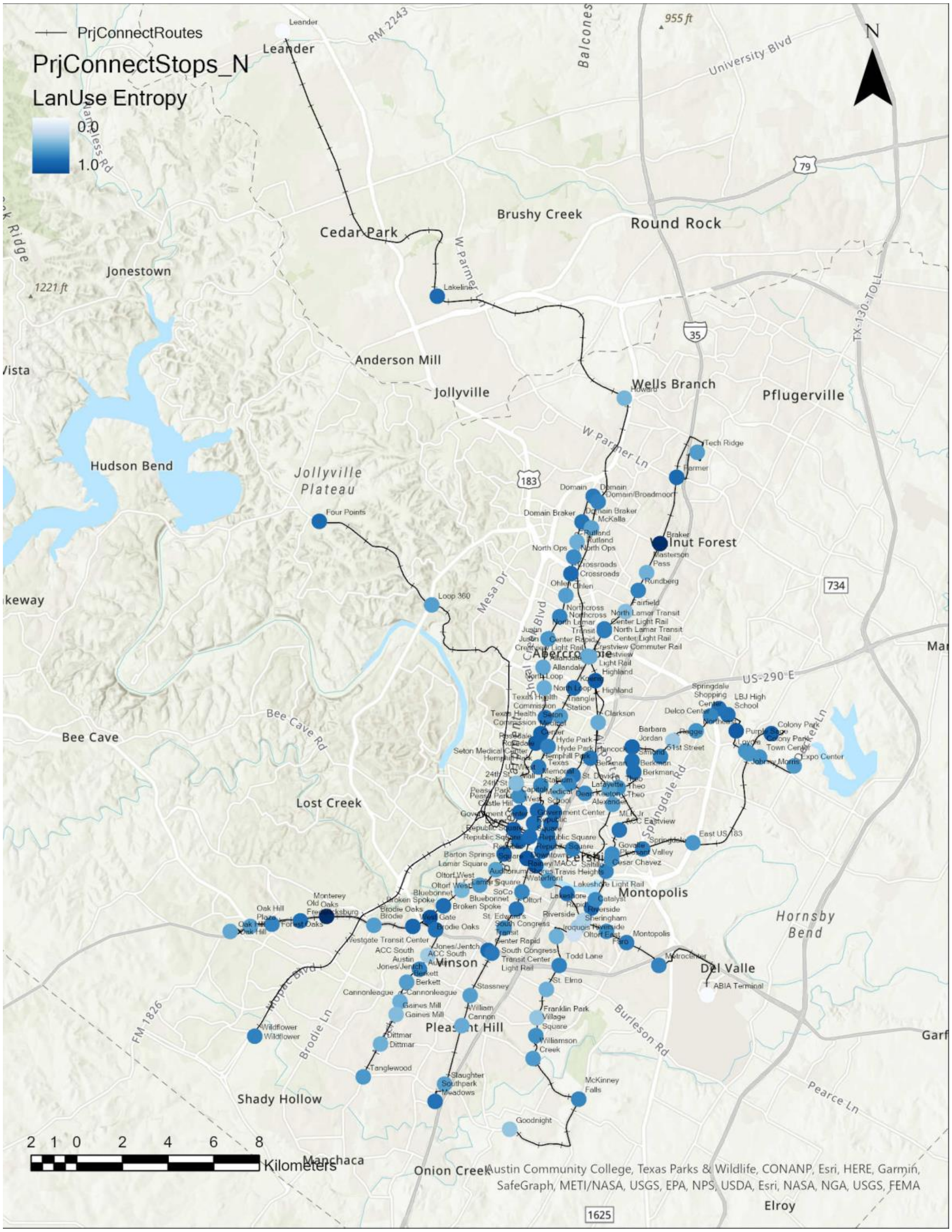
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Austin Community College, Texas Parks & Wildlife, CONANP, Esri, HERE, Garmin, SafeGraph, METI/NASA, USGS, EPA, NPS, USDA, Esri, NASA, NGA, USGS, FEMA

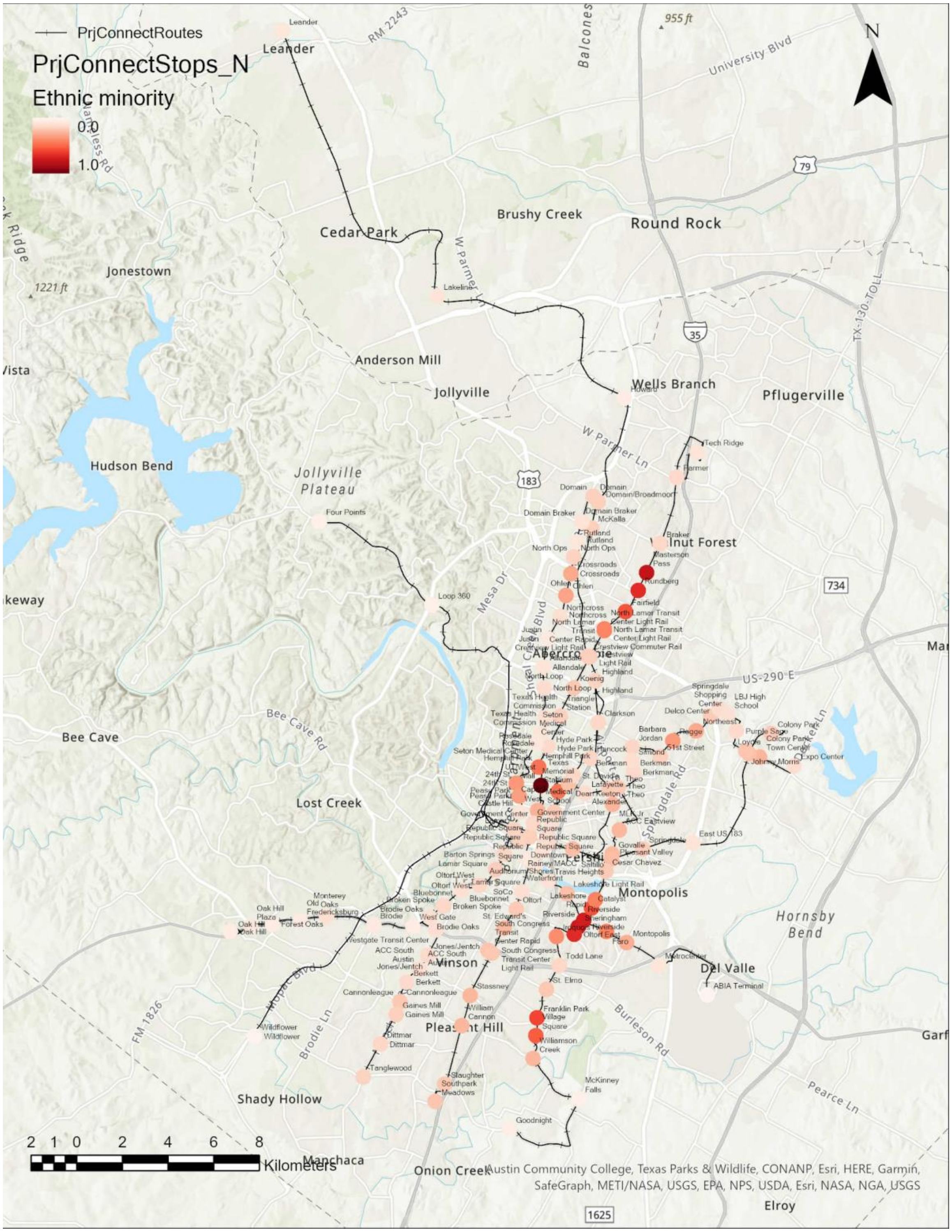
APPENDIX C: TABLE OF NORMALIZED VULNERABILITY ATTRIBUTES IN ALL BUS AND RAIL STOPS OF PROJECT CONNECT PROGRAM

ID	Stop Name	Persons of ethnic minority	Persons aged 65+	Persons foreign-born	Households below 60% Median Households with zero car	Households with zero car
1	24th St	0.36	0.34	0.32	0.45	0.48
2	51st Street	0.18	0.57	0.22	0.12	0.03
3	ABIA Terminal	0.00	0.00	0.00	0.00	0.00
4	ACC Eastview	0.26	0.71	0.08	0.23	0.56
5	ACC South Austin	0.13	0.78	0.12	0.18	0.08
6	Alexander	0.20	0.63	0.14	0.28	0.29
7	Allandale	0.10	0.65	0.13	0.23	0.22
8	Auditorium Shores	0.07	0.44	0.12	0.20	0.25
9	Barbara Jordan	0.16	0.42	0.21	0.13	0.08
10	Barton Springs	0.16	0.73	0.17	0.16	0.24
11	Berkett	0.14	0.50	0.10	0.15	0.10
12	Berkman	0.14	0.67	0.17	0.17	0.16
13	Bluebonnet	0.12	0.46	0.13	0.15	0.19
14	Braker	0.15	0.33	0.40	0.12	0.04
15	Brodie	0.06	0.17	0.07	0.08	0.03
16	Brodie Oaks	0.12	0.21	0.12	0.35	0.48
17	Broken Spoke	0.15	0.27	0.13	0.32	0.37
18	Cannonleague	0.20	0.55	0.12	0.23	0.10
19	Capitol East	0.12	0.36	0.18	0.12	0.43
20	Capitol West	0.27	0.19	0.28	0.21	0.40
21	Castle Hill	0.09	0.53	0.15	0.17	0.27
22	Catalyst	0.56	0.12	0.43	0.66	0.33
23	Cesar Chavez	0.19	0.37	0.16	0.19	0.27
24	Clarkson	0.15	0.38	0.21	0.22	0.21
25	Colony Park	0.19	0.23	0.15	0.27	0.01
26	Colony Park Town Center	0.26	0.24	0.19	0.27	0.01
27	Crestview Commuter Rail	0.18	0.29	0.19	0.52	0.09
28	Crestview Light Rail	0.18	0.27	0.20	0.63	0.09

29	Crossroads	0.30	0.67	0.33	0.31	0.11
30	Dean Keeton	0.22	0.28	0.23	0.21	0.20
31	Delco Center	0.13	0.22	0.06	0.15	0.04
32	Dittmar	0.15	0.62	0.14	0.14	0.04
33	Domain	0.18	0.03	0.24	0.21	0.15
34	Domain Braker	0.10	0.04	0.19	0.29	0.20
35	Domain/Broadmoor	0.18	0.03	0.28	0.28	0.20
36	Downtown	0.14	0.82	0.23	0.17	0.64
37	Downtown Station	0.13	0.79	0.24	0.15	0.64
38	East US 183	0.10	0.17	0.09	0.05	0.04
39	Expo Center	0.13	0.01	0.10	0.04	0.05
40	Fairfield	0.56	0.54	0.95	0.37	0.32
41	Faro	0.42	0.49	0.32	0.33	0.26
42	Forest Oaks	0.05	0.42	0.14	0.10	0.03
43	Four Points	0.02	0.08	0.03	0.02	0.01
44	Franklin Park	0.59	0.90	0.39	0.26	0.24
45	Gaines Mill	0.18	0.70	0.13	0.24	0.06
46	Goodnight	0.04	0.04	0.05	0.05	0.01
47	Govalle	0.25	0.47	0.16	0.19	0.33
48	Government Center	0.15	0.44	0.21	0.13	0.62
49	Hancock	0.16	0.37	0.19	0.28	0.44
50	Hemphill Park	0.47	0.22	0.50	0.68	0.78
51	Highland	0.17	0.17	0.13	0.55	0.07
52	Howard	0.05	0.16	0.08	0.08	0.02
53	Hyde Park	0.14	0.42	0.21	0.39	0.54
54	Iroquois	0.38	0.41	0.47	0.73	0.55
55	Johnny Morris	0.21	0.22	0.13	0.24	0.01
56	Jones/Jentch	0.14	0.77	0.12	0.24	0.09
57	Justin	0.06	0.65	0.12	0.13	0.17
58	Koenig	0.20	0.31	0.13	0.60	0.27
59	Lafayette	0.13	0.47	0.15	0.27	0.21
60	Lakeline	0.10	0.17	0.16	0.09	0.04
61	Lakeshore Light Rail	0.23	0.32	0.31	0.34	0.32
62	Lakeshore Rapid	0.42	0.10	0.31	0.44	0.18
63	Lamar	0.16	0.91	0.20	0.15	0.43
64	Lamar Square	0.18	0.72	0.18	0.19	0.39
65	LBJ High School	0.12	0.13	0.05	0.14	0.03
66	Leander	0.09	0.22	0.05	0.05	0.04
67	Loop 360	0.03	0.25	0.05	0.07	0.01
68	Loyola	0.23	0.23	0.15	0.28	0.01
69	Masterson Pass	0.78	0.42	0.81	0.52	0.35

70	McKalla	0.18	0.14	0.27	0.41	0.17
71	McKinney Falls	0.02	0.03	0.03	0.01	0.00
72	Medical School	0.20	0.22	0.20	0.14	0.19
73	Metrocenter	0.09	0.07	0.09	0.06	0.01
74	MLK Jr	0.27	0.84	0.12	0.27	0.53
75	Monterey Oaks	0.12	0.29	0.17	0.06	0.06
76	Montopolis	0.29	0.35	0.27	0.11	0.10
77	North Lamar Transit Center Light Rail	0.41	0.66	0.55	0.36	0.32
78	North Lamar Transit Center Rapid	0.43	0.66	0.57	0.34	0.34
79	North Loop	0.13	0.63	0.14	0.33	0.46
80	North Ops	0.17	0.20	0.31	0.30	0.22
81	Northcross	0.12	0.63	0.18	0.14	0.15
82	Northeast	0.30	0.54	0.19	0.20	0.15
83	Oak Hill	0.05	0.30	0.07	0.07	0.01
84	Oak Hill Plaza	0.07	0.47	0.10	0.17	0.00
85	Ohlen	0.32	0.88	0.32	0.29	0.11
86	Old Fredericksburg	0.06	0.34	0.19	0.06	0.05
87	Oltorf	0.20	0.70	0.21	0.24	0.51
88	Oltorf East	0.68	0.39	0.58	0.97	0.95
89	Oltorf West	0.15	0.54	0.16	0.18	0.28
90	Parmer	0.14	0.26	0.19	0.16	0.07
91	Pease Park	0.33	0.32	0.32	0.46	0.46
92	Plaza Saltillo	0.24	0.42	0.18	0.21	0.64
93	Pleasant Valley	0.24	0.50	0.16	0.19	0.35
94	Purple Sage	0.14	0.20	0.07	0.16	0.03
95	Rainey/MACC	0.11	0.87	0.21	0.17	0.50
96	Republic Square	0.18	0.75	0.24	0.14	0.66
97	Riverside	0.73	0.26	0.68	0.89	0.84
98	Rogge	0.35	0.88	0.31	0.14	0.10
99	Rosedale	0.09	0.50	0.16	0.22	0.25
100	Rundberg	0.67	0.58	1.00	0.57	0.33
101	Rutland	0.09	0.05	0.20	0.28	0.19
102	Seaholm	0.17	0.78	0.20	0.16	0.42
103	Seton Medical Center	0.08	0.50	0.13	0.25	0.29
104	Sheringham	0.74	0.36	0.72	1.00	1.00
105	Simond	0.13	0.66	0.16	0.17	0.10
106	Slaughter	0.20	0.26	0.19	0.19	0.08
107	SoCo	0.12	0.67	0.09	0.29	0.45
108	South Congress Transit Center Light Rail	0.21	0.28	0.21	0.27	0.17
109	South Congress Transit Center Rapid	0.22	0.31	0.24	0.28	0.16
110	Southpark Meadows	0.21	0.25	0.15	0.16	0.02

111	Springdale	0.19	0.38	0.08	0.11	0.11
112	Springdale Shopping Center	0.19	0.42	0.08	0.23	0.09
113	St. David's	0.15	0.37	0.20	0.29	0.27
114	St. Edward's	0.25	0.48	0.23	0.29	0.35
115	St. Elmo	0.20	0.17	0.31	0.15	0.15
116	Stassney	0.25	0.67	0.18	0.28	0.10
117	Tanglewood	0.16	0.31	0.11	0.13	0.04
118	Tech Ridge	0.10	0.06	0.19	0.13	0.02
119	Texas Health Commission	0.12	0.46	0.17	0.19	0.16
120	Texas Memorial Stadium	0.46	0.10	0.36	0.15	0.13
121	Theo	0.19	0.63	0.15	0.23	0.24
122	Todd Lane	0.15	0.15	0.23	0.32	0.12
123	Travis Heights	0.11	0.80	0.13	0.23	0.37
124	Triangle Station	0.18	0.26	0.19	0.34	0.28
125	Trinity	0.14	0.57	0.23	0.15	0.59
126	UT/West Mall	1.00	0.05	0.84	0.75	0.77
127	Village Square	0.53	0.88	0.40	0.17	0.12
128	Waterfront	0.10	0.81	0.12	0.27	0.41
129	West Gate	0.05	0.27	0.08	0.15	0.16
130	Westgate Transit Center	0.12	0.41	0.15	0.34	0.30
131	Wildflower	0.01	0.15	0.05	0.00	0.00
132	William Cannon	0.25	1.00	0.24	0.24	0.14
133	Williamson Creek	0.25	0.28	0.33	0.08	0.05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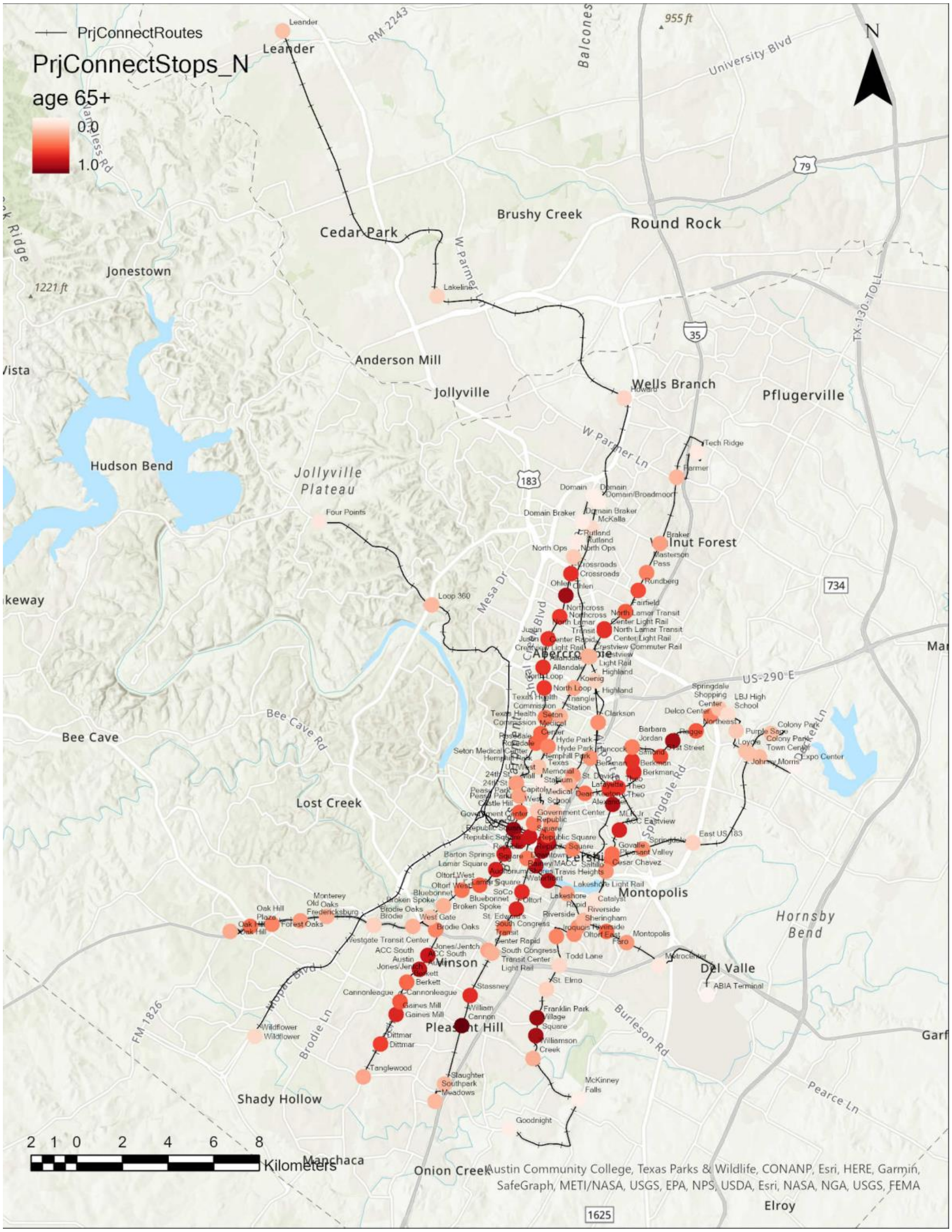
Jonestown
Anderson Mill
Jollyville
Wells Branch
Pflugerville
Hudson Bend
Jollyville Plateau
Bee Cave
Lost Creek
Montopolis
Hornsby Bend
Del Valle
Pleasant Hill
Shady Hollow
Manchaca
Onion Creek
Elroy
2 1 0 2 4 6 8
Kilometers
Austin Community College, Texas Parks & Wildlife, CONANP, Esri, HERE, Garmin, SafeGraph, METI/NASA, USGS, EPA, NPS, USDA, Esri, NASA, NGA, USGS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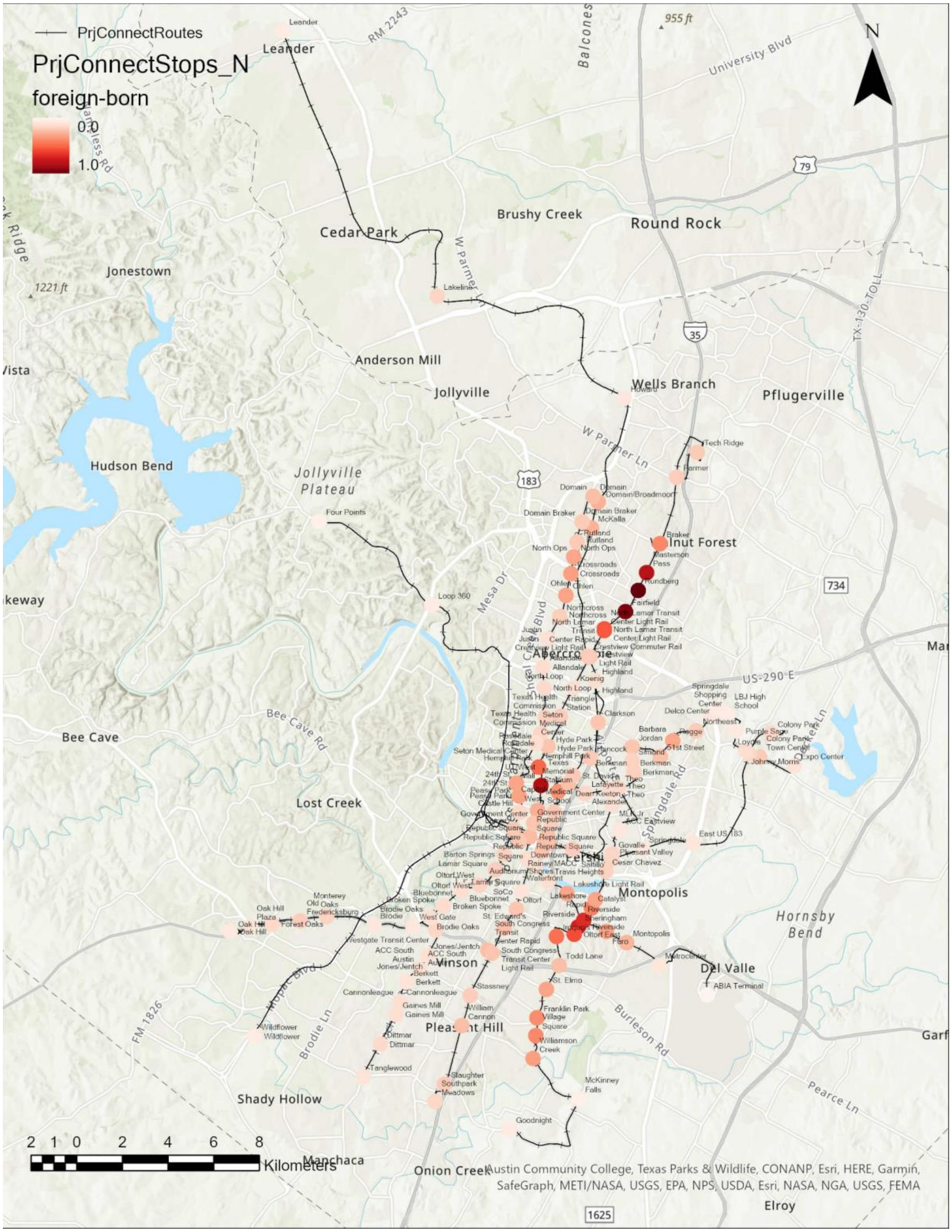
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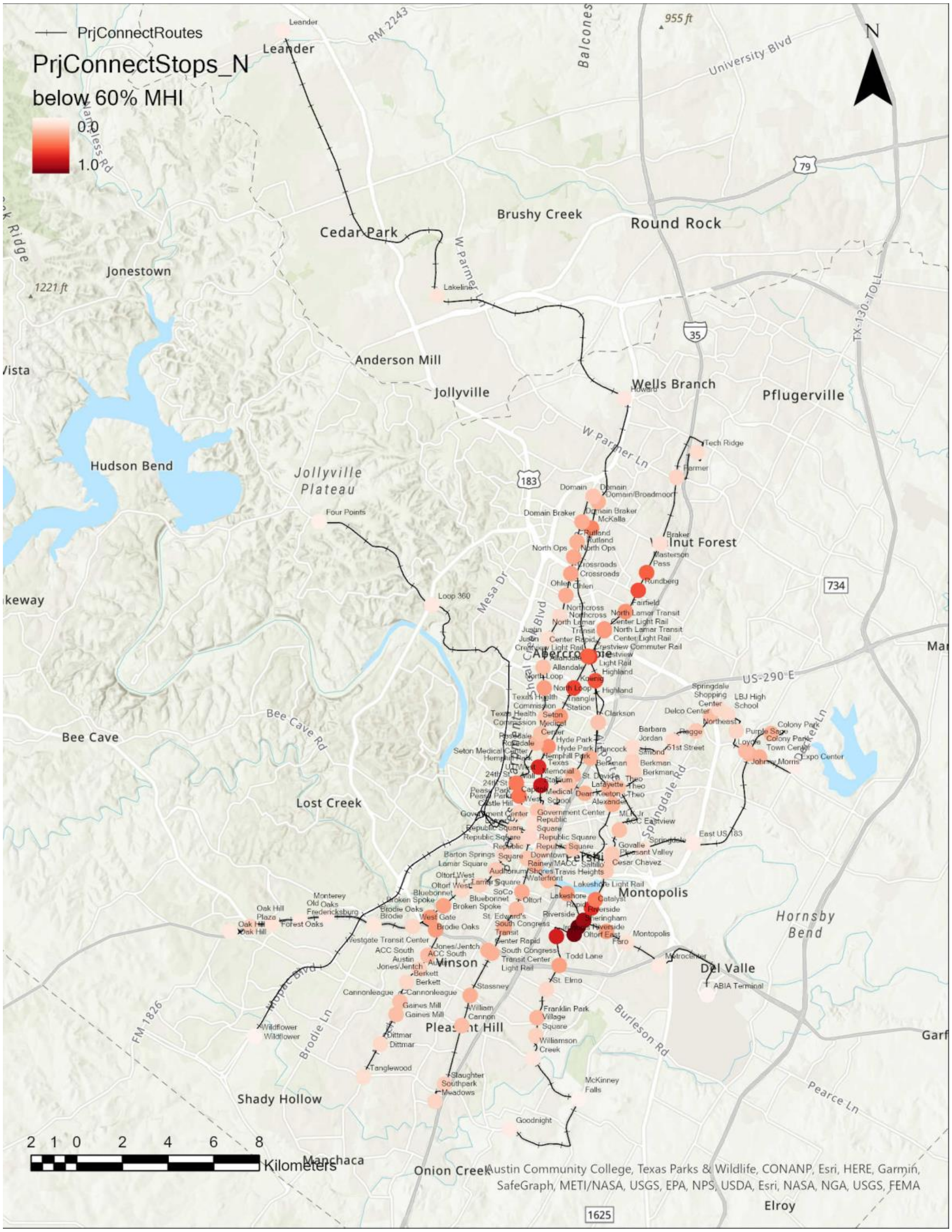
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Round Rock
Jonestown
Anderson Mill
Jollyville
Wells Branch
Pflugerville
Hudson Bend
Jollyville Plateau
Bee Cave
Lost Creek
Montopolis
Hornsby Bend
Del Valle
Pleasant Hill
Shady Hollow
Manchaca
Onion Creek
Elroy
2 1 0 2 4 6 8
Kilometers
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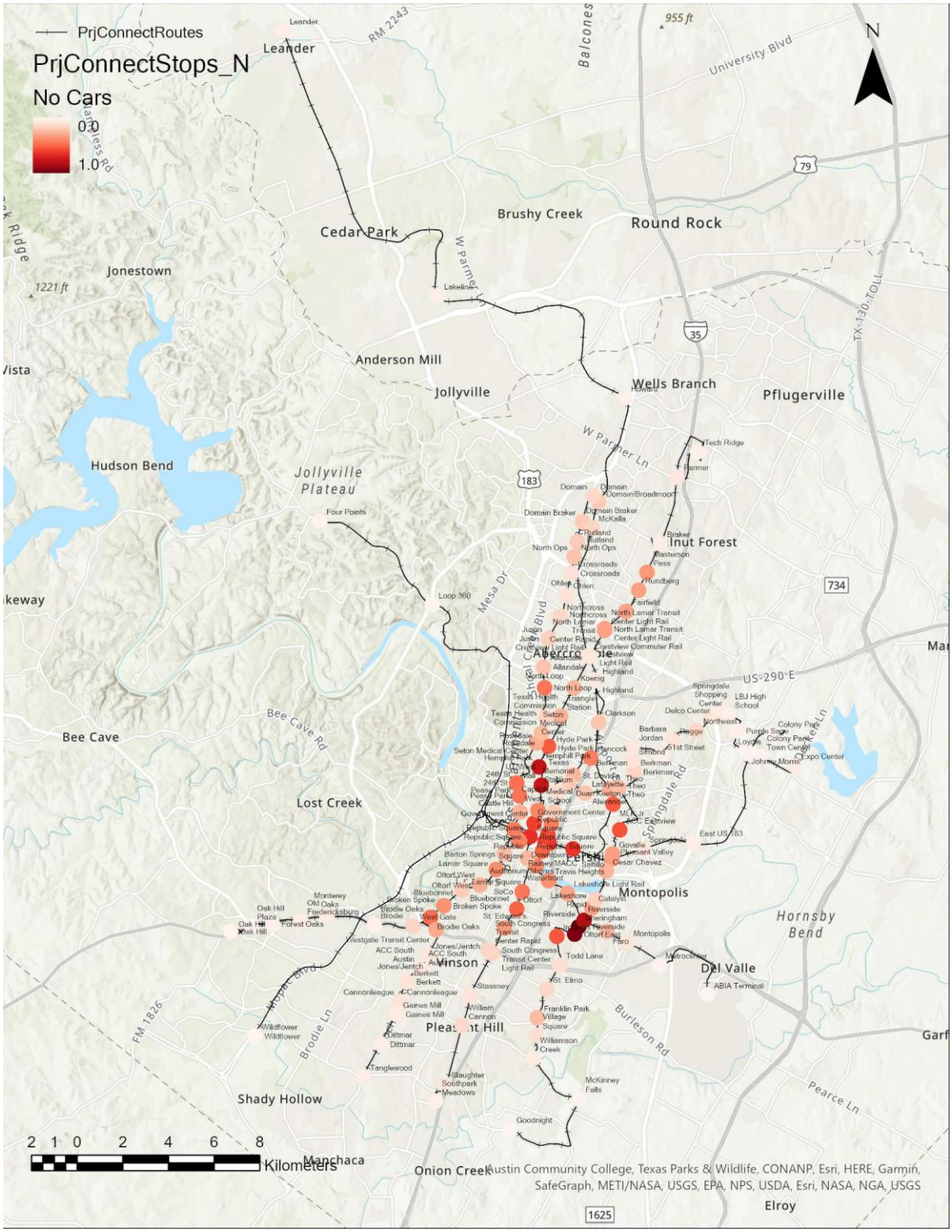
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Bee Cave
Lost Creek
Shady Hollow
Manchaca
Onion Creek
Montopolis
Del Valle
Vinson
Pleasant Hill
Hornsby Bend
Elroy
Austin Community College, Texas Parks & Wildlife, CONANP, Esri, HERE, Garmin, SafeGraph, METI/NASA, USGS, EPA, NPS, USDA, Esri, NASA, NGA, USGS
2 1 0 2 4 6 8
Kilometers

APPENDIX D: IMPACTS OF MAXIMIZING THE AMOUNT OF AFFORDABLE HOUSING UNITS IN STOP LEVEL

ID	Stop Names	Housing					Value Increment	FAR Increment	Emissions Increment	Destination accessibility to		
		Total	Affordable Housing		Accessible Affordable Housing					Housing Stock	Commercial Service	Office Opportunity
			30%MFI	60%MFI	30%MFI	60%MFI						
101	Tech Ridge	457	457	457	457	1021	2565	0.80	633	7	6	3
102	Parmer	0	0	0	457	1585	0	N/A	0	26	20	12
103	Braker	0	0	0	457	6196	0	N/A	0	94	60	42
104	Masterson Pass	0	0	0	457	7731	0	N/A	0	108	64	44
105	Rundberg	0	0	0	457	11645	0	N/A	0	147	80	61
106	Fairfield	51	0	0	457	13065	304	0.69	64	220	117	97
107	North Lamar Transit Center Rapid	4	0	0	196	8141	0	0.40	0	95	53	38
108	South Congress Transit Center Rapid	12	0	0	0	9574	187	0.47	46	224	121	119
109	William Cannon	56	0	56	0	409	0	0.80	0	38	12	4
110	Slaughter	8	0	0	0	24	42	0.80	10	3	8	0
111	Southpark Meadows	27	0	27	0	20	151	0.80	37	1	7	0
201	Domain	0	0	0	0	11364	2847	N/A	703	33	13	39
202	Domain Braker	994	0	994	0	11373	2346	0.76	576	20	9	15
203	Rutland	1550	0	1550	0	9789	4759	0.77	1164	24	12	16
204	North Ops	1572	0	1572	0	10381	11768	0.80	2875	52	29	33
205	Crossroads	0	0	0	0	9152	0	N/A	0	55	36	33
206	Ohlen	0	0	0	0	9017	0	N/A	0	165	108	93

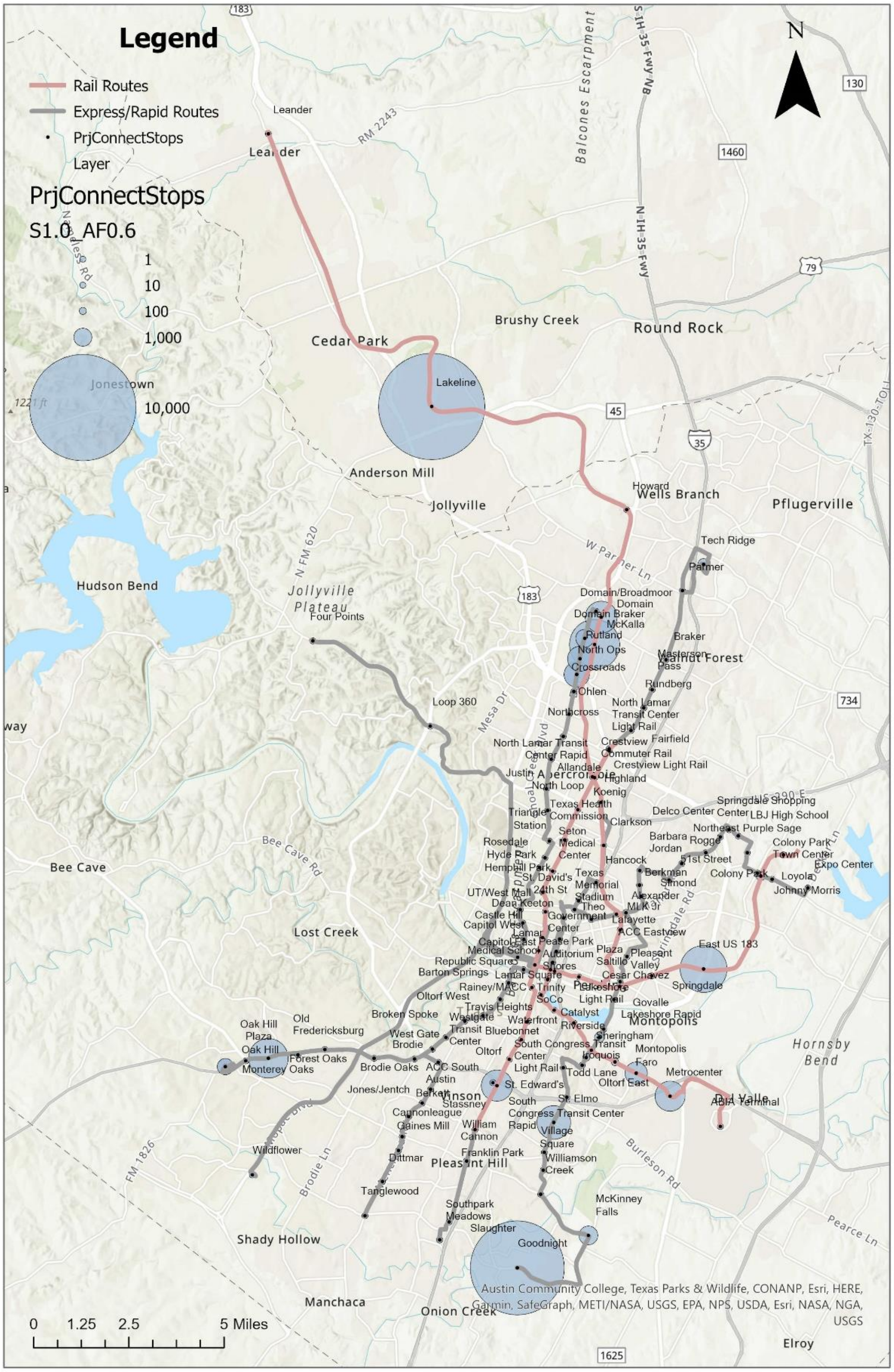
207	Northcross	0	0	0	0	8463	0	N/A	0	76	55	40
208	Justin	0	0	0	0	10215	0	N/A	0	200	130	103
209	Allandale	0	0	0	0	12138	0	N/A	0	222	133	113
210	North Loop	6	0	6	0	12596	32	0.80	8	232	133	115
211	Texas Health Commission	0	0	0	20	13607	0	N/A	0	273	154	150
212	Rosedale	0	0	0	0	16254	0	N/A	0	223	124	130
213	Seton Medical Center	0	0	0	53	16366	0	N/A	0	415	220	237
214	24th St	0	0	0	0	17107	0	N/A	0	500	244	282
215	Pease Park	5	0	0	0	17051	29	0.67	7	381	191	226
216	Castle Hill	24	0	0	0	19367	136	0.68	33	591	332	397
217	Lamar	77	0	0	0	19229	726	0.68	174	573	337	398
218	Seaholm	0	0	0	27	20367	0	N/A	0	484	282	316
219	Barton Springs	0	0	0	0	17141	0	N/A	0	406	242	257
220	Lamar Square	0	0	0	0	12090	0	N/A	0	307	183	183
221	Oltorf West	0	0	0	0	13997	0	N/A	0	274	172	160
222	Bluebonnet	0	0	0	0	15069	0	N/A	0	314	202	181
223	Broken Spoke	0	0	0	0	6509	0	N/A	0	57	38	30
224	Brodie Oaks	0	0	0	0	11921	0	N/A	0	36	25	19
225	Westgate Transit Center	0	0	0	0	3389	0	N/A	0	56	40	25
226	Jones/Jentch	0	0	0	0	7056	0	N/A	0	154	100	67
227	ACC South Austin	0	0	0	0	6670	0	N/A	0	85	55	36
228	Berkett	0	0	0	0	4403	0	N/A	0	67	42	27
229	Cannonleague	0	0	0	0	2124	0	N/A	0	69	43	25
230	Gaines Mill	2	0	2	0	1104	14	0.80	3	34	21	12
231	Dittmar	16	0	16	0	598	88	0.80	21	80	52	27
232	Tanglewood	0	0	0	0	116	0	N/A	0	19	19	7
233	West Gate	13	0	13	0	6369	75	0.80	18	54	41	28

234	Brodie	0	0	0	0	5087	0	N/A	0	22	23	11
235	Monterey Oaks	55	0	0	0	3834	311	0.80	72	12	9	6
236	Old Fredericksburg	0	0	0	0	3914	0	N/A	0	40	28	18
237	Forest Oaks	2760	0	2760	0	3693	15485	0.80	3813	31	16	9
238	Oak Hill Plaza	0	0	0	0	3612	0	N/A	0	30	16	8
239	Oak Hill	832	0	832	0	3612	7023	0.61	1667	9	4	2
301	Expo Center	15	0	15	0	4302	85	0.80	21	31	10	10
302	Colony Park Town Center	0	0	0	0	6334	0	N/A	0	100	34	35
303	Johnny Morris	0	0	0	0	6738	0	N/A	0	47	16	16
304	Purple Sage	0	0	0	0	6560	0	N/A	0	94	29	30
305	LBJ High School	0	0	0	0	5893	0	N/A	0	95	27	27
306	Delco Center	40	0	0	0	3454	540	0.68	129	40	11	11
307	Springdale Shopping Center	0	0	0	0	2966	0	N/A	0	59	18	17
308	Northeast	0	0	0	0	4601	0	N/A	0	144	44	44
309	Rogge	2	0	0	0	4908	11	0.49	3	150	48	53
310	51st Street	39	0	0	0	4888	410	0.54	99	122	41	49
311	Barbara Jordan	279	0	0	0	3555	0	0.54	0	10	4	4
312	Simond	182	0	0	0	11831	2970	0.58	730	108	40	44
313	Alexander	125	0	0	0	14269	1010	0.70	205	245	112	117
314	Lafayette	3	0	0	0	13816	18	0.63	4	813	397	441
315	Dean Keeton	0	0	0	0	14267	0	N/A	0	312	160	178
401	Four Points	0	0	0	0	0	1	N/A	0	1	0	0
402	Loop 360	0	0	0	0	18	0	N/A	0	12	6	9
403	Wildflower	0	0	0	0	0	0	N/A	0	12	4	5
501	Highland	53	0	0	206	13468	290	0.62	72	324	172	170
502	Clarkson	0	0	0	0	8355	0	N/A	0	424	236	234
503	Hancock	0	0	0	0	7317	0	N/A	0	231	136	129

504	St. David's	0	0	0	0	13483	0	N/A	0	245	131	140
505	Texas Memorial Stadium	0	0	0	0	15227	0	N/A	0	280	147	166
506	Medical School	0	0	0	0	17653	0	N/A	0	503	277	330
507	Capitol East	0	0	0	0	18614	0	N/A	0	671	376	461
508	Trinity	0	0	0	0	20869	0	N/A	0	642	360	453
601	Berkman	123	0	0	0	12260	308	0.51	75	220	85	92
602	Theo	52	0	52	0	13629	291	0.80	72	258	111	117
603	ACC Eastview	0	0	0	0	13561	0	N/A	0	295	114	115
604	Govalle	2	0	0	0	14727	13	0.60	2	566	239	232
605	Cesar Chavez	83	0	0	0	15611	571	0.63	140	706	268	271
606	Lakeshore Rapid	14	0	14	0	14554	17	0.80	4	65	22	25
607	Catalyst	306	0	306	0	12636	2175	0.80	528	97	33	35
608	Sheringham	92	0	92	0	17297	650	0.80	161	195	65	73
609	Oltorf East	0	0	0	0	18870	0	N/A	0	175	57	64
610	Iroquois	0	0	0	0	19382	0	N/A	0	207	66	74
611	Todd Lane	130	0	0	0	17761	163	0.54	40	208	64	72
612	St. Elmo	2283	0	2283	0	11889	13372	0.80	3285	33	9	10
613	Franklin Park	0	0	0	0	15561	0	N/A	0	139	37	42
614	Village Square	0	0	0	0	15292	0	N/A	0	166	43	48
615	Williamson Creek	0	0	0	0	14057	0	N/A	0	105	26	28
616	McKinney Falls	1049	0	1049	0	14066	5885	0.80	1418	17	3	3
617	Goodnight	7186	0	7186	0	9916	40311	0.80	9424	12	0	1
701	North Lamar Transit Center Light Rail	3	0	0	314	10980	16	0.80	4	147	78	68
702	Crestview Light Rail	172	0	0	392	14730	777	0.60	191	387	194	191
703	Hyde Park	4	0	0	180	16968	24	0.54	6	1251	623	663
704	Hemphill Park	5	0	0	187	18389	31	0.54	8	1479	726	807
705	UT/West Mall	0	0	0	204	20185	0	N/A	0	1277	635	715

706	Capitol West	3	0	0	122	20272	16	0.40	4	1260	679	833
707	Government Center	0	0	0	111	20657	0	N/A	0	995	553	730
708	Republic Square	0	0	0	0	19715	0	N/A	0	889	536	730
709	Downtown Station	0	0	0	33	20978	0	N/A	0	474	269	347
710	Rainey/MACC	0	0	0	48	18453	0	N/A	0	487	267	323
711	Waterfront	0	0	0	0	16213	0	N/A	0	212	106	128
712	Travis Heights	0	0	0	0	16751	0	N/A	0	1156	522	609
713	Lakeshore Light Rail	106	0	0	0	12115	596	0.58	142	579	232	257
714	Riverside	95	0	95	0	13852	399	0.78	91	62	21	22
715	Faro	134	0	134	0	17962	4805	0.80	1184	573	191	225
716	Montopolis	1354	0	1354	0	13018	5348	0.77	1298	548	182	217
717	Metrocenter	1971	0	1971	0	9565	11848	0.80	2650	229	80	100
718	ABIA Terminal	0	0	0	0	3738	0	N/A	0	12	4	5
801	Koenig	4	0	4	272	14757	128	0.80	31	586	300	290
802	Triangle Station	27	0	0	181	15092	152	0.80	37	656	331	332
803	Auditorium Shores	0	0	0	0	16653	0	N/A	0	248	138	160
804	SoCo	0	0	0	0	15501	0	N/A	0	1491	772	845
805	Oltorf	0	0	0	0	13315	0	N/A	0	603	313	332
806	St. Edward's	31	0	0	0	11929	0	0.53	0	453	237	248
807	South Congress Transit Center Light Rail	2055	0	2055	0	8921	12199	0.79	2951	202	107	105
808	Stassney	90	0	0	0	1934	817	0.75	204	188	90	53
901	Leander	0	0	0	0	2882	0	N/A	0	8	1	1
902	Lakeline	8202	0	8202	0	10843	67454	0.78	15782	46	2	3
903	Howard	4669	0	0	0	10713	31744	0.57	7435	129	26	44
904	Domain/Broadmoor	2119	0	2119	0	11799	13229	0.80	3062	35	8	20
905	McKalla	3600	0	3600	0	13683	22638	0.79	5422	76	26	44

906	Crestview Commuter Rail	147	0	0	222	12930	914	0.64	227	349	179	155
907	MLK Jr	17	0	0	0	15337	91	0.58	22	819	393	409
908	Plaza Saltillo	298	0	0	0	15724	1998	0.61	447	1984	1143	1171
909	Downtown	46	0	0	0	18674	270	0.63	65	721	410	460
1001	Colony Park	0	0	0	0	5252	0	N/A	0	89	30	32
1002	Loyola	283	0	283	0	8645	1585	0.80	369	64	24	25
1003	East US 183	3357	0	3357	0	7031	20233	0.73	4961	114	48	50
1004	Springdale	206	0	0	0	12028	2930	0.63	713	563	263	273
1005	Pleasant Valley	166	0	0	0	14928	827	0.58	192	478	215	213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Jollyville Plateau
Four Points
Domain/Broadmoor
Walnut Forest
Loop 360
Bee Cave
Lost Creek
Oak Hill Plaza
Springdale
East US 183
Montopolis
Hornsby Bend
Metrocenter
Del Valle
ABIA Terminal
Pleasant Hill
Shady Hollow
Manchaca
Onion Creek
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McKinney Falls
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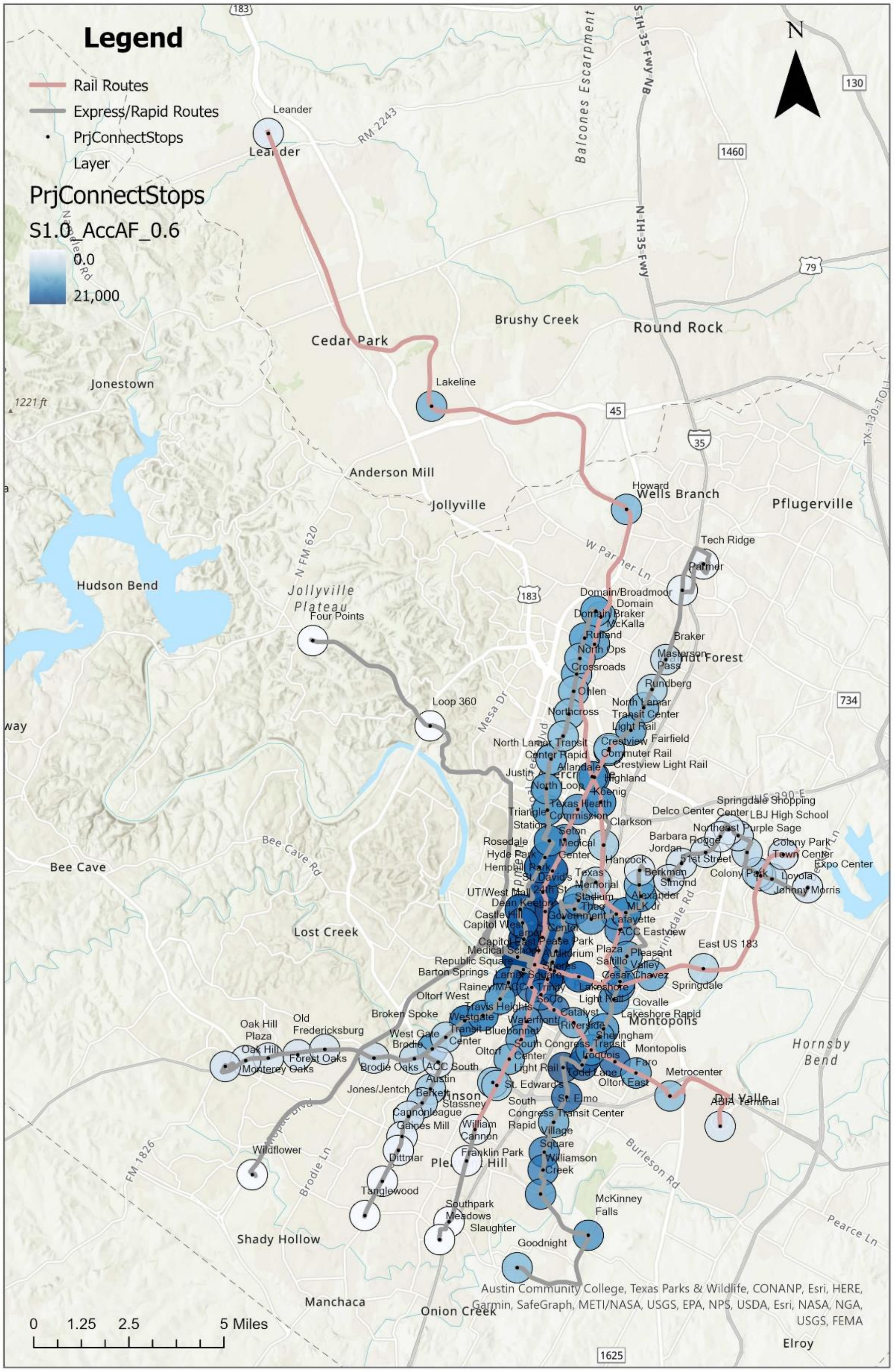
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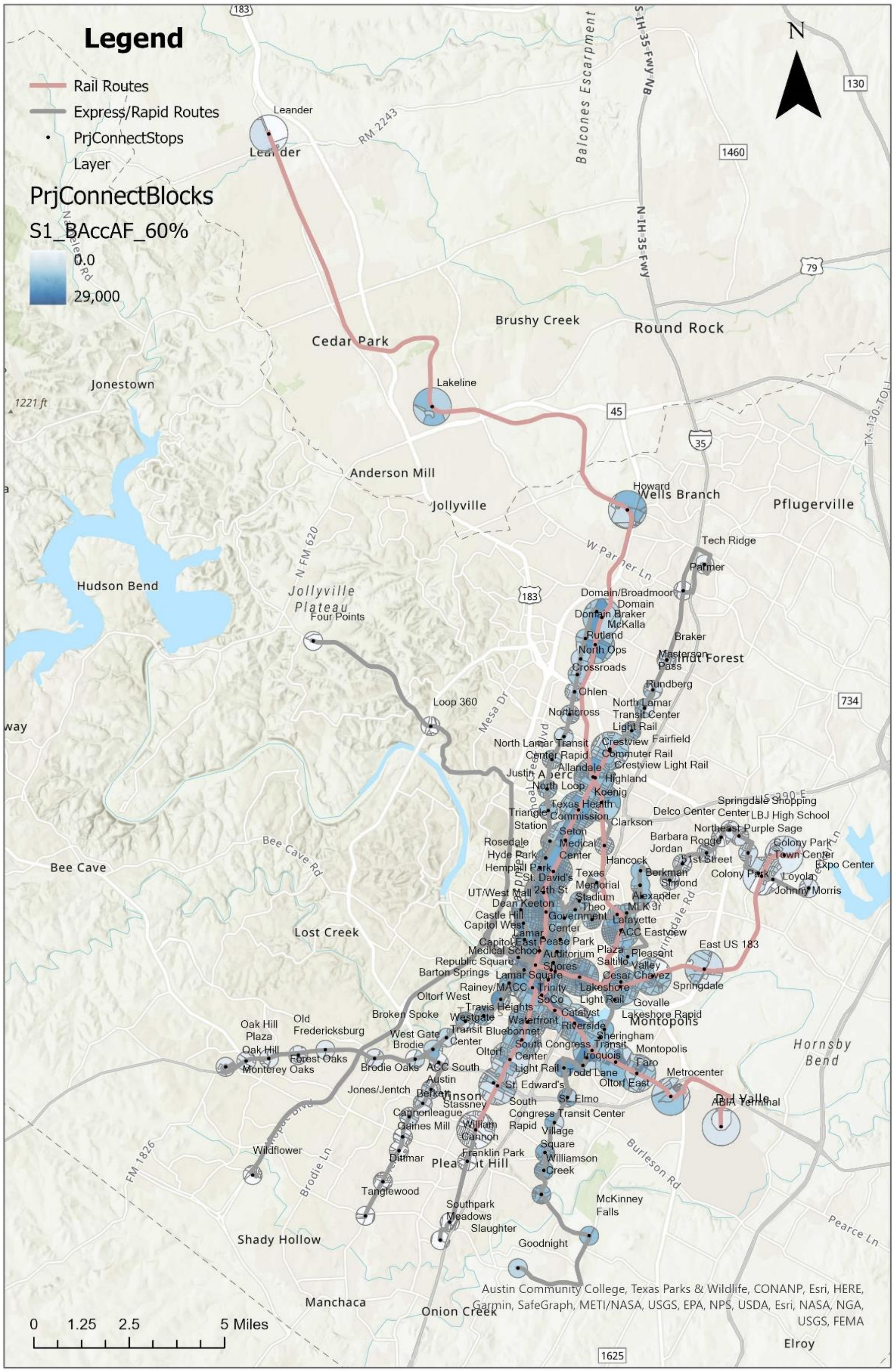
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APPENDIX E. IMPACTS OF MAXIMIZING THE TOTAL ACCESSIBILITY IN STOP LEVEL

ID	Stop Names	Housing					Value Increment	FAR Increment	Emissions Increment	Destination accessibility to		
		Total	Affordable Housing		Accessible Affordable Housing					Housing Stock	Commercial Service	Office Opportunity
			30%MFI	60%MFI	30%MFI	60%MFI						
101	Tech Ridge	0	0	0	0	169	0	0.64	476	6	6	4
102	Parmer	0	0	0	0	402	0	N/A	0	24	20	13
103	Braker	0	0	0	0	2811	0	N/A	0	89	60	45
104	Masterson Pass	0	0	0	0	3614	0	N/A	0	103	64	47
105	Rundberg	0	0	0	0	5683	0	N/A	0	140	81	66
106	Fairfield	29	0	0	0	6503	165	0.40	37	209	118	104
107	North Lamar Transit Center Rapid	0	0	0	0	3825	0	0.40	0	90	54	41
108	South Congress Transit Center Rapid	0	0	0	0	5511	0	0.51	59	211	122	126
109	William Cannon	33	0	33	0	170	0	0.47	0	37	12	4
110	Slaughter	8	0	0	0	0	42	0.80	10	3	8	0
111	Southpark Meadows	0	0	0	0	0	0	0.40	20	1	7	0
201	Domain	0	0	0	0	5735	1715	N/A	436	26	13	42
202	Domain Braker	527	0	527	0	5728	345	0.59	587	15	10	18
203	Rutland	719	0	719	0	4872	2245	0.58	915	18	13	19
204	North Ops	1048	0	1048	0	5191	6910	0.68	2382	41	30	39

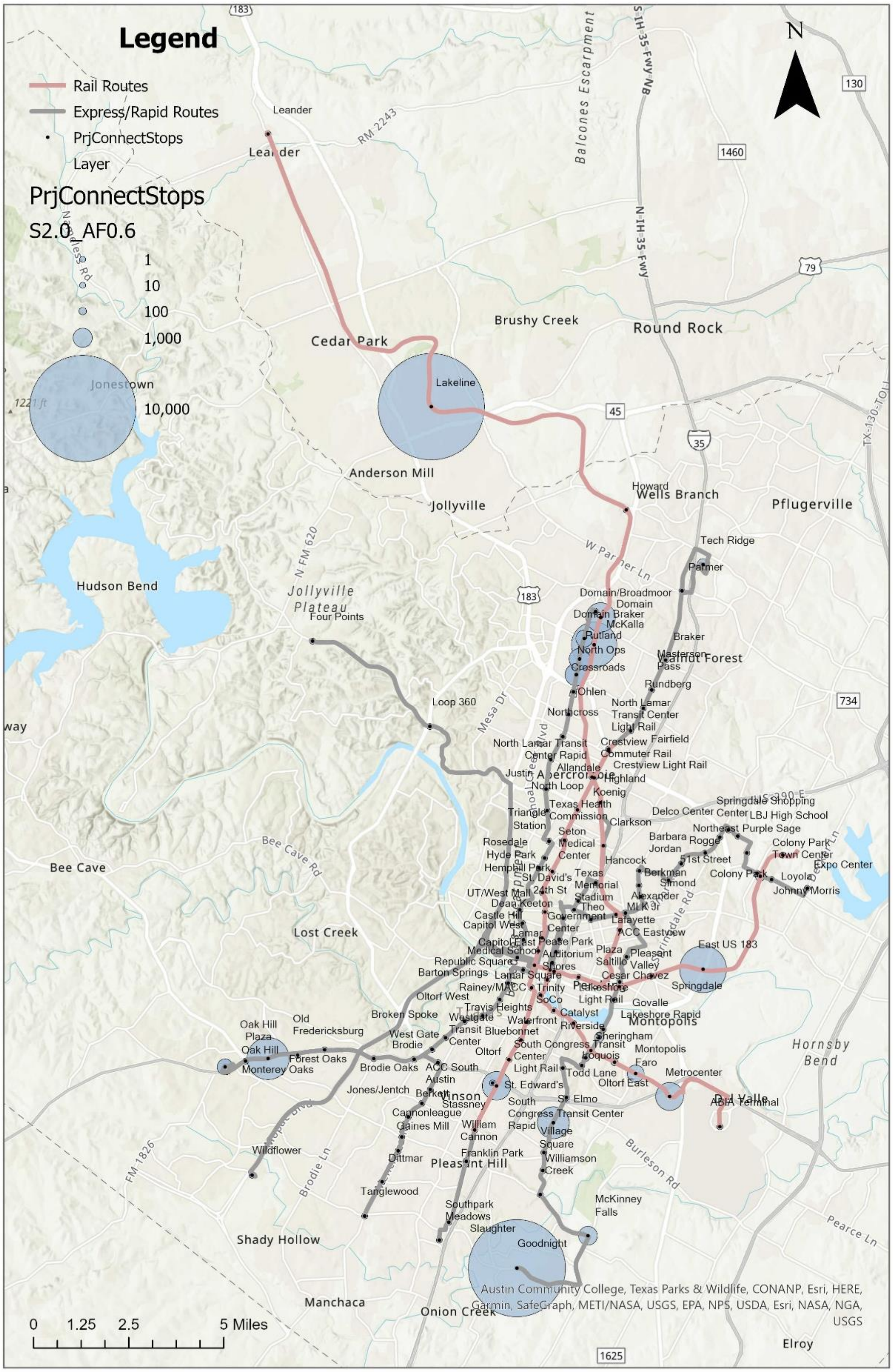
205	Crossroads	0	0	0	0	4549	0	N/A	0	46	37	38
206	Ohlen	0	0	0	0	4388	0	N/A	0	142	110	106
207	Northcross	0	0	0	0	4180	0	N/A	0	67	56	45
208	Justin	0	0	0	0	5110	0	N/A	0	181	131	114
209	Allandale	0	0	0	0	6303	0	N/A	0	206	134	122
210	North Loop	5	0	5	0	6522	25	0.63	6	219	134	123
211	Texas Health Commission	0	0	0	0	7046	0	N/A	0	259	154	159
212	Rosedale	0	0	0	0	8985	0	N/A	0	212	125	136
213	Seton Medical Center	0	0	0	0	9081	0	N/A	0	396	221	248
214	24th St	0	0	0	0	10050	0	N/A	0	479	246	294
215	Pease Park	0	0	0	0	10013	0	0.53	6	365	192	235
216	Castle Hill	7	0	0	0	11792	37	0.53	26	564	334	414
217	Lamar	64	0	0	0	11874	360	0.56	163	547	339	415
218	Seaholm	0	0	0	0	12736	0	N/A	0	462	283	329
219	Barton Springs	0	0	0	0	10989	0	N/A	0	389	243	268
220	Lamar Square	0	0	0	0	7639	0	N/A	0	295	184	191
221	Oltorf West	0	0	0	0	9398	0	N/A	0	263	173	167
222	Bluebonnet	0	0	0	0	10176	0	N/A	0	302	202	188
223	Broken Spoke	0	0	0	0	4496	0	N/A	0	55	38	32
224	Brodie Oaks	0	0	0	0	8286	0	N/A	0	35	25	20
225	Westgate Transit Center	0	0	0	0	2412	0	N/A	0	54	41	26
226	Jones/Jentch	0	0	0	0	5163	0	N/A	0	150	100	70
227	ACC South Austin	0	0	0	0	4978	0	N/A	0	83	55	37
228	Berkett	0	0	0	0	3168	0	N/A	0	66	43	28
229	Cannonleague	0	0	0	0	1362	0	N/A	0	67	43	26
230	Gaines Mill	1	0	1	0	784	7	0.40	2	33	21	12
231	Dittmar	8	0	8	0	484	45	0.41	11	79	52	28

232	Tanglewood	0	0	0	0	99	0	N/A	0	19	19	7
233	West Gate	13	0	13	0	4657	75	0.80	18	52	41	29
234	Brodie	0	0	0	0	4274	0	N/A	0	21	23	12
235	Monterey Oaks	0	0	0	0	3596	0	0.74	76	11	9	7
236	Old Fredericksburg	0	0	0	0	3651	0	N/A	0	39	28	18
237	Forest Oaks	2760	0	2760	0	3570	15485	0.80	3813	30	16	9
238	Oak Hill Plaza	0	0	0	0	3557	0	N/A	0	30	16	8
239	Oak Hill	781	0	781	0	3554	8483	0.67	2127	9	4	2
301	Expo Center	8	0	8	0	3139	45	0.62	20	30	10	11
302	Colony Park Town Center	0	0	0	0	4419	0	N/A	0	95	34	38
303	Johnny Morris	0	0	0	0	4812	0	N/A	0	45	16	18
304	Purple Sage	0	0	0	0	4761	0	N/A	0	90	29	33
305	LBJ High School	0	0	0	0	4242	0	N/A	0	91	28	31
306	Delco Center	28	0	0	0	2466	158	0.60	109	38	11	13
307	Springdale Shopping Center	0	0	0	0	2132	0	N/A	0	56	18	19
308	Northeast	0	0	0	0	3148	0	N/A	0	137	44	50
309	Rogge	0	0	0	0	3075	0	0.80	7	142	49	59
310	51st Street	22	0	0	0	2700	175	0.54	116	115	42	55
311	Barbara Jordan	29	0	0	0	2176	0	0.62	0	10	4	5
312	Simond	87	0	0	0	7048	842	0.59	901	101	40	50
313	Alexander	33	0	0	0	8443	183	0.61	162	230	113	128
314	Lafayette	0	0	0	0	8287	0	0.80	6	769	400	473
315	Dean Keeton	0	0	0	0	8645	0	N/A	0	297	161	188
401	Four Points	0	0	0	0	0	1	N/A	0	1	0	0
402	Loop 360	0	0	0	0	3	0	N/A	0	12	6	9
403	Wildflower	0	0	0	0	0	0	N/A	0	12	4	5
501	Highland	0	0	0	0	7150	20	0.56	67	300	174	185

502	Clarkson	0	0	0	0	4364	0	N/A	0	404	237	247
503	Hancock	0	0	0	0	4155	0	N/A	0	221	136	136
504	St. David's	0	0	0	0	8058	0	N/A	0	234	131	147
505	Texas Memorial Stadium	0	0	0	0	9177	0	N/A	0	267	148	174
506	Medical School	0	0	0	0	10885	0	N/A	0	479	278	346
507	Capitol East	0	0	0	0	11450	0	N/A	0	638	378	482
508	Trinity	0	0	0	0	12971	0	N/A	0	610	362	473
601	Berkman	71	0	0	0	7397	205	0.56	51	207	86	103
602	Theo	7	0	7	0	8259	41	0.62	59	242	112	129
603	ACC Eastview	0	0	0	0	8291	0	N/A	0	277	115	128
604	Govalle	0	0	0	0	8996	0	0.40	1	531	241	256
605	Cesar Chavez	20	0	0	0	9674	284	0.64	166	663	271	298
606	Lakeshore Rapid	0	0	0	0	8866	8	0.80	2	61	22	27
607	Catalyst	187	0	187	0	7699	1038	0.51	423	92	33	38
608	Sheringham	64	0	64	0	11595	359	0.61	104	186	66	79
609	Oltorf East	0	0	0	0	12880	0	N/A	0	167	57	69
610	Iroquois	0	0	0	0	13922	0	N/A	0	196	66	80
611	Todd Lane	28	0	0	0	12565	158	0.58	39	196	65	79
612	St. Elmo	1493	0	1493	0	8206	8376	0.59	2806	29	9	11
613	Franklin Park	0	0	0	0	11242	0	N/A	0	130	38	46
614	Village Square	0	0	0	0	11125	0	N/A	0	156	44	53
615	Williamson Creek	0	0	0	0	10511	0	N/A	0	97	26	32
616	McKinney Falls	731	0	731	0	10703	4101	0.67	999	15	3	4
617	Goodnight	6253	0	6253	0	7791	35080	0.66	8918	11	0	1
701	North Lamar Transit Center Light Rail	0	0	0	0	5455	0	0.40	2	139	78	73
702	Crestview Light Rail	73	0	0	0	7591	360	0.62	198	363	196	206
703	Hyde Park	3	0	0	0	9683	18	0.56	6	1197	627	696

704	Hemphill Park	2	0	0	0	10794	12	0.55	-8	1417	730	846
705	UT/West Mall	0	0	0	0	12080	0	N/A	0	1224	638	748
706	Capitol West	6	0	0	0	12270	32	0.80	8	1203	682	868
707	Government Center	0	0	0	0	12585	0	N/A	0	949	556	758
708	Republic Square	0	0	0	0	12140	0	N/A	0	848	538	755
709	Downtown Station	0	0	0	0	12988	0	N/A	0	451	270	361
710	Rainey/MACC	0	0	0	0	11458	0	N/A	0	463	268	338
711	Waterfront	0	0	0	0	10038	0	N/A	0	202	107	134
712	Travis Heights	0	0	0	0	10658	0	N/A	0	1101	526	642
713	Lakeshore Light Rail	0	0	0	0	7562	0	0.55	134	550	234	274
714	Riverside	45	0	45	0	8569	254	0.54	57	59	21	24
715	Faro	40	0	40	0	12020	1881	0.59	751	540	192	243
716	Montopolis	603	0	603	0	8188	2889	0.62	1137	512	184	237
717	Metrocenter	1364	0	1364	0	5673	7832	0.53	2153	211	81	109
718	ABIA Terminal	0	0	0	0	2205	0	N/A	0	11	4	6
801	Koenig	0	0	0	0	7797	56	0.80	48	556	302	308
802	Triangle Station	0	0	0	0	8242	0	0.51	25	626	333	350
803	Auditorium Shores	0	0	0	0	10077	0	N/A	0	236	139	167
804	SoCo	0	0	0	0	9448	0	N/A	0	1422	776	886
805	Oltorf	0	0	0	0	7957	0	N/A	0	575	315	349
806	St. Edward's	11	0	0	0	6976	0	0.47	0	430	238	262
807	South Congress Transit Center Light Rail	855	0	855	0	5007	5154	0.60	2209	186	108	113
808	Stassney	0	0	0	0	801	186	0.62	143	178	91	59
901	Leander	0	0	0	0	1972	0	N/A	0	5	1	3
902	Lakeline	6728	0	6728	0	7853	46254	0.59	13827	29	4	11
903	Howard	2164	0	0	0	6394	16585	0.60	6021	101	29	56
904	Domain/Broadmoor	1096	0	1096	0	6470	7294	0.57	2311	28	9	24

905	McKalla	1596	0	1596	0	7705	10713	0.63	4589	57	28	55
906	Crestview Commuter Rail	112	0	0	0	6657	604	0.64	236	328	181	168
907	MLK Jr	6	0	0	0	9080	80	0.65	24	766	397	445
908	Plaza Saltillo	151	0	0	0	9433	881	0.62	478	1870	1151	1247
909	Downtown	13	0	0	0	11462	88	0.56	55	682	413	485
1001	Colony Park	0	0	0	0	3711	0	N/A	0	85	31	35
1002	Loyola	196	0	196	0	5585	1100	0.56	260	61	24	27
1003	East US 183	2889	0	2889	0	4627	18237	0.63	4734	107	48	55
1004	Springdale	46	0	0	0	7371	257	0.57	985	522	265	308
1005	Pleasant Valley	86	0	0	0	9070	312	0.61	162	447	217	234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Domain
Braker
McKalla
Rutland
North Ops
Crossroads
Walnut Forest
Masterson Pass
Rundberg
Ohlen
Loop 360
North Lamar Transit Center Light Rail
Northcross
North Lamar Transit Center Rapid
Crestview Commuter Rail
Fairfield
Crestview Light Rail
Allandale
Highland
Justin
North Loop
Koenig
Texas Health Commission
Triangle Station
Clarkson
Delco Center
Springdale Shopping Center
LBJ High School
Northeast
Purple Sage
Colony Park Town Center
Expo Center
Seton Medical Center
Rosedale
Hyde Park
Hemphill Park
Barbara Jordan
Rogge
51st Street
Hancock
Berkman
Simond
Colony Park
Loyola
Johnny Morris
Bee Cave
St. David's
Texas Memorial Stadium
24th St
UT/West Mall
Dean Keeton
Alexander
Theo
MLK Jr
Castle Hill
Government Center
Lafayette
Capitol West
Lamar
ACC Eastview
Lost Creek
Capitol East
Pease Park
Medical School
Auditorium Shores
Plaza Saltillo
Pleasant Valley
East US 183
Republic Square
Barton Springs
Lamar Square
Cesar Chavez
Springdale
Rainey/MACC
Trinity
Pleasant
Oltorf West
SoCo
Light Rail
Govalle
Broken Spoke
Travis Heights
Catalyst
Lakeshore Rapid
Montopolis
Oak Hill Plaza
Old Fredericksburg
Westgate
Waterfront
Riverside
West Gate Transit Center
Bluebonnet
Sheringham
Oak Hill
Brodie
South Congress Transit Center Light Rail
Montopolis
Monterey Oaks
Forest Oaks
Oltorf
Iroquois
Faro
Brodie Oaks
ACC South Austin
Todd Lane
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Wildflower
Dittmar
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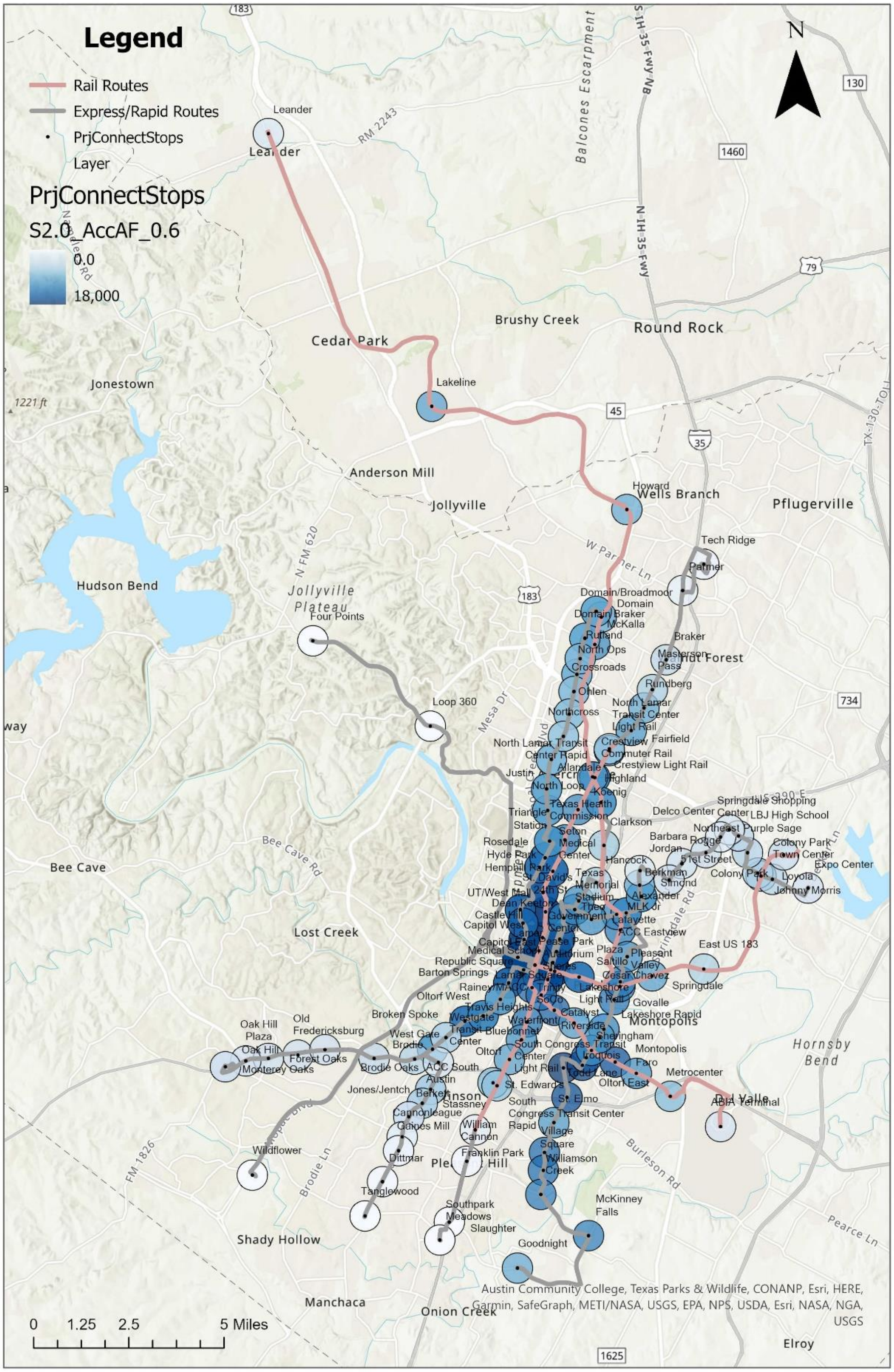
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Loop 360
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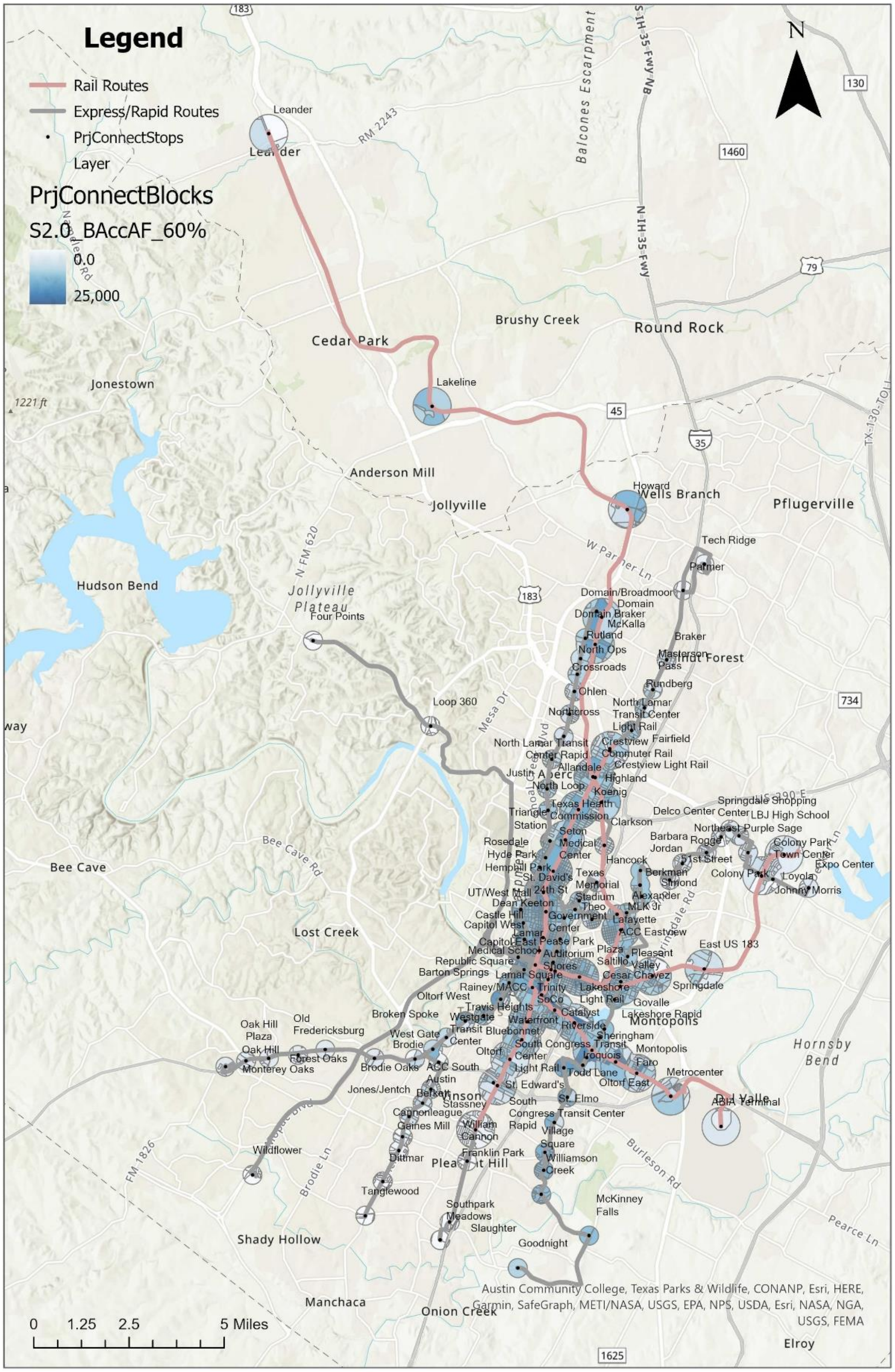
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McKalla
Rutland
North Ops
Crossroads
Ohlen
Northcross
Braker
Masterson Pass
Rundberg
North Lamar Transit Center Light Rail
North Lamar Transit Center Rapid
Crestview Commuter Rail
Crestview Light Rail
Fairfield
Allandale
Highland
Koenig
North Loop
Triangle Station
Texas Health Commission
Clarkson
Seton Medical Center
Rosedale
Hyde Park
Hemphill Park
St. David's
24th St
Texas Memorial Stadium
UT/West Mall
Dean Keeton
Castle Hill
Capitol West
Capitol East
Medical School
Republic Square
Barton Springs
Lamar Square
Rainey/MACC
Oltorf West
Travis Heights
Westgate
Transit Center
Waterfront
Bluebonnet
Riverside
Sheringham
South Congress Transit Center Light Rail
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Montopolis
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Gaines Mill
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Tanglewood
Wildflower
Jones/Jentch
Brodie Oaks
ACC South
West Gate
Brodie
Broken Spoke
Old Fredericksburg
Oak Hill Plaza
Oak Hill
Forest Oaks
Monterey Oaks
Four Points
Loop 360
Delco Center
Springdale Shopping Center
LBJ High School
Northeast
Purple Sage
Barbara Jordan
Rogge
51st Street
Colony Park Town Center
Expo Center
Colony Park
Loyola
Johnny Morris
Berkman
Simond
Hancock
Alexander
MLK Jr
Lafayette
ACC Eastview
Theo
Government Center
Lamar
Peace Park
Auditorium
Plaza Saltillo
Pleasant Valley
Cesar Chavez
Trinity
SoCo
Lakeshore Light Rail
Catalyst
Govalle
Lakeshore Rapid
East US 183
Springdale
Cedar Park
Brushy Creek
Round Rock
Jonestown
Anderson Mill
Jollyville
Wells Branch
Pflugerville
Hudson Bend
Jollyville Plateau
Bee Cave
Lost Creek
Montopolis
Hornsby Bend
Shady Hollow
Manchaca
Onion Creek
Elroy
Balcones Escarpment
RM 2243
W Parmer Ln
N FM 620
Mesa Dr
Bee Cave Rd
FM 1826
Brodie Ln
Burleson Rd
Pearce Ln
1221 ft

APPENDIX F. MAIXIMIZING THE SUSTAINABLE GOAL IN STOP LEVEL

ID	Stop Names	Housing					Value Increment	FAR Increment	Emissions Increment	Destination accessibility to		
		Total	Affordable Housing		Accessible Affordable Housing					Housing Stock	Commercial Service	Office Opportunity
			30%MFI	60%MFI	30%MFI	60%MFI						
101	Tech Ridge	572	572	572	572	1146	3206	1.00	692370	7	6	3
102	Parmer	0	0	0	572	1632	0	N/A	696152	25	20	13
103	Braker	0	0	0	572	4910	0	N/A	659308	92	60	46
104	Masterson Pass	0	0	0	572	6116	0	N/A	1119646	107	64	49
105	Rundberg	0	0	0	572	8888	0	N/A	826094	145	80	68
106	Fairfield	0	0	0	572	10094	0	1.00	652616	216	117	109
107	North Lamar Transit Center Rapid	0	0	0	245	6347	0	0.60	710522	93	53	43
108	South Congress Transit Center Rapid	0	0	0	0	8617	0	0.60	589115	220	121	130
109	William Cannon	0	0	0	0	363	0	0.60	491299	37	12	4
110	Slaughter	0	0	0	0	0	0	0.60	293627	3	8	0
111	Southpark Meadows	0	0	0	0	0	0	0.60	1294564	1	7	0
201	Domain	0	0	0	0	8475	407	N/A	1662094	29	13	45
202	Domain Braker	456	0	456	0	8296	2113	1.00	206955	17	9	20
203	Rutland	1178	0	1178	0	7088	4468	0.85	389077	22	12	21
204	North Ops	1149	0	1149	0	7633	8447	0.92	1085722	47	29	43
205	Crossroads	0	0	0	0	6641	0	N/A	803746	51	36	41

206	Ohlen	0	0	0	0	6593	0	N/A	715557	154	108	114
207	Northcross	0	0	0	0	6135	0	N/A	904535	72	55	48
208	Justin	0	0	0	0	7521	0	N/A	601996	191	130	121
209	Allandale	0	0	0	0	9021	0	N/A	440515	215	133	128
210	North Loop	0	0	0	0	9456	0	1.00	653191	226	133	128
211	Texas Health Commission	0	0	0	25	10648	0	N/A	229453	267	154	164
212	Rosedale	0	0	0	0	13327	0	N/A	307125	219	124	140
213	Seton Medical Center	0	0	0	66	13675	0	N/A	450243	408	220	255
214	24th St	0	0	0	0	14756	0	N/A	396176	493	244	300
215	Pease Park	0	0	0	0	14940	0	0.60	312523	376	191	240
216	Castle Hill	0	0	0	0	16404	0	0.73	252578	583	332	422
217	Lamar	62	0	0	0	16268	677	1.00	1275292	566	337	423
218	Seaholm	0	0	0	34	17166	0	N/A	689276	478	282	336
219	Barton Springs	0	0	0	0	15187	0	N/A	310611	401	242	274
220	Lamar Square	0	0	0	0	10531	0	N/A	1002850	303	183	195
221	Oltorf West	0	0	0	0	12865	0	N/A	408275	270	172	171
222	Bluebonnet	0	0	0	0	14100	0	N/A	274297	310	202	193
223	Broken Spoke	0	0	0	0	5502	0	N/A	1154003	56	38	32
224	Brodie Oaks	0	0	0	0	10966	0	N/A	537683	35	25	20
225	Westgate Transit Center	0	0	0	0	2727	0	N/A	385326	55	40	26
226	Jones/Jentch	0	0	0	0	6179	0	N/A	174951	152	100	72
227	ACC South Austin	0	0	0	0	5829	0	N/A	336912	84	55	38
228	Berkett	0	0	0	0	3541	0	N/A	88090	67	42	29
229	Cannonleague	0	0	0	0	1326	0	N/A	448364	68	43	27
230	Gaines Mill	2	0	2	0	493	11	0.61	145606	33	21	13
231	Dittmar	18	0	18	0	185	102	0.80	303942	80	52	29
232	Tanglewood	0	0	0	0	42	0	N/A	838803	19	19	8

233	West Gate	10	0	10	0	5393	56	0.60	547055	53	41	30
234	Brodie	0	0	0	0	4772	0	N/A	1551978	22	23	12
235	Monterey Oaks	42	0	0	0	3767	233	0.60	343514	11	9	7
236	Old Fredericksburg	0	0	0	0	3847	0	N/A	131629	38	28	21
237	Forest Oaks	3450	0	3450	0	3642	19357	1.00	828361	30	16	12
238	Oak Hill Plaza	0	0	0	0	3554	0	N/A	506250	28	16	12
239	Oak Hill	85	0	85	0	3558	1107	0.89	616203	7	4	5
301	Expo Center	0	0	0	0	4096	0	0.87	174631	31	10	11
302	Colony Park Town Center	0	0	0	0	5737	0	N/A	92860	99	34	39
303	Johnny Morris	0	0	0	0	6046	0	N/A	62763	47	16	19
304	Purple Sage	0	0	0	0	5832	0	N/A	142886	94	29	34
305	LBJ High School	0	0	0	0	5412	0	N/A	100997	95	27	31
306	Delco Center	42	0	0	0	3214	237	0.80	40681	39	11	13
307	Springdale Shopping Center	0	0	0	0	2908	0	N/A	281971	59	18	19
308	Northeast	0	0	0	0	4065	0	N/A	332348	144	44	50
309	Rogge	0	0	0	0	4095	0	1.00	275910	149	48	59
310	51st Street	0	0	0	0	4022	426	0.90	388100	122	41	55
311	Barbara Jordan	425	0	0	0	2663	0	0.82	26129	10	4	5
312	Simond	159	0	0	0	10819	3282	0.82	1187549	108	40	50
313	Alexander	117	0	0	0	12573	1411	1.29	375002	243	112	130
314	Lafayette	10	0	0	0	12442	58	2.00	200018	807	397	479
315	Dean Keeton	0	0	0	0	13131	0	N/A	163032	309	160	191
401	Four Points	0	0	0	0	0	0	N/A	150732	1	0	0
402	Loop 360	0	0	0	0	22	0	N/A	178381	12	6	9
403	Wildflower	0	0	0	0	0	0	N/A	94851	12	4	6
501	Highland	71	0	0	258	10484	456	1.05	1427305	317	172	194
502	Clarkson	0	0	0	0	7223	0	N/A	264902	420	236	251

503	Hancock	0	0	0	0	6371	0	N/A	826175	230	136	138
504	St. David's	0	0	0	0	12454	0	N/A	544832	243	131	149
505	Texas Memorial Stadium	0	0	0	0	13679	0	N/A	8251	278	147	177
506	Medical School	0	0	0	0	15135	0	N/A	88892	498	277	352
507	Capitol East	0	0	0	0	15729	0	N/A	965565	663	376	490
508	Trinity	0	0	0	0	17501	0	N/A	648106	634	360	481
601	Berkman	138	0	0	0	11221	771	1.23	177455	220	85	104
602	Theo	19	0	19	0	12230	104	1.50	336944	257	111	130
603	ACC Eastview	0	0	0	0	12545	0	N/A	139907	292	114	131
604	Govalle	0	0	0	0	13465	0	0.60	179987	558	239	264
605	Cesar Chavez	11	0	0	0	14345	59	1.20	285777	696	268	309
606	Lakeshore Rapid	0	0	0	0	13482	42	0.60	185133	64	22	28
607	Catalyst	223	0	223	0	11604	1209	1.02	1275692	95	33	39
608	Sheringham	115	0	115	0	16823	646	1.00	1509650	193	65	81
609	Oltorf East	0	0	0	0	19239	0	N/A	673654	173	57	71
610	Iroquois	0	0	0	0	20435	0	N/A	421997	205	66	82
611	Todd Lane	113	0	0	0	18604	0	0.76	248826	207	64	82
612	St. Elmo	2393	0	2393	0	12223	14060	1.04	707480	33	9	12
613	Franklin Park	0	0	0	0	16669	0	N/A	213929	140	37	47
614	Village Square	0	0	0	0	16445	0	N/A	138569	168	43	55
615	Williamson Creek	0	0	0	0	15421	0	N/A	52231	107	26	33
616	McKinney Falls	787	0	787	0	15331	4416	0.96	233016	17	3	4
617	Goodnight	9347	0	9347	0	11960	52439	0.94	1996179	15	0	1
701	North Lamar Transit Center Light Rail	0	0	0	393	8383	0	1.00	804165	144	78	76
702	Crestview Light Rail	159	0	0	490	11579	794	1.21	477163	379	194	215
703	Hyde Park	4	0	0	225	14208	24	0.74	572967	1234	623	714
704	Hemphill Park	5	0	0	234	15479	25	1.00	1178866	1461	726	866

705	UT/West Mall	0	0	0	255	16787	0	N/A	1328916	1262	635	764
706	Capitol West	0	0	0	152	16740	0	1.00	1059882	1244	679	885
707	Government Center	0	0	0	139	17001	0	N/A	756884	982	553	772
708	Republic Square	0	0	0	0	16532	0	N/A	1713354	878	536	767
709	Downtown Station	0	0	0	41	17449	0	N/A	1155443	469	269	367
710	Rainey/MACC	0	0	0	60	16203	0	N/A	1395993	481	267	344
711	Waterfront	0	0	0	0	14850	0	N/A	1166407	210	106	137
712	Travis Heights	0	0	0	0	15547	0	N/A	655861	1143	522	656
713	Lakeshore Light Rail	15	0	0	0	11135	82	0.95	1235665	571	232	282
714	Riverside	81	0	81	0	12853	455	1.02	612333	61	21	25
715	Faro	93	0	93	0	17959	3997	1.00	1189479	565	191	251
716	Montopolis	1224	0	1224	0	12260	5594	0.96	760078	541	182	245
717	Metrocenter	1503	0	1503	0	8456	8829	0.95	1902496	225	80	113
718	ABIA Terminal	0	0	0	0	3134	0	N/A	0	12	4	6
801	Koenig	0	0	0	340	11792	0	1.00	931100	576	300	319
802	Triangle Station	0	0	0	226	12270	0	2.00	430245	646	331	362
803	Auditorium Shores	0	0	0	0	14271	0	N/A	1538527	244	138	171
804	SoCo	0	0	0	0	13587	0	N/A	716521	1472	772	907
805	Oltorf	0	0	0	0	12017	0	N/A	931941	595	313	358
806	St. Edward's	17	0	0	0	10689	0	0.63	627451	446	237	269
807	South Congress Transit Center Light Rail	1732	0	1732	0	7928	10043	0.95	1496326	197	107	118
808	Stassney	72	0	0	0	1618	403	0.60	1577006	186	90	60
901	Leander	0	0	0	0	2664	0	N/A	0	7	1	3
902	Lakeline	7591	0	7591	0	9710	63689	0.86	2989376	43	2	17
903	Howard	2873	0	0	0	8602	23940	0.95	2578346	117	26	75
904	Domain/Broadmoor	1703	0	1703	0	9011	10044	0.81	2448493	32	8	25
905	McKalla	2698	0	2698	0	10669	17193	1.10	1419580	67	26	62

906	Crestview Commuter Rail	35	0	0	277	9921	237	0.95	916677	340	179	178
907	MLK Jr	11	0	0	0	13096	134	1.02	377918	809	393	456
908	Plaza Saltillo	354	0	0	0	13795	2239	1.36	1866456	1959	1143	1278
909	Downtown	38	0	0	0	15932	213	0.78	325644	712	410	494
1001	Colony Park	0	0	0	0	4814	0	N/A	326487	88	30	35
1002	Loyola	0	0	0	0	7710	0	0.60	135483	63	24	28
1003	East US 183	3587	0	3587	0	6547	20124	0.73	991871	113	48	57
1004	Springdale	295	0	0	0	11012	1654	0.97	558975	552	263	311
1005	Pleasant Valley	70	0	0	0	13553	395	0.93	225990	470	215	243


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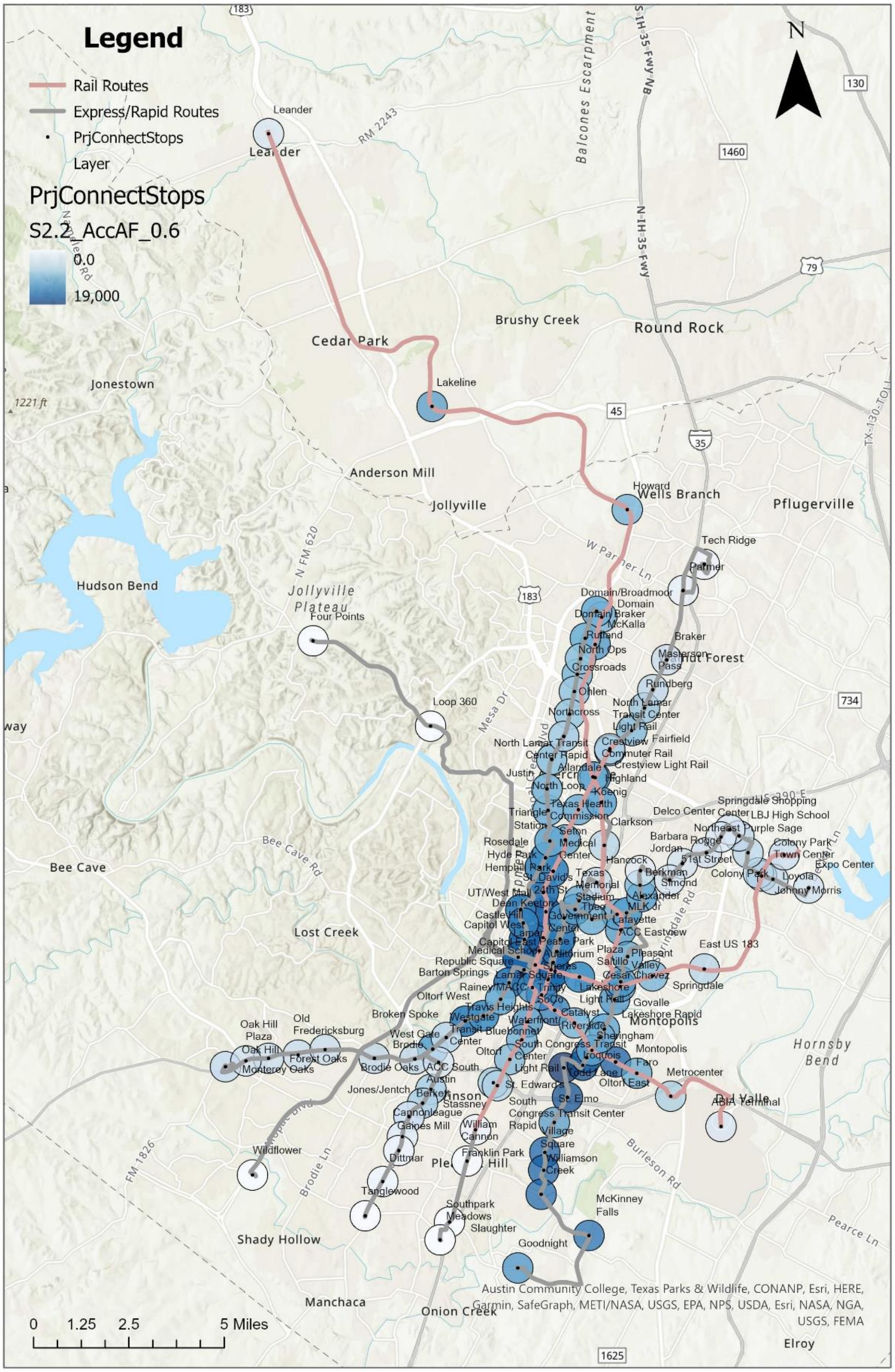
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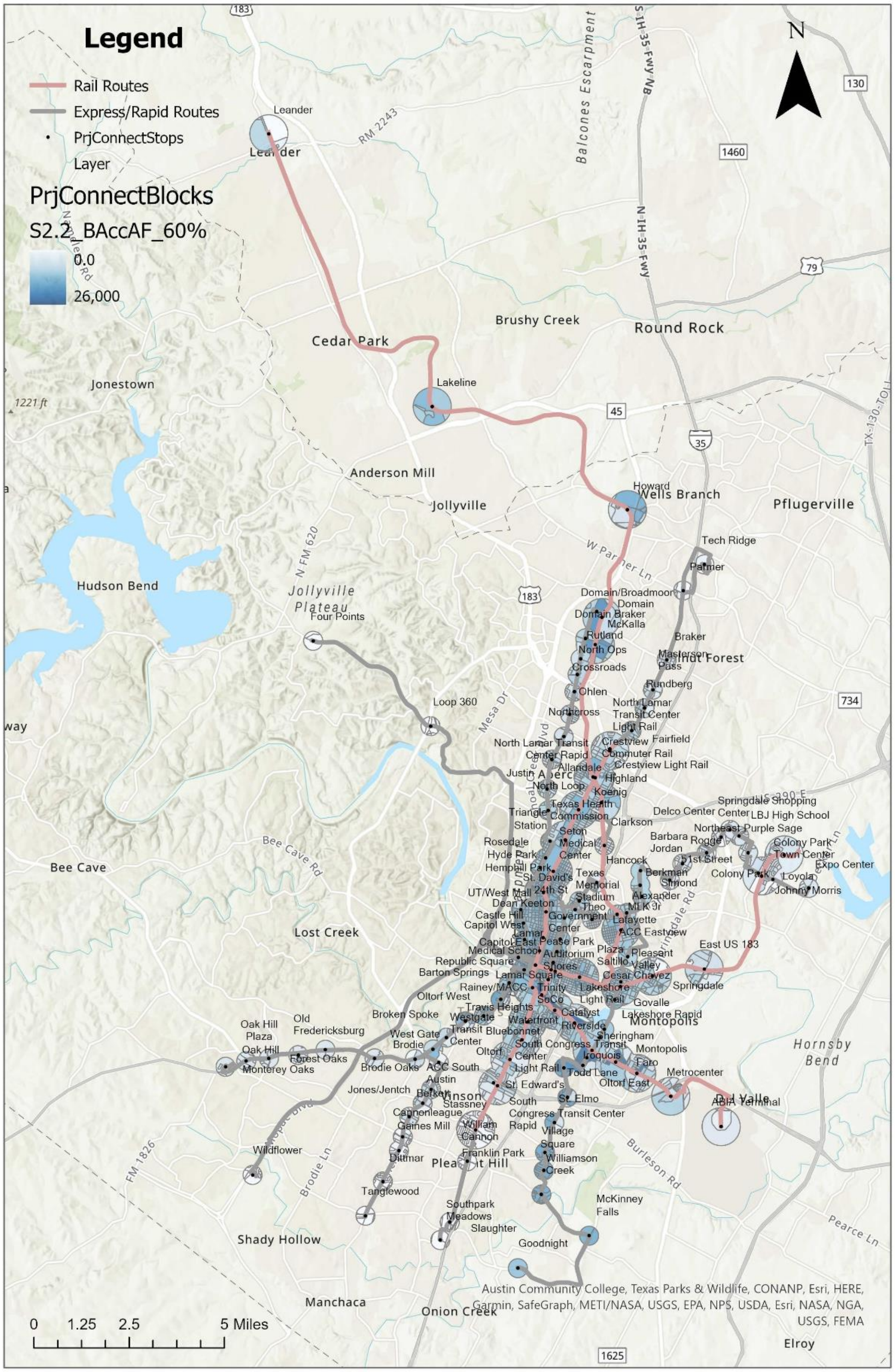
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