Commuter Rail Transit and Economic Development

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Abstract
Commuter rail transit (CRT) is a form of rail passenger service connecting downtowns and other major activity centers with suburban commuter towns and beyond. Between 1834 and 1973, only three public CRT systems were built in the U.S. serving New York, Chicago and then Boston. There are now 25 such systems. Modern CRT systems aim to expand economic development in metropolitan areas. But do they? Our paper evaluates the economic development performance of five modern CRT systems. We find that several economic sectors perform well within 0.50 miles of CRT stations. We offer planning and policy implications.

Introduction

There is scant empirical analysis of whether and the extent to which commuter rail stations are associated with economic development. Historically, commuter rail service connected distant suburbs with downtowns in the northeast and Great Lakes regions, serving mostly affluent business people working in downtowns. In recent years, commuter rail service has opened outside these older metropolitan areas. One implicit purpose of these systems is to generate economic development especially around commuter rail stations. In this paper we explore this connection for five commuter rail systems.

Commuter rail transit (CRT) is a form of rail passenger service connecting downtowns and other major activity centers with suburban commuter towns and beyond. CRT systems are passenger rail that occupies a niche between intercity rail and heavy rail metro systems. They serve lower-density suburbs by connecting them to downtowns, city centers, and other major activity centers. CRT systems usually have less frequent of service than heavy rail metro systems, often hourly, or just during peak commuting hours. Their service areas extend 10 to 100 miles from downtown, traveling at speeds from about 30 to more than 100 miles per hour. Due to these longer travel distances and travel times, they provide more seating options than light rail. They are typically not electrified, although portions may be. Although the use of tunnels is not unknown, they are typically not grade separated. They typically make use of existing railroad rights-of-way, and often share track with freight or intercity rail lines.

A number of privately-operated railroads have long provided commuter services. In *The Exurbanites*, August Spectorsky (1955) chronicled the lifestyles of families who lived in Bucks County, Pennsylvania but whose breadwinners commuted daily to work through New Jersey into midtown or downtown Manhattan via privately operated railroads. Amtrak now provides these longer-distance commuter services, notably between Boston and Washington, DC.

The nation's first public commuter rail service was launched in 1834. It was the Metropolitan Transit Authority's Long Island Rail Road connecting Long Island with Manhattan Island, New York. Nearly 70 years later, the nation's second public commuter rail service started (in 1903) connecting South Bend, Indiana with Chicago. It took nearly another 70 years (1973) before the nation's third public commuter rail service was launched, connecting Boston with its suburbs. Since 1983, another 22 public CRT systems have been initiated. Table 1 shows key features of all public systems in place as of 2013.

The Unexplored Connection between Commuter Rail Transit and Economic Development

Commuter Rail (CRT) is part of the family of fixed guide-way transit systems, which includes both rail and Bus Rapid Transit (BRT). Unlike regular buses, streetcars, or mixed traffic light rail, CRT belongs which is formally 'rapid' transit, which has exclusive right of way. Rapid transit systems only stop at stations. This family includes metro (subway) systems, elevated systems, and other third-rail systems. While there is extensive literature on the economic development effects of other fixed guide-way transit modes, there is little research on the effects of CRT systems.

Aside from making it more convenient for middle and high income earners to work downtown while keeping their families in the suburbs, CRT systems play a significant role in urban economic development by mitigating the one of the dis-economies of urban aggregation, namely transportation congestion. Yet the existing literature provides no explicit assessment of the role of CRT stations in economic development.

In this paper, we identify the nascent role of CRT as an economic development strategy for moderate and smaller metropolitan areas outside the densely developed areas of the Northeast and Midwest. We then identify five CRT systems in the South and West for analysis. We compare those systems in terms of change in jobs near the CRT stations as well as change in those areas' share of workers by low, middle, and higher wage brackets. We offer implications for the role of CRT in advancing economic development.

Agglomeration Economies, Automobile Dependency, and Fixed Guide-way Transit

In this section we review the role of agglomeration economies in economic development, assess how the advantages of agglomeration economies are undermined by automobile dependency, and summarize the role of fixed-guideway transit systems in recreating those economies.

Cities are formed and grow in large part by creating agglomeration economies (Glaeser 2011). Annas, Arnott and Small define the term as "the decline in average cost as more production occurs within a specified geographical area" (1998, p. 1427). As more firms in related sectors cluster together, costs of production fall as productivity increases. These economies can spill over into complementary sectors (Holmes 1999). Cities can become ever larger as economies of agglomeration are exploited (Ciccone and Hall 1996). Transportation improvements make it possible to reduce transportation times, increasing the size of market areas, increasing the effective size of industrial clusters. If cities get too large, however, transportation congestion may have a counter-productive force, encouraging the relocation of firms (Bogart 1998). Highway projects have been shown to induce this change in metropolitan form, and at a net cost to society (Boarnet 1997; Boarnet and Haughwout 2000). Because firm location follows residential relocation (Ganning and McCall 2012; Renkow and Hoover 2000), changes in firm location may not be temporally trackable to specific highway projects. If we presume the urban rent curve to be a proxy for accessibility, any transportation improvement having a metropolitan-area effect will shift the value surface of the land market. Thus, firm location in a metropolitan area is a sort of slow-motion equilibrium assignment process. In a static or stagnant economy, any transportation improvement will just shuffle jobs (and housing) around.

More recent research shows that the degree of suburbanization significantly varies within metropolitan regions, in accordance to both variation in the levels of population de-concentration drivers and due to sub-regional fixed effects (Ganning and McCall 2012). Thus, the preservation of and creation of new agglomeration economies within metropolitan regions varies tremendously and can be influenced by policy decisions.

A key role of transit is thus to mitigate transportation congestion effects of agglomeration. Voith (1998) characterizes public transit as essentially "noncongestible" and is best suited to sustaining agglomeration economies in downtowns and secondary activity centers, and along the corridors that connect them. Nonetheless, not all economic sectors benefit from agglomeration economies and/or density.

In part because of their role in facilitating agglomeration economies, there is a growing body of research showing that rail-based public transit enhances economic development (see Nelson et al. 2009). Transit improves accessibility between people and their destinations by reducing travel time relative to alternatives (Littman 2009). At the metropolitan scale, adding transit modes in built-up urban areas increases aggregate economic activity (Graham 2007). There is another aspect of agglomeration economies identified by Chapman and Noland (2011). Although transit systems can lead to higher density development by shifting new jobs and population to station areas, it could lead instead to the redistribution of existing development even in the absence of growth, as in the case of Detroit (Galster 2012).

Economic development can be measured in many ways. Our focus here is whether, and to what extent, there is a link between a specific form of transit, CRT, and employment changes. We are specifically concerned with the changes both the numbers and concentration of jobs. Theoretically, areas proximate to commuter rail stations should have much better accessibility. Commuter Rail systems tend to run parallel to major freeway corridors, and the main impetus for their construction tends to be mitigation congestion along parallel freeway corridors. By reducing the effects of congestion, CRT systems should abet the preservation of existing agglomeration economies and the creation of new ones. Without the diseconomies of congestion, existing employment clusters should continue to grow, and the relative concentration of employment within clusters served by a CRT should continue to increase.

A necessary caveat for this phenomenon to occur is fixed amount of urbanized area. While most metropolitan areas with commuter rail system are characterized by geographical and regulatory constraints to their expansion, they cannot be considered fixed. Thus, employment concentration near CRT stations may not always rise. In such cases, it is possible to assess the effect of proximity to a CRT station by determining if employment near the station grew faster than would be expected on the basis of general metropolitan growth and industry mix.

Secondly, we are concerned about which industries in which total employment or employment concentration increase. We know from recent work that not all firms benefit from transit. In their recent study of employment within one-half mile of transit stations serving 34 transit systems, Belzer, Srivastava and Austin (2011) found that while jobs increase in the arts, entertainment, and recreation sector as well as the food and accommodation, and health care and social assistance sectors, they fell in the manufacturing sector. They also found that public

administration had the greatest share of jobs found near transit stations. Several other sectors also concentrated around transit stations such as professional, scientific, and technical services, and retail. On the other hand, as a whole the station areas experienced declining shares of jobs relative to their regions, with the exception of jobs in the utilities, information, and the arts, entertainment, and recreation sectors. Belzer, Srivastava and Austin surmised that much of the metropolitan job growth continues to favor auto-oriented locations. Their study did not report results for individual systems or even types of systems. Also, with a study period from 2002 to 2008, it did not include the Great Recession. In sum, there is no research directly linking CRT to economic development. We aim to close this gap in literature.

Research Question

Fixed-guideway transit systems generally should capture a higher share of jobs in certain economic sectors than the metropolitan area as a whole (Belzer, Srivvastava & Austin 2011). Whether this applies to CRT as well is unknown. Our research question is simple:

Do public commuter rail stations capture proportionately more jobs in certain sectors than the metropolitan area as a whole over time?

We mean the term "capture" to mean the share of total jobs, and jobs by 2-digit NAICS sectors, that are within 0.25 and 0.50 mile of a CRT station, and whether that share changes from the beginning of the study period (2002) to the end (2011). We elaborate on this below.

Research Design

Given that the employment capture rate and change in rate over time is our principal concern we choose descriptive and economic base (location quotient and shift-share) analysis approaches. Descriptive analysis was used to compare jobs by 2-digit NAICS sector in the base year (2002) to the most recent year for which data are available (2011). Location quotients are used to calculate industry-specific capture rates at the beginning and ending years of analysis. Shift-share analysis is used to estimate the sources of those changes in capture over time??. We want to see whether there are intra-metropolitan shifts in the share of jobs by sector our region in the metropolitan area itself.

Method

We will first report absolute shares of jobs within 0.25 and 0.50 mile of CRT stations in 2002 and compare those shares in 2011. We will then report location quotients (LQ) for each year, again comparing changes over time. LQ analysis allows us to decompose changes in shares of jobs between transit and control corridors during the same time period. This has the advantage of identifying economic sectors that are attracted to, or repelled by, transit corridors during economic shocks and recovery.

LQs are calculated as the share of jobs in one economic sector compared to (divided by) all jobs in that small area as the numerator, compared to (divided by) the share of all jobs in a larger area compared to (divided by) all jobs in that area as the denominator.[1] They are an efficient way to assess concentrated a particular economic sector is in a region compared to other sectors, and compared to other parts of the same region such as transit and control corridors in our study.

LQs for economic sectors quantifying how "concentrated" the sector is in the smaller area compared to the larger one. Because they can be measured at any given point in time, changes in LQs can identify emerging or lagging economic activity in a specific sector of a smaller area relative the larger one, again in our case transit and control corridors compared to the metropolitan area as a whole. LQs can be considered a measure of the capture rate in a given sector so that LQs >1.0 indicate local advantage in attracting jobs. Over time, as LQs rise or fall, analysis can detect growing or declining attractiveness of the smaller area. In our case, if transit corridor LQs rise in some sectors over time such would indicate growing attractiveness of the corridor for new economic activity.

Third, we will use shift-share analysis to conclude our study. The first two techniques are straight-forward.

Shift-share analysis assigns the change or shift in the number of jobs with respect to the region, other economic sectors, and the local area. The "region" can be any level of geography and is often the nation or the state. In our case, the region is the Metropolitan Area.

The 'local" area is often a city or county or even state but it can be any geographic unit that is smaller than the region. Our local areas are the station areas within 0.25 miles and between 0.25 and 0.50 miles of the nearest CRT station. We call this the CRT station area. As shifts in the share of jobs may vary by sector over time because of changes in economic sector mixes there is also an "industry mix" adjustment that we call "sector mix".

Adapting notations by the Carnegie Mellon Center for Economic Development (no date), the shift-share formula is:

$$SS_i = MA_i + SM_i + CRT_i$$

Where

SS_i = Shift-Share
MA_i = Metropolitan Area share
SM_i = Sector Mix
CRT_i = CRT station area shift

The Metropolitan Area (MA) share measures by how much total employment in a CRT station area changed because of change in the metropolitan area economy during the period of analysis. If metropolitan area employment grew by 10 percent during the analysis period, then employment in the CRT station area would have also grown by 10 percent. The Sector Mix (SM) identifies fast growing or slow growing economic sectors in a CRT station area based on the metropolitan area growth rates for the individual economic sectors. For instance, a CRT station area with an above-average share of the metropolitan area's high-growth sectors would have grown faster than a CRT station area with a high share of low-growth sectors. The CRT station area shift, also called the "competitive effect", is the most relevant component. It identifies a the portion of the change in jobs attributable to characteristics of the local area (station area). A leading sector is one where that sector's CRT station area growth rate is greater than its metropolitan area growth rate. A lagging sector is one where the sector's BRT station area growth rate is less than its metropolitan area growth rate.

The equations for each component of the shift-share analysis are:

$MA = ({}_iCRT\ station\ area_{t-1} \bullet MA_t / MA_{t-1})$;

$SM = [({}_iCRT\ station\ area_{t-1} \bullet {}_iMA_t / {}_iMA_{t-1}) - MA]$; and

$CRT = [{}_iCRT\ station\ area_{t-1} \bullet ({}_iBRT\ station\ area_t / {}_iBRT\ station\ area_{t-1} - {}_iMA_t / {}_iMA_{t-1})]$.

Where:

${}_iCRT\ station\ area_{t-1}$ = number of jobs in the CRT station area sector (i) at the beginning of the analysis period (t-1);

${}_iCRT\ station\ area_t$ = number of jobs in the CRT station area in sector (i) at the end of the analysis period (t);

MA_{t-1} = total number of jobs in the metropolitan area at the beginning of the analysis period (t-1);

MA_t = total number of jobs in the metropolitan area at the end of the analysis period (t);

${}_iMA_{t-1}$ = number of jobs in the metropolitan area in sector (i) at the beginning of the analysis period (t-1); and

${}_iMA_t$ = number of jobs in the metropolitan area in sector (i) at the end of the analysis period (t).

Study Areas

We selected all five CRT systems that were in the South and West, not in one of the top 10 largest combined statistical areas, and having more than one million riders in 2013 (see Table 1). They include Albuquerque, Miami, Salt Lake City, San Diego and Seattle. Key features of each study area follow.

Rail Runner

The RailRunner runs along a 97 mile corridor from Santa Fe to Albuquerque and south to Belen (see Figure 1). It began with 3 stations in 2006 and was expanded to 13 stations by 2013. It was developed as part of an ongoing project to connect Albuquerque with Santa Fe and relieve congestion along I-25, and almost more of a regional rail system than a commuter rail, requiring over two hours of travel from one end to the other. It makes use of existing freight rail right of way, and consists largely of single track with passing sidings.

Tri-Rail

This study examines Miami-Dade commuter rail system, Tri-Rail, a heavy rail rapid transit system. Opened in 1984, it had 70 miles of track along a freight rail corridor with 19 park and ride stations. The corridor was intended as congestion relief for the parallel I-95 corridor. It has gradually added several additional stations over the past few years. As a commuter rail system, its length is extensive as it connects multiple metropolitan areas running along the narrow strip of land between the Atlantic Ocean and Lake Okeechobee (see Figure 2).

FrontRunner

The Utah Transit Authority's Front Runner commuter rail system started operations in 2008. It has since been extended to almost double its length. Only the initial segment between downtown

Ogden and downtown Salt Lake City is used in our analysis. The study corridor has 8 stations along 42 miles of track. The corridor was intended as congestion relief for the parallel I-15 corridor. As seen in Figure 3, the FrontRunner runs down the spine of a long, narrow metropolitan area.

Coaster

The Coaster is a commuter rail service that operates in the central and northern coastal regions of San Diego County, California. The service is operated by TransitAmerica Services through a contract with North County Transit District (NCTD). The Coaster has 8 stations along 41 miles of track. Its route is shown in Figure 4.

Sounder

Sounder commuter rail is a regional rail service operated by the Burlington Northern-Santa Fe Railroad on behalf of Sound Transit serving the greater Seattle metropolitan area. Service began in 2000 and by 2013 it had 9 stations along 80 miles of track. The corridor was intended as congestion relief for the parallel I-5 corridor between Everett and Seattle. Its service area runs the narrow urbanized land area is between the Cascade Mountains and Puget Sound, as seen in Figure 5.

Data

We use data from the Longitudinal Employer-Household Dynamics (LEHD) program which is a venture of the Center for Economic Studies and the Census Bureau. The data offers public-use information combining federal, state and Census Bureau data on employers and employees under the Local Employment Dynamics (LED) Partnership. With the exception of Massachusetts, all states and the District of Columbia participate in the LED Partnership. As we are interested in employment data, the LEHD provides census block level employment at the 2-digit level of the North American Industrial Classification System (NAICS). However, we consider only those jobs that normally require space to occupy; as such, we do not include the natural resources (NAICS 11 and 21) or construction (NAICS 23) sectors.[2]

For all metropolitan areas included in our analysis, such data are available from 2002 through 2011, a span of 10 years. For each system we use figures for 2002 and 2011. This provides for consistency in data analysis while also aiding in interpreting results, as will be seen next. In the case of the Rail Runner and FrontRunner systems, which are the newest and started operations after 2002, those systems were planned if not under construction in 2002 or shortly thereafter.

Economic Development Outcomes

In this section we assess economic development performance in terms of descriptive changes, capture-rate changes, and shift-share outcomes over the study period for all five CRT systems combined.

Descriptive Changes

Table 2 reports the change and percent change in jobs for the selected CRT systems within 0.25 mile, within 0.50 mile and between 0.25 and 0.50 mile of CRT stations over the period 2002 through 2011. It also reports those sectors that grew or declined for all 34 systems studied by

Belzer, Srivastava and Austin for the period 2002 through 2008; we use their analysis to compare and contrast CRT outcomes.

For the area within 0.25 mile of CRT stations, total employment remained about the same yet employment in several sectors grew especially Utilities, Transportation and Warehousing, and Arts, Entertainment and Recreation. The outcome for the first group of sectors is sensible as CRT systems largely use existing freight lines. We are perplexed by the outcome for Arts, Entertainment and Recreation. Out to 0.50 miles total employment grew. With one exception (Arts, Entertainment and Recreation) all sectors that grew within 0.25 mile also grew out to 0.50 mile along with several others, notably the Real Estate, Management, Administrative, Health and Social Services, and Public Administration sectors.

While much if not all the literature on TODs focuses on the first 0.50 mile from transit stations, our analysis allows for differentiation the first and next 0.25 mile. For the band between 0.25 and 0.50 mile, Table 2 shows substantial job growth overall as well as in several sectors.

These results are very different from those found by Belzer, Srivastava and Austin for 34 transit systems between 2002 and 2008. Their analysis showed growth in only the Utilities, Information, and Arts, Entertainment and Recreation sectors. While they do not report the figures, we deduce they also found a considerable reduction in total jobs. As their analysis included 2008, the first full year of the Great Recession, much of those losses may be attributable to layoffs especially in the Manufacturing sector and to a lesser extent in the Education sectors. Nonetheless, for the five CRT systems we analyzed, job gains were evident in about half the sectors with overall job gains between 0.25 and 0.50 miles.

Changes in Capture Rates

Job gains, or losses, however can mask an important economic development consideration: Capture rates. That is, to what extent do CRT stations' rate of capturing jobs in any given sector for a given year and change over time? This can also be called "leakage" or "capture" analysis. If LQ falls over time in a given economic sector, the implication is that jobs are relocating to other places and thus "leaking". If LQ increases over it is an indication that the local area is attracting more of those jobs in a given economic sector than the broader region.

In Table 3, we see that within the first 0.25 mile of a CRT station, more than half the sectors – 10 of 17 – saw a gain in share of the metropolitan area's jobs. In contrast, only six sectors experience a gain over the next 0.25 mile. However, between 0.25 and 0.50 mile, two sectors gained share that did not also gain share within 0.25 mile. In other words, within 0.50 mile of CRT stations, nearly three-quarters (12 of 17) of the economic sectors saw gains in job capture relative to metropolitan area jobs.

Shift-Share

To what extent can CRT stations themselves be considered an advantage in economic location? For this we turn to shift-share analysis, the results of which are reported in Table 4 for the first 0.25 mile and Table 5 for the next 0.25 mile. Before we proceed with interpretations, we caution that shift-share analysis does not demonstrate cause-and-effect between job formation and CRT station proximity.

For the most part, shift-share analysis does not ascribe many regional shifts of jobs necessarily to CRT stations; indeed, fewer sectors show positive shift-share outcomes over time than the analysis of change in capture rates. One reason is that metropolitan-scale job markets are much larger, offering many times more location options for firms than CRT stations. For instance, with a radius of 0.50 miles all the CRT station areas included in our analysis sum to just 50 square miles where the urbanized land area of the five metropolitan areas within which they are located exceed 2,000 square miles. Moreover, individual economic sectors are also much larger than firms in those sectors located within CRT station areas. For instance, while CRT station areas gained relative share of jobs in Utilities between 2002 and 2011 – seeing a relative shift of 269 of the 457 or nearly 60 percent of the jobs created; yet because of its sheer size the metropolitan areas as a whole accounted for more than 26,000 jobs in that sector or 60 times more than CRT station areas captured in 2011.

Nonetheless, shift-share analysis provides further insights into CRT station area attractiveness. Within the first 0.25 mile, the CRT advantage was attractive to the Utilities, Management and Administrative sectors while for the next 0.25 mile the Transportation/Warehousing and Real Estate sectors were added. These are also sectors that gained in share of jobs within CRT station areas between 2002 and 2011.

Policy Implications for Economic Development

There is very little analysis of the association between commuter rail transit stations and economic development. Our work helps close this gap but more analysis is needed to establish cause-and-effect relationships. Nonetheless, we deduce from shift-share analysis that these sectors appear especially attracted to CRT station areas within the first 0.25 mile:

- Utilities
- Wholesale Trade
- Management
- Administrative
- Education Services
- Arts, Entertainment and Recreation

While, with some overlap, these sectors are attracted to the next 0.25 mile:

- Utilities
- Transportation/Warehousing
- Real Estate
- Management
- Administrative

Based on our analysis of changes in capture rates over time, these additional sectors may be attracted to CRT station areas within the first 0.25 mile

- Transportation/Warehousing
- Finance, Insurance

Accommodation, Food Service
Other Services

And these may be attracted to the next 0.25 mile, with some overlap:

Transportation/Warehousing
Health, Social Services

We also suspect that for the most part commuter rail transit is not seen as an economic development investment per se. In the past, CRT's role has chiefly been in transporting mostly while-collar, upper-middle and affluent workers to downtowns of large metropolitan areas. Those workers may have held their jobs in downtown anyway so there would thus not be much of an economic development relationship with CRT. On the other hand, CRT facilitated the rise of suburban and exurban developments accessible to CTR stations.

From an economic perspective, CRT systems facilitate the continued growth of existing high-density employment centers by mitigating the negative agglomeration effects of congestion. CRT and related other forms of fixed guideway investments can sustain the growth of centers leading to a virtuous cycle where increased transportation expenditures mitigate the effect of congestion, which makes more agglomeration possible, and which may provide the political will for other rounds of transit infrastructure.

We also note that all the CRT systems we studied serve linear corridors. Miami, San Diego and Seattle serve coastal areas hemmed in by mountains and/or water bodies. Salt Lake is hemmed in by two mountain ranges and a large water body. The Rail Runner is also hemmed in by public and tribal ownerships. For these metropolitan areas, using CRT may be more important than other metropolitan areas to help sustain economies of agglomeration.

Our research of all five CRT systems operating in the South and West, outside of the 10 largest CSAs and serving more than one million passengers in 2013 finds that CRT stations may be attractive to a large range of economic sectors. Indeed, we suspect there are important opportunities for expanding economic activity around many of these stations. For instance, during our study period, the newest of these CRT systems, FrontRunner, served only one major employment center – downtown Salt Lake City. Once arriving in downtown, numerous job opportunities exist within a half-mile walk but many more exist by connecting directly to the TRAX light rail line which serves the CRT station. At the northern terminus, FrontRunner serves Ogden but because the job centers are quite distant from the station with little bus service, that station is used mostly as a park-and-ride facility. Between Ogden and Salt Lake City, the Farmington CRT station is exclusively a park-and-ride facility. Important long-term economic development opportunities would seem to exist at these and other FrontRunner CRT stations.

As our research reveals that several economic sectors perform well within 0.50 miles of CRT stations. We recommend that planners consider unlocking the economic development potential of all CRT stations throughout CRT networks, not just the high-density destinations they may have been initially designed to serve.

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Table 1
U.S. Commuter Rail Systems, 2003

Rank	System	Major cities served	Annual Ridership (2013)	Ave. Weekday Ridership (Q4 2013)	Route miles	Ridership per mile (Q4 2013)	Lines	Stations	Year Opened
1	MTA Long Island Rail Road	New York	97,090,300	334,100	335.9	994.6	11	124	1834
2	MTA Metro-North Railroad	New York	83,326,200	298,700	329.6	777.9	5	121	1983
3	New Jersey Transit Rail	New York / Philadelphia	81,942,000	302,500	398.2	758.4	11	164	1983
4	Metra	Chicago	73,603,100	292,600	487.7	600.0	11	241	1984
5	SEPTA Regional Rail	Philadelphia	36,532,900	130,900	280.0	467.5	13	153	1983
6	MBTA Commuter Rail	Boston	34,865,700	124,400	368.0	338.0	13	127	1973
7	Caltrain	San Francisco / San Jose	16,294,900	50,800	77.0	659.7	1	32	1987
8	Metrolink	Los Angeles / San Bernardino	11,543,600	40,800	388.0	105.2	7	55	1992
9	MARC Train	Baltimore / Washington, D.C.	9,147,000	34,100	187.0	182.4	3	43	1984
10	Virginia Railway Express	Washington, D.C.	4,520,600	15,900	90.0	138.7	2	18	1992
11	Tri-Rail	Miami	4,351,000	14,800	70.9	208.7	1	18	1987
12	UTA FrontRunner	Salt Lake City / Ogden / Provo	3,800,400	14,700	88.0	167.0	1	16	2008
13	NICTD South Shore Line	Chicago / South Bend	3,606,800	11,600	90.0	128.9	1	20	1903
14	Sounder Commuter Rail	Seattle / Tacoma	3,035,500	11,900	80.0	148.8	2	9	2000
15	Trinity Railway Express	Dallas / Fort Worth	2,144,900	8,000	34.0	235.3	1	10	1996
16	NCTD Coaster	San Diego / Oceanside	1,689,200	5,200	41.0	126.8	1	8	1995
17	Capitol Corridor	San Jose / Oakland / Sacramento	1,615,400	4,300	168.0	25.6	1	15	1991
18	New Mexico Rail Runner Express	Albuquerque	1,082,400	3,500	97.0	36.1	1	13	2006
19	Altamont Corridor Express (ACE)	San Jose / Stockton	1,019,700	4,100	86.0	47.7	1	10	1998
20	Capital MetroRail	Austin	817,300	2,400	32.0	75.0	1	9	2010
21	Northstar Line	Minneapolis	787,300	2,500	40.0	62.5	1	6	2009
22	Shore Line East	New Haven	658,000	2,200	59.0	37.3	1	13	1990
23	A-Train	Denton	521,700	2,000	21.0	95.2	1	6	2011
24	Westside Express Service	Beaverton	478,600	2,000	15.0	133.3	1	5	2010
25	Music City Star	Nashville	245,900	900	32.0	28.1	1	6	2006

Total	474,720,400	1,714,900	3,895	6,579	1,242

Source: Adapted from http://en.wikipedia.org/wiki/List_of_United_States_commuter_rail_systems_by_ridership

Table 2
Job Change by 2-Digit NAICS Sector by CRT Station Distance Band, 2002-2011

Sector	CRT Change within 0.25 Mile 2002-2011	CRT Percent Change within 0.25 Mile 2002-2011	CRT Change within 0.25 Mile 2002-2011	CRT Percent Change within 0.50 Mile 2002-2011	CRT Change 0.25-0.50 Mile 2002-2011	CRT Percent Change 0.25-0.50 Mile 2002-2011	Growth or Decline 2002-2008 Among all Fixed Guideway Systems[a]
Utilities	269	**163%**	666	**17%**	397	**11%**	**Growth**
Manufacturing	(1,921)	-41%	(6,141)	-40%	(4,220)	-39%	*Decline*
Wholesale	292	**10%**	(27)	-0%	(319)	-4%	*Decline*
Retail	(656)	-14%	(3,006)	-17%	(2,350)	-17%	*Decline*
Trans/Warehousing	1,445	**75%**	1,722	**19%**	277	**4%**	*Decline*
Information	(1,531)	-49%	(5,498)	-39%	(3,967)	-36%	**Growth**
Finance, Insurance	(132)	-5%	(1,101)	-12%	(969)	-14%	*Decline*
Real Estate	(514)	-31%	1,518	**38%**	2,032	**88%**	*Decline*
Prof., Sci, Tech	(108)	-2%	1,641	**7%**	1,749	**10%**	*Decline*
Management	125	**11%**	1,568	**70%**	1,443	**126%**	*Decline*
Administrative	651	**22%**	2,367	**18%**	1,716	**17%**	*Decline*
Education	320	**9%**	(1,924)	-21%	(2,244)	-39%	*Decline*
Health, Social	(502)	-13%	5,320	**39%**	5,822	**61%**	*Decline*
Arts, Ent., Rec	177	**25%**	(315)	-5%	(492)	-9%	**Growth**
Accomm, Food	378	**6%**	854	**4%**	476	**3%**	*Decline*
Other Services	41	**2%**	69	**1%**	28	**1%**	*Decline*
Public Admin	574	**9%**	12,902	**21%**	12,328	**22%**	*Decline*
Total	(1,092)	-2%	10,615	**4%**	11,707	**6%**	*Decline*

a. Adapted from Belzer, Srivastava and Austin (2011).
Note: Sectors that grew around CRT station areas highlighted in bold.
Source: Data from LEHD. Data exclude natural resources and construction sectors.

Table 3
Location Quotients by 2-Digit NAICS Sector by CRT Station Distance Band, 2002-2011

Sector	LQ CRT Jobs within 0.25 mile Jobs 2002	LQ CRT Jobs within 0.25 mile Jobs 2011	LQ Gain or Loss within 0.25 mile 2002-2011	LQ CRT Jobs 0.25-0.50 mile Jobs 2002	LQ CRT Jobs 0.25-0.50 mile Jobs 2012	LQ Gain or Loss 0.25-0.50 mile 2002-2011
Utilities	0.63	1.81	**Gain**	4.23	4.76	**Gain**
Manufacturing	0.89	0.67	Loss	0.61	0.44	Loss
Wholesale	0.93	1.09	**Gain**	0.79	0.75	Loss
Retail	0.64	0.56	Loss	0.58	0.45	Loss
Trans/Warehousing	0.85	1.68	**Gain**	0.91	0.99	**Gain**
Information	1.38	0.83	Loss	1.46	1.02	Loss
Finance, Insurance	1.06	1.12	**Gain**	0.75	0.66	Loss
Real Estate	1.24	1.00	Loss	0.51	1.03	**Gain**
Prof., Sci, Tech	1.62	1.50	Loss	1.24	1.18	Loss
Management	1.16	1.43	**Gain**	0.36	0.84	**Gain**
Administrative	0.74	0.95	**Gain**	0.77	0.87	**Gain**
Education	0.65	0.73	**Gain**	0.33	0.19	Loss
Health, Social	0.62	0.46	Loss	0.45	0.56	**Gain**
Arts, Ent., Rec	0.56	0.69	**Gain**	1.30	1.07	Loss
Accomm, Food	1.32	1.37	**Gain**	0.82	0.77	Loss
Other Services	0.98	1.01	**Gain**	0.68	0.64	Loss
Public Admin	2.54	2.39	Loss	6.60	6.43	Loss

Source: Data from LEHD.

Table 4
Shift-Share Analysis with Respect to 0.25 Mile from CRT Stations, 2002-2011

Sector	CRT 2002	CRT 2011	MSA 2002	MSA 2011	Metropolitan Area Share	Industry Mix	CRT Advantage
Utilities	165	434	25,588	26,045	150	18	**266**
Manufacturing	4,682	2,761	510,933	446,468	4,259	(168)	(1,330)
Wholesale	2,856	3,148	299,692	314,026	2,598	394	**155**
Retail	4,535	3,879	683,883	755,159	4,126	882	(1,129)
Trans/Warehousing	1,935	3,380	221,190	218,494	1,760	151	1,469
Information	3,123	1,592	220,314	208,150	2,841	109	(1,359)
Finance, Insurance	2,855	2,723	260,446	263,702	2,597	293	(168)
Real Estate	1,682	1,168	131,799	127,427	1,530	96	(458)
Prof., Sci, Tech	6,845	6,737	410,442	489,427	6,227	1,935	(1,425)
Management	1,100	1,225	91,727	93,331	1,001	119	**106**
Administrative	2,978	3,629	392,193	417,573	2,709	462	**458**
Education	3,477	3,797	521,892	566,754	3,163	613	**21**
Health, Social	3,987	3,485	619,885	820,876	3,627	1,653	(1,795)
Arts, Ent., Rec	695	872	119,630	137,550	632	167	**73**
Accomm, Food	6,730	7,108	493,243	563,762	6,123	1,570	(584)
Other Services	2,206	2,247	217,810	241,163	2,007	436	(196)
Public Admin	6,466	7,040	246,823	320,029	5,882	2,501	(1,344)
Total	56,317	55,225	5,467,490	6,009,936	51,234	11,230	(7,239)

Source: Data from LEHD.

Table 5
Shift-Share Analysis with Respect to 0.25-0.50 Mile from CRT Stations, 2002-2011

Sector	CRT 2002	CRT 2011	MSA 2002	MSA 2011	Metropolitan Area Share	Industry Mix	CRT Advantage
Utilities	3,709	4,106	25,588	26,045	3,374	401	**331**
Manufacturing	10,716	6,496	510,933	446,468	9,749	(385)	(2,868)
Wholesale	8,099	7,780	299,692	314,026	7,368	1,118	(706)
Retail	13,524	11,174	683,883	755,159	12,303	2,630	(3,760)
Trans/Warehousing	6,922	7,199	221,190	218,494	6,297	540	**361**
Information	10,990	7,023	220,314	208,150	9,998	385	(3,360)
Finance, Insurance	6,703	5,734	260,446	263,702	6,098	689	(1,053)
Real Estate	2,322	4,354	131,799	127,427	2,112	133	**2,109**
Prof., Sci, Tech	17,436	19,185	410,442	489,427	15,862	4,929	(1,606)
Management	1,141	2,584	91,727	93,331	1,038	123	**1,423**
Administrative	10,324	12,040	392,193	417,573	9,392	1,600	**1,048**
Education	5,813	3,569	521,892	566,754	5,288	1,024	(2,744)
Health, Social	9,498	15,320	619,885	820,876	8,641	3,937	**2,742**
Arts, Ent., Rec	5,346	4,854	119,630	137,550	4,863	1,283	(1,293)
Accomm, Food	13,826	14,302	493,243	563,762	12,578	3,225	(1,501)
Other Services	5,109	5,137	217,810	241,163	4,648	1,009	(520)
Public Admin	55,847	68,175	246,823	320,029	50,806	21,604	(4,236)
Total	187,325	199,032	5,467,490	6,009,936	170,417	44,246	(15,632)

Source: Data from LEHD.

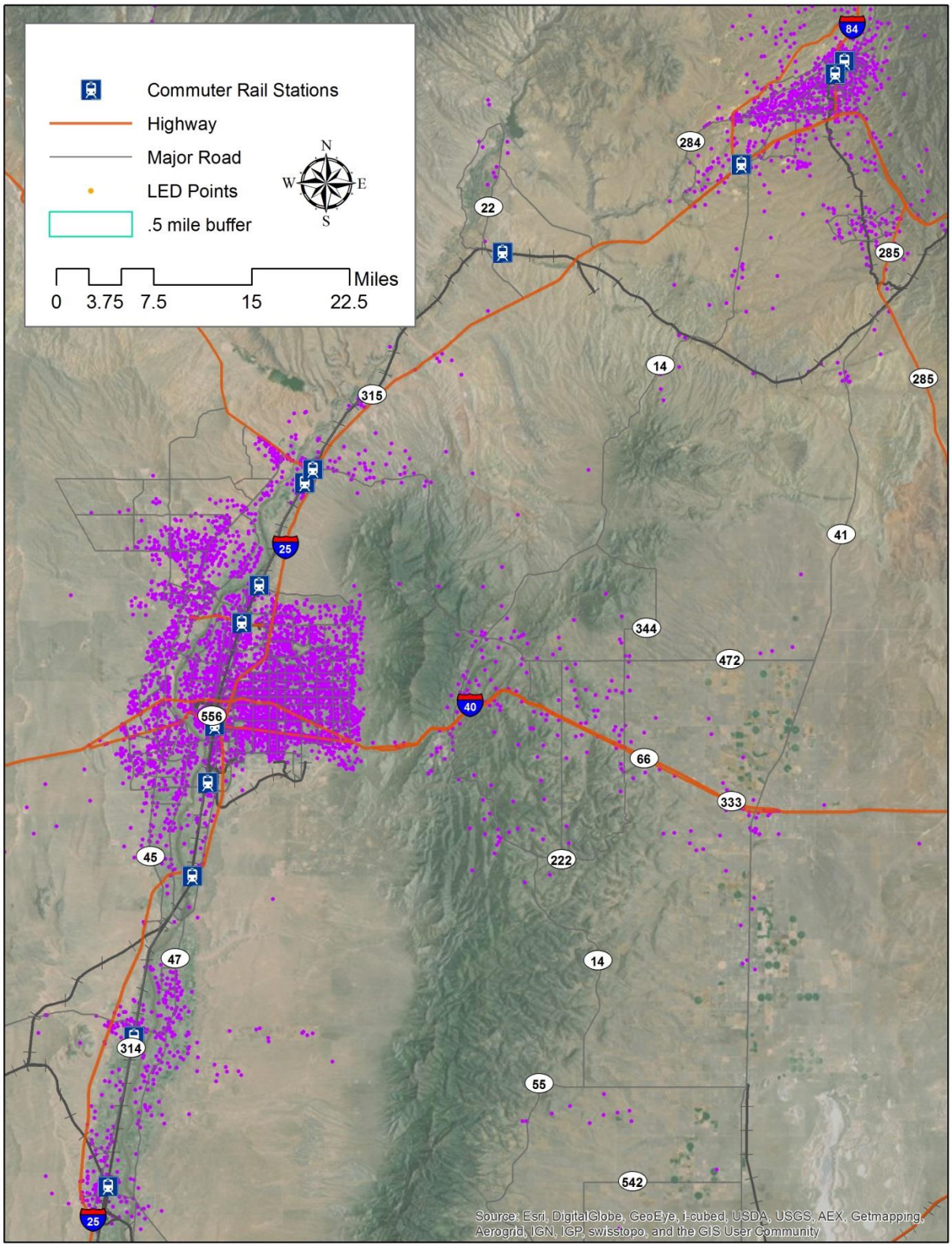

Figure 1
Rail Runner Express with LED census block centroids

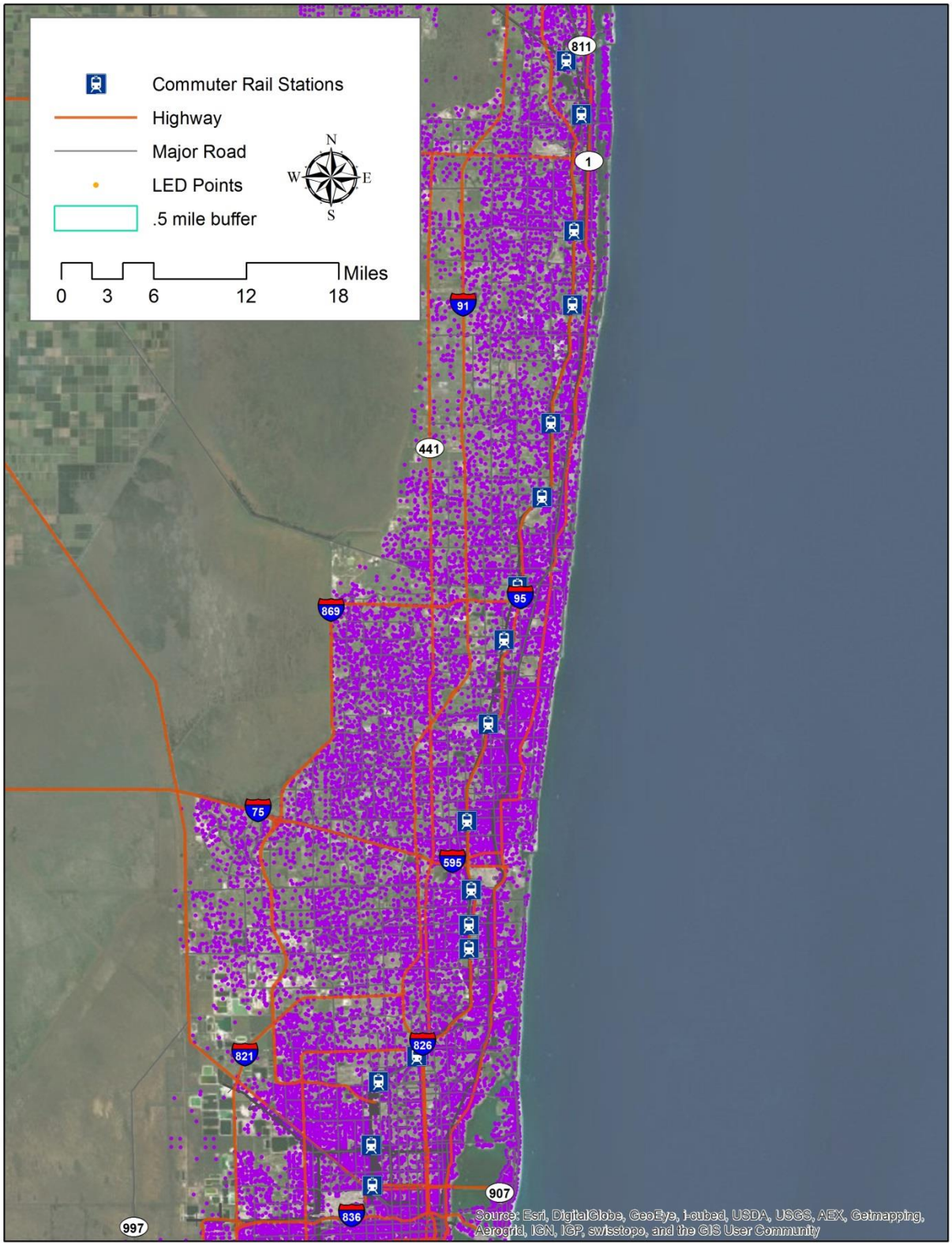

Figure 2
Tri-Rail CRT with LED census block centroids

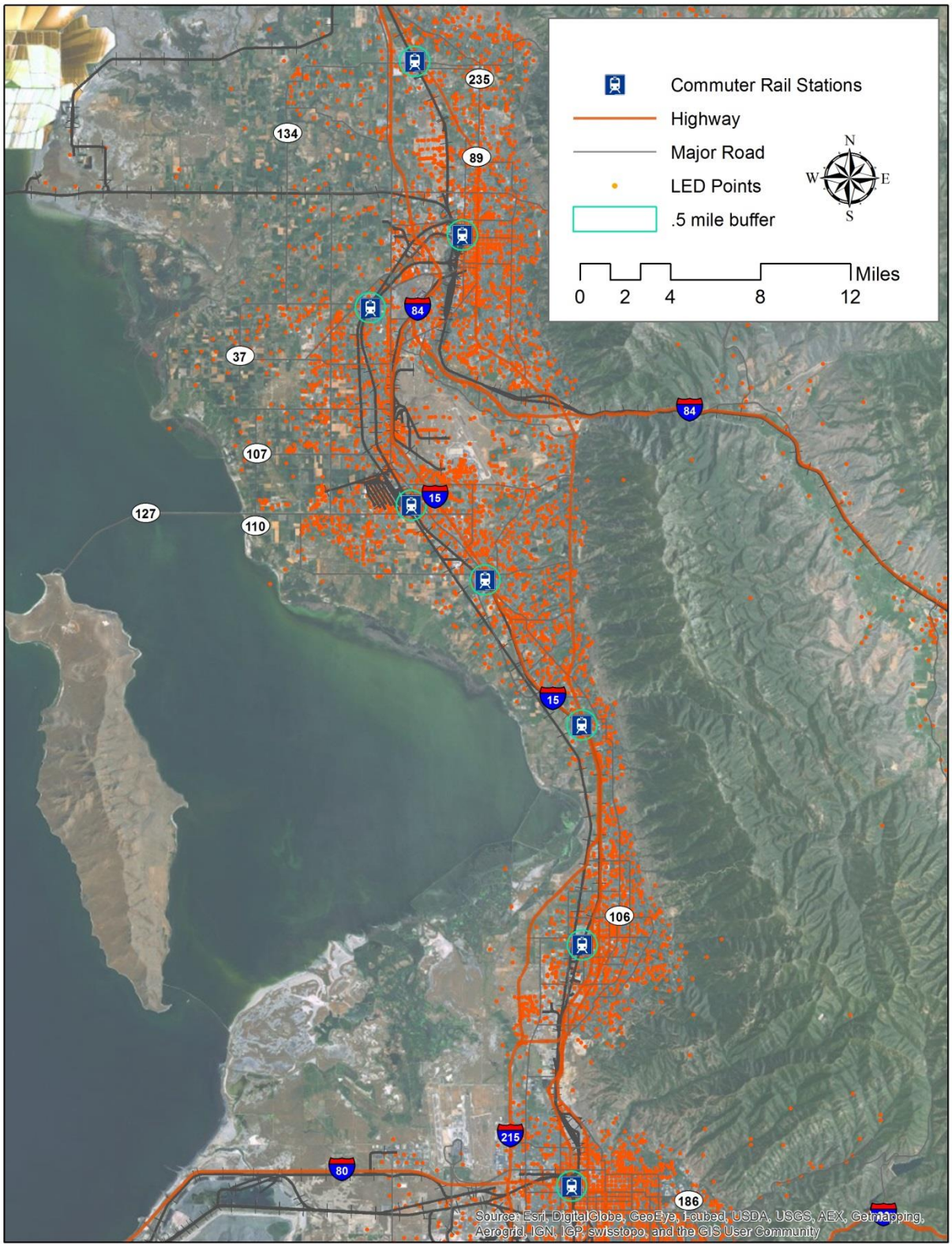

Figure 3
FrontRunner CRT with LED census block centroids

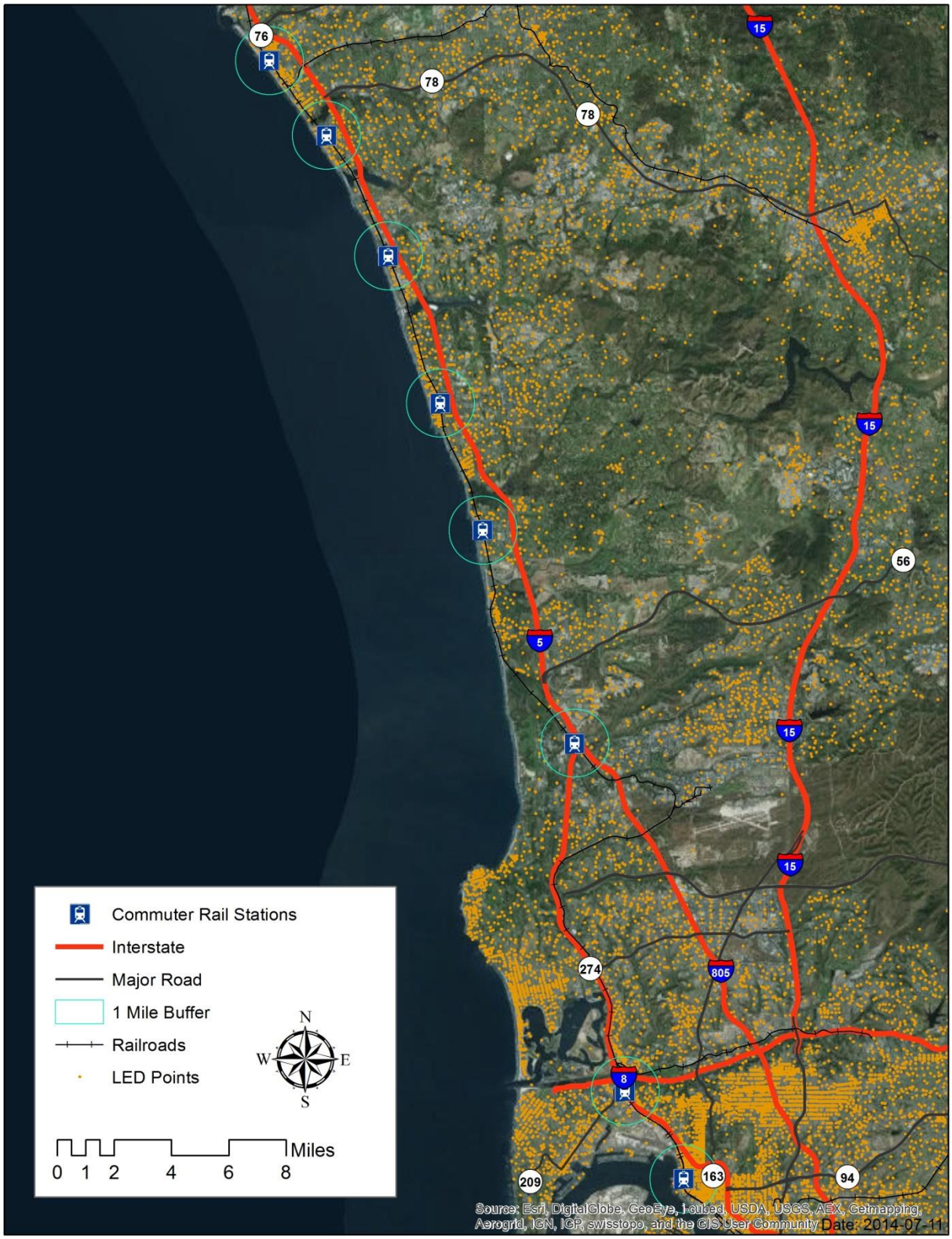

Figure 4
Coaster CRT with LED census block centroids

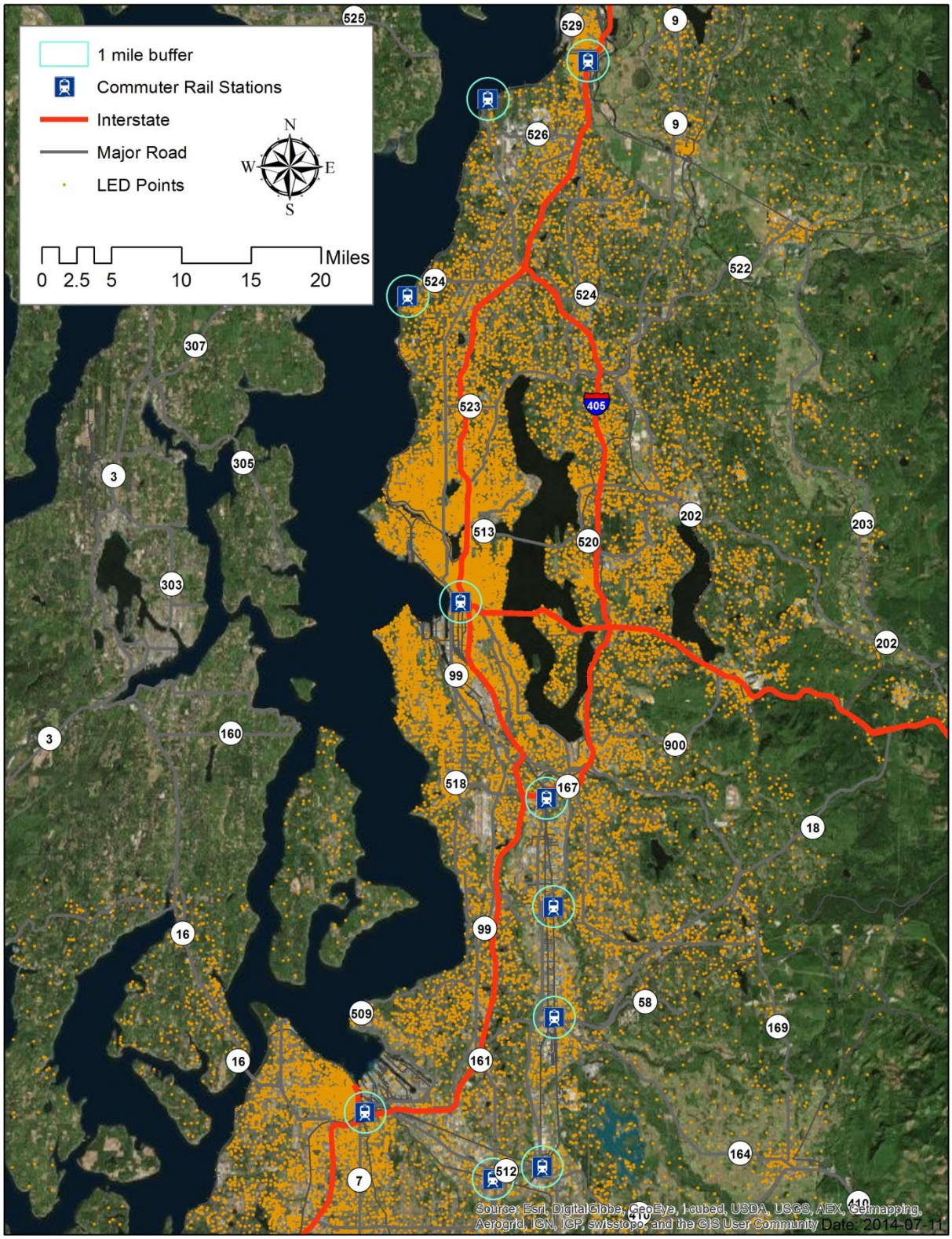

Figure 5
Sounder CRT with LED census block centroids

Endnote

[1] The formula is:

$$LQ = \frac{e_i/e}{E_i/E}$$

Where:

e_i = Local employment in industry i

e = Total local employment

E_i = Reference area employment in industry i

E = Total reference area employment

[2] For brevity we use condensed or abbreviated titles for the NAICS sectors we evaluate. For complete titles of these sectors please see https://www.census.gov/eos/www/naics/.