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Connecting Cleveland: Economic Impact of Greater Cleveland Regional Transit Authority

Iryna Lendel
Cleveland State University, i.lendel@csuohio.edu

Obed Pasha
Cleveland State University, o.pasha@csuohio.edu

Dro Sohrabian

Matthew B. Ellerbrock
Cleveland State University, m.ellerbrock@csuohio.edu

Levin.
The Maxine Goodman Levin
College of Urban Affairs

CONNECTING CLEVELAND:
Economic Impact of Greater Cleveland Regional Transit Authority

Prepared for:

GREATER CLEVELAND REGIONAL TRANSIT AUTHORITY

Prepared by:

Dr. Iryna V. Lendel
Dr. Obed Pasha
Dro Sohrabian
Matthew B. Ellerbrock

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CENTER FOR ECONOMIC DEVELOPMENT

2121 Euclid Avenue, Cleveland, Ohio 44115
http://urban.csuohio.edu/economicdevelopment

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CONNECTING CLEVELAND

About the Study Team

Iryna V. Lendel, Ph.D. is the Director of the Center for Economic Development and a Research Associate Professor at the Maxine Goodman Levin College of Urban Affairs at Cleveland State University. Dr. Lendel was the principal investigator for this project. She is an economist with vast experience conducting academic and applied economic research analyzing regional and urban economic development. Her research portfolio includes projects on industry analyses, state and regional science and innovation policies, and multiple economic impact studies. She serves in an advisory capacity in national and state economic development organizations and is an assistant editor of *Economic Development Quarterly*.

Obed Pasha, Ph.D. is an assistant professor of Public Administration and Policy in the Maxine Goodman Levin College of Urban Affairs at Cleveland State University. He earned his joint Ph.D. in Public Policy and Administration from Georgia Institute of Technology and Georgie State University. His research focuses on performance management and social equity in the areas of criminal justice and local public transportation. Dr. Pasha has published in leading journals in the field, such as *Public Administration Review*, *American Review of Public Administration*, and *Transport Policy*, among others.

Dro Sohrabian is a graduate assistant at the Center for Economic Development pursuing a Master of Urban Planning and Development from the Maxine Goodman Levin College at Cleveland State University, specializing in GIS. His interests include regional and demographic analysis, transportation, urban design and development.

Matthew B. Ellerbrock is a graduate research assistant at Cleveland State University's Center for Economic Development. He is pursuing a Master of Environmental Studies from the Levin College of Urban Affairs, with a specialization in Geographic Information Systems (GIS). His passions include urban sustainability, energy-efficient transportation, and economic impact analysis.

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The Center also acknowledges the gracious technical assistance and expertise provided by faculty, professional staff, and students at Levin College of Urban Affairs, including **Dr. Merissa Piazza**, **Charlie Post**, **Dr. Mark Salling**, **Dr. Brian Mikelbank**, and graduate assistant **Benjamin Lee**.

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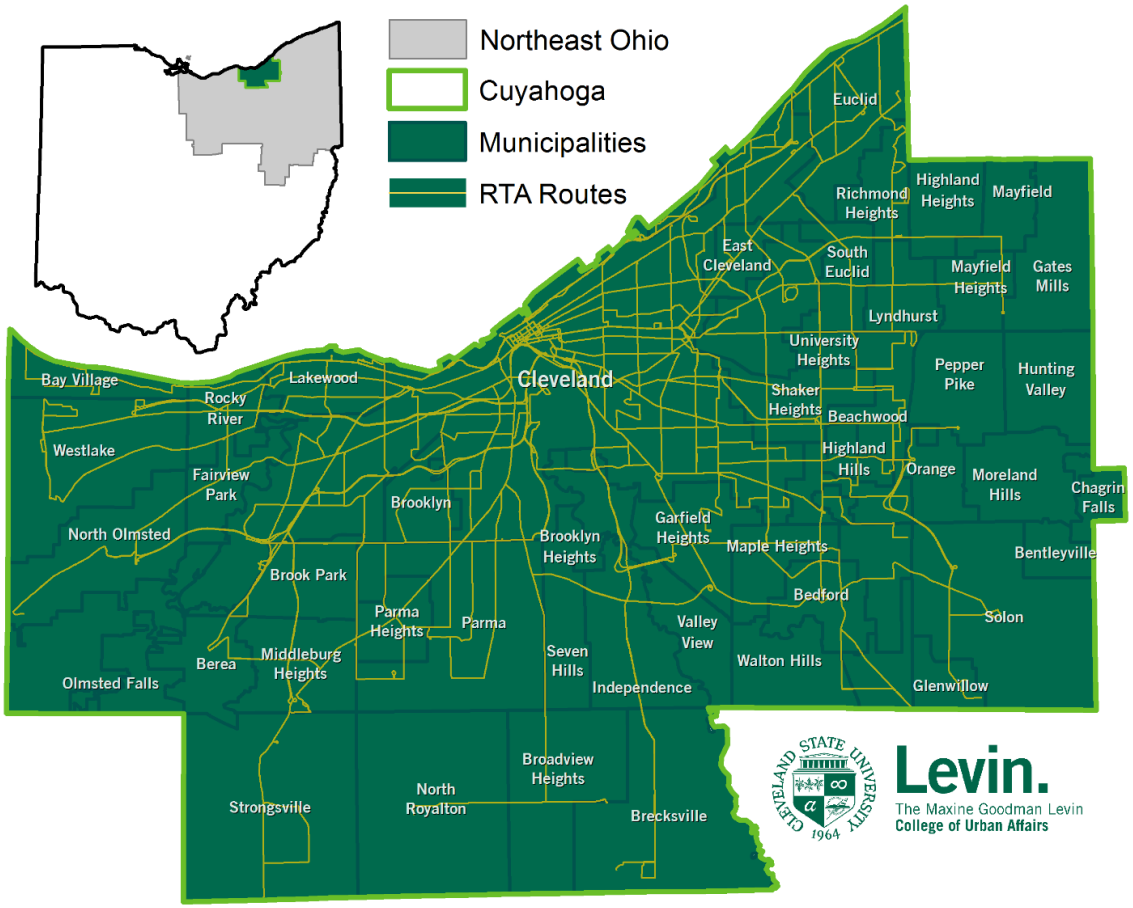
EXECUTIVE SUMMARY

The Center for Economic Development (the Center) produced this economic impact report for the Greater Cleveland Regional Transit Authority (GCRTA) to illustrate how their operations, infrastructure, and services contribute to Cuyahoga County's economy. Cleveland is fortunate among the Midwestern metropolitan areas to have a rich transit history and infrastructure which is actively updated and shapes regional life. Among similar metro transit authorities in the region (Detroit, Cincinnati, and others), GCRTA was second only to Pittsburgh's Port Authority of Allegheny County in terms of ridership and vehicle-revenue miles in 2017.[1]

With 2,300 full-time employees in 2017, GCRTA is the 13th largest Northeast Ohio employer based in Cleveland and the 38th largest in the region.[2] GCRTA's service area is Cuyahoga County; its 2017 operating budget totaled $247 million, and its capital budget varied from $60 million to $87 million over the last five years.

Figure I: Cuyahoga County Municipalities



Sources: U.S. Census Bureau, Cuyahoga County Open Data, GCRTA GTFS data

[1] Time Series. (2017). *National transit database* [Data file]. Retrieved from https://www.transit.dot.gov/ntd/ntd-data

[2] Employers, Top 100. (2018, August 13). *Crain's Cleveland Business*. Retrieved from https://www.crainscleveland.com/data-lists/10608/employers-top-100

The scale of GCRTA operations creates an economic impact on the regional economy and affects the lives of those who rely on its services to get to work, school, and local amenities. While its employees reside across Greater Cleveland, the lion's share live in Cuyahoga County (82%). GCRTA spends roughly 24% of its operating budget and 30% of its capital expenditures within Cuyahoga County by purchasing from local suppliers. The direct employment and operations of GCRTA, their purchases from suppliers within Cuyahoga County, and local spending of GCRTA employees' salaries and salaries of employees of local suppliers give a boost to the regional economy.

Economic Impact

Using an IMPLAN® input-output economic model, the Center calculated the economic impact of GCRTA on the economy of Cuyahoga County in 2017. This impact is created from its annual operations: direct operating and capital budgets and employment, spending from its operating and capital budgets on purchases from suppliers located within Cuyahoga County, as well as spending from GCRTA and suppliers' employees residing in Cuyahoga County.

In 2017, GCRTA created and sustained a total of 2,977 jobs in Cuyahoga County; 1,800 of these are employees of GCRTA (direct economic impact), while 433 jobs were created from local businesses selling goods and services to GCRTA (indirect economic impact) and 744 jobs were created in consumer goods and services companies and institutions by purchases made from salaries of GCRTA and suppliers' employees (induced impact). The indirect and induced jobs are created from 2017 GCRTA spending of more than $170 million on operations and almost $60 million on capital projects locally (Table E).

Jobs at GCRTA—drivers, mechanics, and administrators (direct employment)—and additional jobs in the supply-chain and consumer industries across the region (indirect employment) generated a total of $207.5 million in labor income.

Labor income consists of salaries and wages paid to GCRTA employees ($156.4 million in wages and benefits as a direct impact paid to those residing in Cuyahoga County), employees of their local suppliers ($14.8 million of indirect impact), and those paid in consumer goods and services industries from spending of the former two categories ($36.3 million of induced impact). GCRTA spending in Cuyahoga County also generated $255.6 million in value added and $321.7 million in output.

Table I. Total 2017 Economic Impact of GCRTA on Cuyahoga County

Impact	Employment	Labor Income	Value Added	Output	State & Local Tax
Direct	1,800	$156.4	$169.5	$182.1	$7.0
Indirect	433	$14.8	$21.2	$35.0	$1.0
Induced	744	$36.3	$64.9	$104.6	$5.7
Total	**2,977**	**$207.5**	**$255.6**	**$321.7**	**$13.8**

All monetary values in 2019 millions of dollars

Value added includes the enhancement of products and services created in an organization. In for-profit businesses, many of these enhancements are built into the cost of goods through the supply chain, since value added also includes profit. However, for a public organization like GCRTA, value added is the difference between the sale price and production cost of their services, accounting for such costs as labor and depreciation. In 2017 the operation and spending of GCRTA created $255.6 million in value added to the Cuyahoga County economy; 66% of which was created directly by GCRTA, 8% from supply-chain companies, and 26% across the myriad companies delivering consumer goods and services to GCRTA employees and employees of their suppliers.

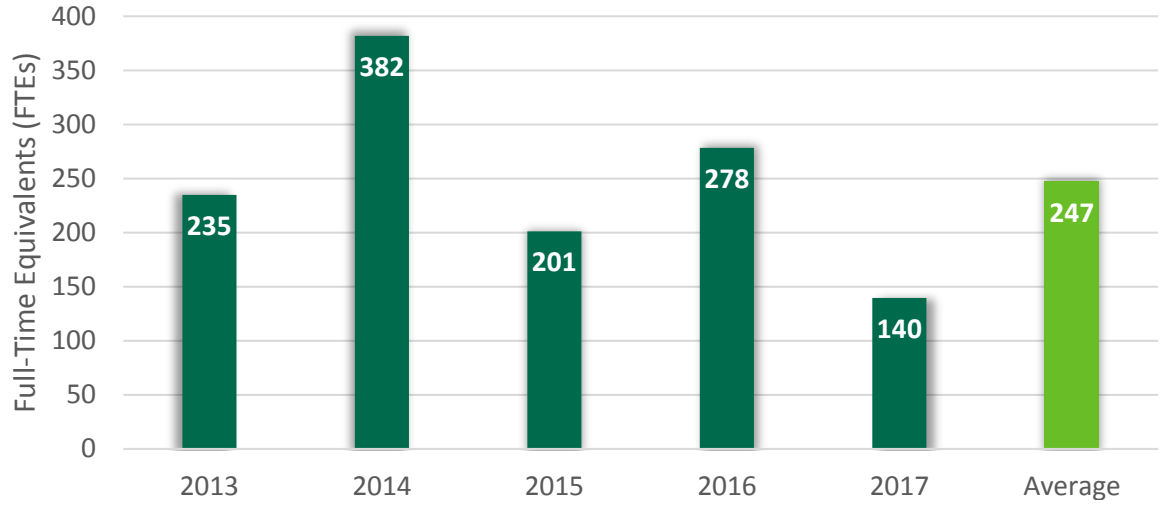
Output accounts for the total quantity of goods and services produced in a given period by an organization, whether consumed or used for further production. In addition to value added, output accounts for intermediate goods and services—such as gasoline, utilities, and energy consumed by GCRTA to provide transit services. The total economic output generated in Cuyahoga County in 2017 due to GCRTA operations and spending was $321.7 million. Out of this total, $182.1 million was created within GCRTA, $35 million of output was created by its local supply chain companies, and another $104.6 million was generated across many consumer industries in the region.

Since GCRTA is a public entity, it does not directly pay state and local taxes from the operations; rather, it generates taxes associated with employees' payroll and property taxes (direct impact on state and local taxes). That being said, GCRTA operations require purchases from entities in Cuyahoga County (part of operating and capital spending, the spending of GCRTA wages, and wages of their suppliers); through this secondary spending, it triggers those commercial entities to pay local and state taxes. Cumulatively, GCRTA spending in Cuyahoga County contributed to the collection of at least $13.8 million in state and local taxes. Because GCRTA services are labor-intensive, aside from direct employment the most substantial economic impact was created through spending of wages and salaries by GCRTA's employees and employees of its suppliers purchasing goods and services in Cuyahoga County. Due to this spending, 25% (744) of total employment impact was created as an induced effect. Local spending also generated 41% ($5.7 million) of all taxes collected within the state and local governments from industries in the supply chain and from consumer products and services.

Driven by spending from GCRTA operations, consumer goods and services industries were affected most within the local economy. The largest induced effect was seen in healthcare industries (including hospitals, home healthcare services, and offices of physicians), restaurants (full-service, limited-service, and eating places), real estate, and retail. Businesses which benefited most from GCRTA supply chain spending were in the services-to-building industry, wholesale trade, architectural and engineering services, employment services, and investigation and security services.

Alongside purchasing from local suppliers for day-to-day operations, GCRTA updates its stock of capital by purchasing new vehicles, building new facilities, and enhancing roadway infrastructure. The economic impact created by capital spending has varied over the last five years. Total annual employment from capital expenditures from 2013 to 2017 ranged from

Figure II. Annual Employment Impact of GCRTA Capital Expenditures on Cuyahoga County

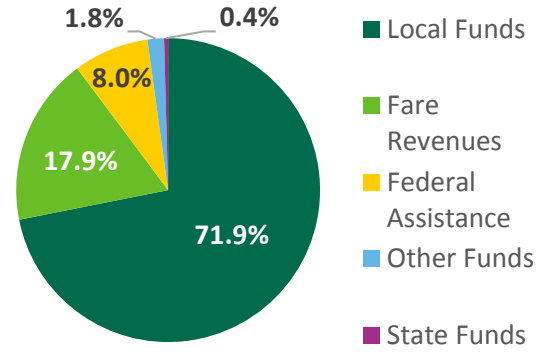


382 in 2014 to 140 in 2017 (Figure E2). The impact of capital spending was created primarily through supply-chain companies. In 2017, out of 140 jobs created by capital spending, 111 were from supply-chain companies located in Cuyahoga County. In 2014—the year of the highest level of capital spending in the last five years—302 of 382 total jobs were created in local supply-chain companies. From 2013 to 2017, an average of 80% of jobs created and retained in Cuyahoga County due to GCRTA capital spending were created in local supply-chain companies.

Usually, the economic impact of a local company or organization would consider only external revenue spent locally. However, we considered GCRTA services as a component of regional infrastructure and based our economic impact calculation on the premise that it is inefficient to have competing transit agencies within a region.

In this study, we considered the following research question: *what would be the effect on Cuyahoga County's economy if GCRTA ceased operations?* Many cities with vital urban life consider transit services as a local amenity and incorporate them into public costs, funding a large share of transit expenditures from municipal budgets. GCRTA receives some external revenues in the form of federal and state assistance. In 2017, GCRTA received $48.9 million in federal funding and an additional $1.1 million in state operational funding, part of which was spent locally.[3] The rest of their expenditure is sourced from local funds (a 1% county-wide sales tax in place since 1975) and fare revenues.

Figure III: GCRTA Operating Expense Sources, 2017



Source: National Transit Database

[3] 2017 Funding Sources. (2017). *National transit database* [Data file]. Retrieved from https://www.transit.dot.gov/ntd/ntd-data

Local Contributions and Effects

The Center considered various societal effects of public transit services on the County: for example, how transit connectivity affects socioeconomic conditions. From a dataset of historical transit access (1970 to 2010) at the census tract level, the Center found that within a decade of introducing GCRTA services employment in a census tract[4] increased by 3.1% on average while poverty decreased by 12.9%, controlling for other socioeconomic factors.

After gaining transit access, median property values increased in the long-term by 3.5%, estimated to equate to $2.2 billion of additional property value in the County. Studies in other regions identified similar premiums for property values as a result of enhanced transit service.[5] Therefore, access to transit is beneficial not only to those dependent on services, but also across a given region by increased general prosperity.

Based on data collected from the 2013 GCRTA "On-Board" Survey, 24,721 riders are dependent (have no vehicle) or highly dependent (have no vehicle and no driver's license) on public transit to get to work. Based on the median income of surveyed transit riders, the Center estimates that at least $485.8 million of annual income is generated by those dependent upon transit to hold their jobs. If this dependent group could not access their places of work (64% according to Northeast Ohio Areawide Coordinating Agency's mode-shift assumptions) and were to lose their jobs, unemployment benefits could cost the state upwards of $5.82 million.

Cuyahoga County commuters realize substantial cost savings using transit to get to work rather than driving alone and paying for fuel, maintenance, and depreciation. If the 178 million passenger miles traveled in 2017 by GCRTA had been driven to their destination at the cost of 54¢ per mile (the federal mileage rate), commuters would have spent $51.9 million more than paid in transit fares.[6] This figure does not account for other societal costs such as increased congestion, pollution, vehicle acquisition and maintenance costs, safety, and burden on parking assets.

Cuyahoga County is adversely affected by what is called a "spatial mismatch" between low-skill workers and entry-level job opportunities. Census and employment data show that high-poverty neighborhoods with low vehicle ownership are geographically distant from many entry-level job hubs, creating barriers to economic participation and widening inequality gaps.[7] Using origin-destination employment and travel-time data, our analysis shows that GCRTA transit services increase chances for entry-level workers in disinvested neighborhoods of Cuyahoga County to find employment in decentralized job hubs. Effectively, adverse outcomes of the spatial mismatch in Cuyahoga County are alleviated to some extent by transit service.

[4] A census tract generally has a population size between 1,200 and 1,800, usually covering a contiguous area.
[5] Finn, A. (2017, March 20). How much is one point of transit score worth? *Redfin*. Retrieved from https://www.redfin.com/blog/2017/03/how-much-is-one-point-of-transit-score-worth.html
[6] Edmonds, E. (2017, August 23). AAA reveals true cost of vehicle ownership. *AAA NewsRoom*. Retrieved from https://newsroom.aaa.com/tag/driving-cost-per-mile/
[7] U.S. Census Bureau. (2015). Origin-Destination Statistics. Longitudinal Employer-Household Dynamics Program. Available from https://lehd.ces.census.gov/data/

Transit options also benefit employers trying to attract a talented workforce. Recent trends indicate businesses are increasingly choosing transit-rich office space in efforts to attract top talent seeking urban areas and shorter commutes. [8] According to U.S. Census data, the percentage of Greater Cleveland's transit commuters who are in the 20-24-year-old range has experienced an uptick (about 4%) in the past decade. Services provided by GCRTA become a selling point for the region and can be added to the list of amenities to attract and retain a younger workforce.

Beyond those who depend upon GCRTA for work travel, over 3,000 individuals are estimated to use GCRTA daily to attend medical appointments. If GCRTA were no longer in service, many individuals would likely cancel or miss appointments due to an inability to reach their destination. We estimate that it would cost healthcare institutions over $100 million a year in lost efficiency and absent appointments. Those individuals reliant on transportation are also likely to be more vulnerable and incur higher health risks if they do not have mobility options to reach healthcare providers.

Not only does GCRTA transport people to work and doctors' appointments, it also acts as a school transit system for a majority of students in the Cleveland Metropolitan School District (CMSD). About 1/4th of all GCRTA ridership is estimated to be students, depending on the season; 3/4^{ths} of these are transit-dependent (no car). Students and the CMSD see benefits and cost-savings from GCRTA with the ability to provide students with a reliable option to reach school. GCRTA helps CMSD save $28.7 million annually in busing costs.

About one in ten GCRTA riders are traveling to buy groceries or food, with more than half of them highly dependent on transit (no car or a driver license). Additionally, one in four riders travels for recreational or social purposes. More than 60% of riders who use transit to reach their workplace are people of color, and 54% are women—reflecting transit's importance to the livelihood of marginalized groups. GCRTA benefits communities across all of Cuyahoga County, not only by providing transit services, but also by GCRTA employees living in its neighborhoods, spending their income in these neighborhoods, maintaining their properties, and contributing to economic stability.

The Center found that GCRTA paid $112 million to their employees residing in Cuyahoga County in 2017. Using ZIP code-level data, we estimated that 2017 GCRTA salaries were distributed across 59 municipalities and townships within the county. The top 5 municipalities benefitting from GCRTA employee salaries were Cleveland with $35.2 million, Euclid ($7.8 million), Maple Heights ($5.1 million), Parma ($4.6 million), and Cleveland Heights ($4.2 million).

The impact of the GCRTA on Cuyahoga County's economy is multifaceted and all-encompassing. GCRTA secures jobs in Cuyahoga County, creates labor income and output, and generates local taxes. Without access to transit, people would not be able to perform the basic functions of daily life – getting to and from work and school, seeing the doctor, purchasing groceries, and meeting friends for entertainment.

[8] Schaper, D. (2018, November 29). 'Talent wants transit': Companies near transportation gaining the upper hand. *National Public Radio*. Retrieved from https://www.npr.org/2018/11/29/671203167/talent-wants-transit-companies-near-transportation-gaining-the-upper-hand

INTRODUCTION

The Mission Statement of GCRTA is "To Provide safe, reliable, clean and courteous public transportation." In fulfilling that mission, GCRTA plays an important role in sustaining regional businesses and jobs and providing mobility for residents of Cuyahoga County. This study assessed the economic impact of GCRTA on the region and identified a supply chain servicing its operation and new capital investments.

The scope of work included an estimate of the economic impact of GCRTA on Cuyahoga County using an assumption that GCRTA supports existing jobs and that those jobs would be lost if GCRTA's operation will be suspended.

In addition to direct economic impact, the Center explored the higher-level effects of enhanced mobility: for example, how transit services might affect neighborhood-level poverty rates, property values, employment, etc. These community effects reflect the more intuitive goals of transportation services but are considerably more challenging to delineate from a web of complicated factors.

Transportation is a significant part of daily life; it also plays a key role in allowing people to engage in economic activity. The Center analyzed available data on ridership to understand which groups depend on GCRTA and for what purposes they ride.

Finally, the Center considered other substantial cost avoidances for individuals, neighborhoods, municipalities, school boards, and the public at large. This includes externalities related to traffic congestion, healthcare sector efficiency, student transportation, and other consequences of transit.

Figure 1: Collage of Cleveland Transit, Past and Present

Source: Cleveland Memory Project

GCRTA bus on Euclid Ave. (above) and Green Line Rapid (below)

HealthLine stations at E. 14th (bottom)

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PART 1: ECONOMIC IMPACT ANALYSIS

The following five measures are used to estimate the quantitative economic impact of GCRTA:

- *Employment* (number of jobs)
- *Labor income* (household earnings)
- *Value added* (output less the value of intermediary goods – often used as a proxy for Gross Regional Product, a regional equivalent of Gross Domestic Product)
- *Output* (total value of goods and services produced in the region, including intermediate products and services)
- *Taxes* (Impact on federal, state, and local tax revenues)

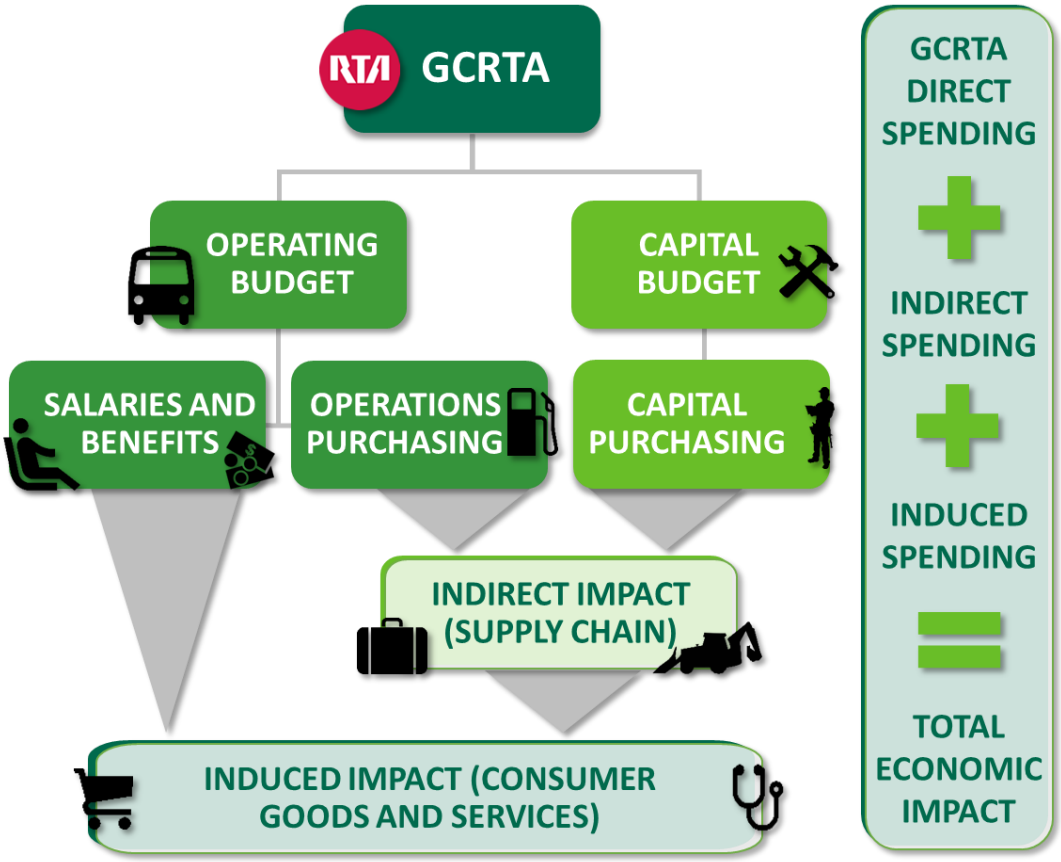
Each of these components is composed of *direct*, *indirect*, and *induced* impacts.

Direct impact refers to the initial value of goods and services used in construction projects and the operation of local businesses (GCRTA). These purchases are sometimes referred to as the first-round effect.

Indirect impact measures the value of labor, capital, and other inputs of production needed to produce the goods and services being purchased at the initial round of spending (second- and additional-round effects).

Induced impact measures the change in spending by local households due to increased earnings of employees at the businesses in the corridor and employees working in local industries who produce goods and services for them.

Figure 2: GCRTA Economic Impact Model



The Center for Economic Development (the Center) conducted the economic impact study using IMPLAN Professional and IMPLAN Data Files. IMPLAN Professional® 3.2 is the latest economic impact assessment software system. Using the IMPLAN® Data Files, the user can develop sophisticated models of regional economies to estimate a wide range of economic impacts. The IMPLAN impact model is used by more than 1,000 public and private institutions. The number of users, as well as their reputation, points to the acceptability of the IMPLAN model among researchers and consultants.

Impact is measured using a framework of input-output modeling utilizing the economic multiplier-based approach. A set of rigorous assumptions are made on the assessment of funding invested into the economy in terms of both GCRTA operations and construction. In anticipation of a substitution effect—a concept whereby money could be alternatively spent on different activities within the region—spending on GCRTA subject to the substitution effect will be explained by an assumption of lost economic benefits in the hypothetical case of GCRTA suspending all operations in the region (Figures 3 and 4).

Figure 3: GCRTA Spending in Cuyahoga County

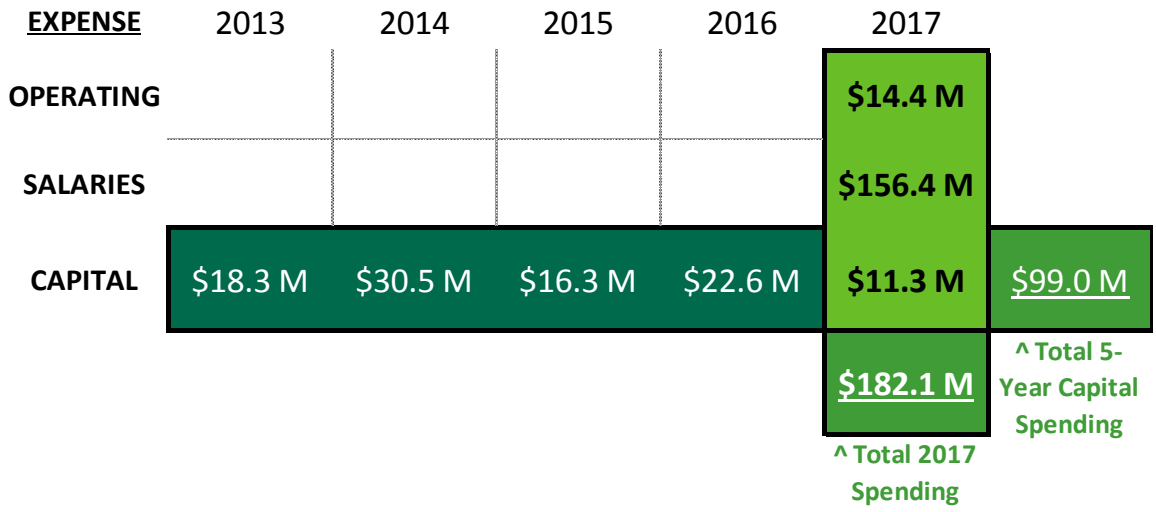
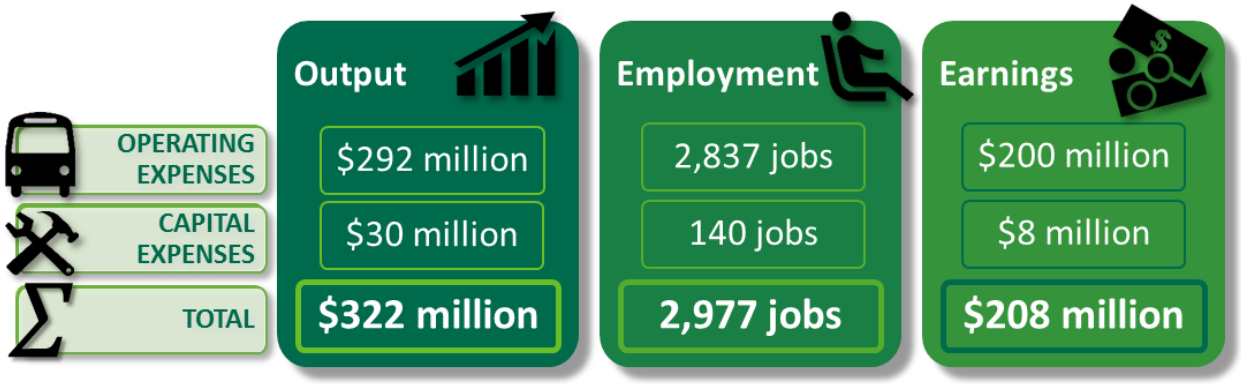


Figure 4: 2017 Total Economic Impact of GCRTA on Cuyahoga County



Total Economic Impact

The total 2017 spending of $156.4 million in wages and benefits, $14.4 million in other operating expenses, and $11.3 million in capital expenses in Cuyahoga County (Figure 3) created and retained 2,977 full-time equivalent jobs, $207.5 million in labor income, $255.6 million in value added, and $321.7 million in total output (Figure 4 and Table 1).

All GCRTA operations triggering spending in Cuyahoga County—operating and capital spending, spending of the wages of workers at GCRTA and their suppliers—cumulatively contributed to the collection of $13.8 million in state and local taxes. A large economic impact was created through spending of GCRTA employees' wages. Nearly 25% (744) of total employment impact is created as an induced effect: that is, spending done by GCRTA's employees and the employees of its suppliers (buying goods and services in the region of impact). Local spending in consumer-driven industries generated 41% ($5.7 million) of all taxes collected by state and local governments (Table 1). There are two types of industries affected by operations and spending of the GCRTA; GCRTA-driven actions affect transportation, construction, and related professional, trade, and financial services, also known as supply chain industries, while population-driven actions affect consumer goods and services industries such as healthcare, retail, real estate, and other population services (Figure 5 – see Appendix Table A4 for detailed breakdown – and Table 2).

Table 1: Total 2017 Economic Impact of GCRTA on Cuyahoga County

Impact	Employment	Labor Income	Value Added	Output	State & Local Tax
Direct	1,800	$156.4	$169.5	$182.1	$7.0
Indirect	433	$14.8	$21.2	$35.0	$1.0
Induced	744	$36.3	$64.9	$104.6	$5.7
Total	**2,977**	**$207.5**	**$255.6**	**$321.7**	**$13.8**

All monetary values in 2019 millions of dollars

Figure 5: Top Employment Industries Affected by Total 2017 Impact

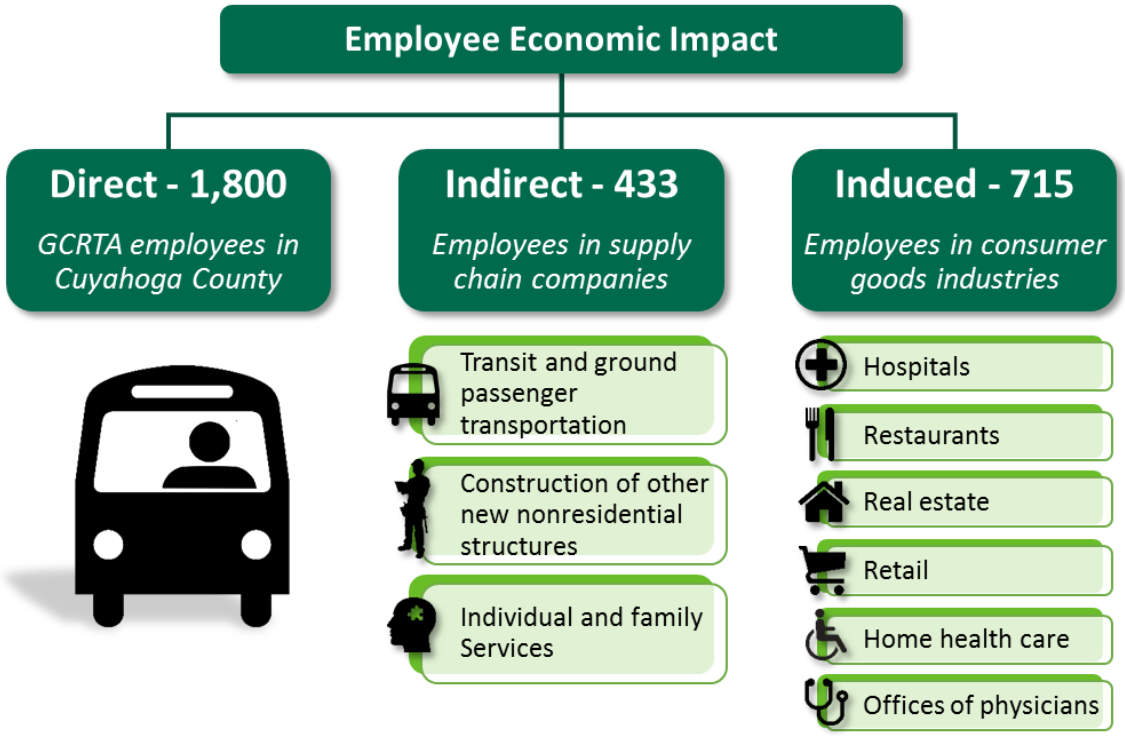


Table 2: Top Industries Affected by Total 2017 Expenditures: Employment

Industry	Employment	Labor Income	Output
Transit and ground passenger transportation	2,039	$159.9	$176.0
Construction of other new nonresidential structures	82	$4.6	$10.2
Hospitals	48	$4.3	$8.5
Full-service restaurants	40	$1.0	$2.0
Limited-service restaurants	38	$0.7	$3.1
Real estate	32	$0.5	$8.3
Retail - Food and beverage stores	22	$0.6	$1.4
Services to buildings	21	$0.5	$1.0
Individual and family services	21	$0.7	$0.8
Home healthcare services	21	$0.7	$0.9

All monetary values in 2019 millions of dollars

Table 3: 2017 Economic Impact of Operational Expenditures on Cuyahoga County

Impact	Employment	Labor Income	Value Added	Output	State & Local Tax
Direct	1,800	$156.4	$163.7	$170.7	$7.0
Indirect	322	$8.3	$12.5	$20.2	$0.6
Induced	715	$34.9	$62.4	$100.6	$5.5
Total	**2,837**	**$199.6**	**$238.6**	**$291.5**	**$13.1**

All monetary values in 2019 millions of dollars

Operating Expenses Impact

Spending of $156.4 million on wages and benefits and $14.4 million in other operating expenses in Cuyahoga County by GCRTA created and retained 2,837 full- and part-time jobs, $199.6 million in labor income, $238.6 million in value added, and $291.5 million in total output for Cuyahoga County (Table 3).

Operational expenditures, including GCRTA employee's salaries and benefits, triggered collection of $13.1 million in state and local taxes in 2017. GCRTA employed 1,800 directly in the County, paying labor income of $156.4 million resulting in $7 million in state and local taxes.

Labor income plus operational expenditures results in direct output, with a fraction of operational expenditures combining with labor income to create value added, which can be thought of as GCRTA's direct contribution to Gross Regional Product.

Since more than 90% of operational expenditures are spent on salaries and benefits, the most jobs created—outside of transit and ground passenger transportation—are population-serving industries (Table 4). Labor income patterns mirror employment in these population-serving industries.

Table 4: Top Industries Affected by 2017 Operational Expenditures: Employment

Industry	Employment	Labor Income	Output
Transit and ground passenger transportation	2,039	$159.9	$176.0
Hospitals	47	$4.1	$8.2
Full-service restaurants	38	$0.9	$1.9
Limited-service restaurants	36	$0.7	$3.0
Real estate	30	$0.5	$7.8
Retail - Food and beverage stores	22	$0.6	$1.4
Services to buildings	21	$0.5	$1.0
Individual and family services	21	$0.7	$0.8
Home healthcare services	21	$0.7	$0.9
Offices of physicians	20	$2.5	$3.5

All monetary values in 2019 millions of dollars

Table 5: Top Employment Industries Affected by 2017 Operational Impact

Industry	Direct	Indirect	Induced	Total
Transit and ground passenger transportation	1,800	235	3	**2,039**
Hospitals	0	0	47	**47**
Full-service restaurants	0	1	37	**38**
Limited-service restaurants	0	0	36	**36**
Real estate	0	2	28	**30**
Retail - Food and beverage stores	0	0	22	**22**
Individual and family services	0	11	10	**21**
Home healthcare services	0	2	19	**21**
Offices of physicians	0	0	21	**21**
Services to buildings	0	0	20	**20**
Other Sectors	0	71	473	**544**
Total	**1,800**	**322**	**715**	**2,837**

Population-serving industries create employment primarily as an induced effect in a number of industries, such as healthcare, restaurants, retail, real estate, and other population services (Table 5).

Capital Expenses Impact

In the last five years, the GCRTA spent nearly $100 million locally in Cuyahoga County. On average, 31% ($19.7 million) of the capital budget is spent on vendors located in the County (see Appendix Table A5). Expenditures for CIP-Capital Project (Grant) and preventative-maintenance labor were removed from the original capital expenditures table, as these can be assumed to already be included in salaries.

Additionally, miscellaneous professional and technical services were added from 2013 operating expenditures. Each year of capital expenditures was run independently as IMPLAN input-output models based on a translation of each expense to IMPLAN sectors (See Appendix Table A6). The 2017 capital expenditure impact results can be found below, while other individual years' results can be found in the appendix (see Appendix Tables A8-A12).

GCRTA's spending of $11.3 million as capital expenditures in 2017 created and retained 140 full-time and part time jobs, with an associated $7.9 million in labor income, $16.9 million in value added, and $30.2 million in output. It is worthwhile to note that the $11.3M spent in 2017 was considerably lower than in other years within the five-year period. Capital spending during this time ranged from $11.3M in 2017 to $30.5M in 2014 Table 6); it totaled $99M for the last five years and averaged $19.8M. In this study, however, the IMPLAN model illustrates the results of only one year of actual capital spending in 2017.

Table 6. GCRTA Capital Expenditures, 2013-2017

Year	Total Capex	Capex in Cuyahoga
2013	$70.4 M	$18.3 M
2014	$61.1 M	$30.6 M
2015	$87.1 M	$16.3 M
2016	$54.4 M	$22.6 M
2017	$59.9 M	$11.3 M
TOTAL	**$332.9 M**	**$99.0 M**

Capital expenditures triggered the accumulation of $0.6 million in state and local tax revenue in 2017 (Table 7).

Table 7: 2017 Economic Impact of Capital Expenditures on Cuyahoga County

Impact	Employment	Labor Income	Value Added	Output	State & Local Tax
Direct	0	$0.0	$5.8	$11.3	$0.0
Indirect	111	$6.5	$8.7	$14.8	$0.4
Induced	29	$1.4	$2.5	$4.1	$0.2
Total	**140**	**$7.9**	**$16.9**	**$30.2**	**$0.6**

All monetary values in 2019 millions of dollars

The majority of jobs created from capital spending were in construction and related supply chain businesses (Table 8). Labor income patterns mirror employment in these categories.

Table 8: Top Industries Affected by 2017 Capital Expenditures: Employment

Industry	Employment	Labor Income	Output
Construction of other new nonresidential structures	82	$4.6	$10.2
Architectural, engineering, and related services	7	$0.6	$1.1
Wholesale trade	4	$0.3	$0.9
Full-service restaurants	2	$47,520	$98,434
Real estate	2	$32,936	$0.5
Hospitals	2	$0.2	$0.3
Employment services	2	$61,920	$0.1
Limited-service restaurants	2	$32,187	$0.1
Investigation and security services	1	$33,088	$54,890
Retail - Miscellaneous store retailers	1	$21,177	$40,504

All monetary values in 2019 millions of dollars (unless below $100,000)

Most jobs are created as an indirect effect in construction and related supply chain industries (Table 9). Additional jobs are created in population-serving industries.

Table 9: Top Employment Industries Affected by 2017 Capital Impact

Industry	Direct	Indirect	Induced	Total
Construction of other new nonresidential structures	0	82	0	**82**
Architectural, engineering, and related services	0	7	0	**7**
Wholesale trade	0	3	1	**4**
Full-service restaurants	0	1	2	**2**
Real estate	0	1	1	**2**
Hospitals	0	0	2	**2**
Employment services	0	1	1	**2**
Limited-service restaurants	0	0	1	**2**
Investigation and security services	0	1	0	**1**
Retail - Miscellaneous store retailers	0	1	0	**1**
Other Sectors	0	13	21	**35**
Total	**0**	**111**	**29**	**140**

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PART 2: LOCAL CONTRIBUTIONS

The spatial structure of legacy city regions is characterized by two interacting processes: (1) a complex internal spatial reorganization of people and economic activity, and (2) in- and out-migration of these same resources. All the while, transit plays a critical role in connecting these emerging, disappearing, and shifting origins and destinations.

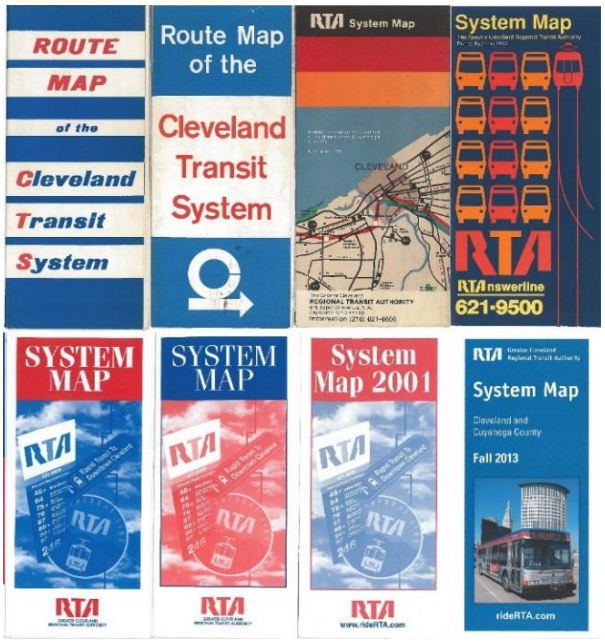
Transit systems serve as drivers for local economies by providing people with access to jobs, local businesses, food, recreation, education, healthcare, and other services. GCRTA offers mobility services to residents of the Greater Cleveland area and helps reduce poverty by connecting people with jobs. Proximity to GCRTA may influence housing prices, choice of housing, and car ownership. This study documents the net change in demographic and economic characteristics throughout Cuyahoga County; consequently, it will determine what portion of that change in activity is located within GCRTA catchment areas as compared to outside of them.

This analysis will help answer questions about population and employment change relative to GCRTA service areas and illustrate many characteristics of the region as they relate to the transit system.

Transit Access

The Center used system maps from 1966, 1974, 1981, 1990, 2000 and 2010, creating a dataset to measure transit access on the census-tract level in Cuyahoga County[9].

Figure 6: Historical GCRTA System Maps



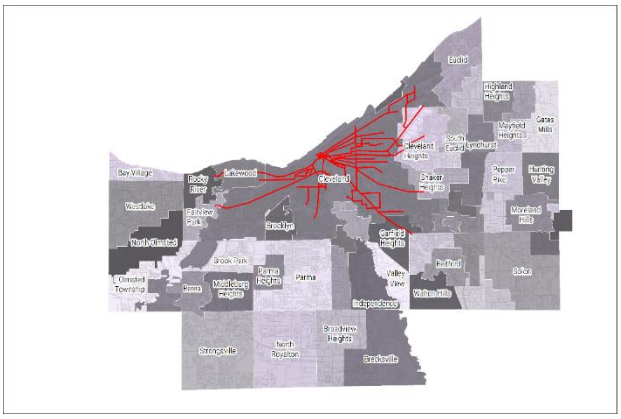
When no lines passed through or along the edge of a census tract, that census tract was said to have "no access" to transit. In the 1960's, as the process of decentralization was in full swing, new communities were being built on traditional urban edges, and transit services had not yet expanded into those regions. As the system expanded—and transit lines passed through previously unserved tracts—those tracts become classified as having "access" to transit.

This transit access variable allows us to compare the socioeconomic differences from 1970 onwards using a longitudinal database of detailed census data to use as control variables.[10]

[9] Printed system maps were digitized through a process of georeferencing and digital tracing (see Appendix B).
[10] Logan, J. R., Xu, Z., & Stults, B. (2014). Interpolating US decennial census tract data from as early as 1970 to 2010: A longitudinal tract database. In B. Warf (Ed.), *The professional geographer* (Vol. 66, No. 3) (pp. 412–420). London, UK: Taylor & Francis Group

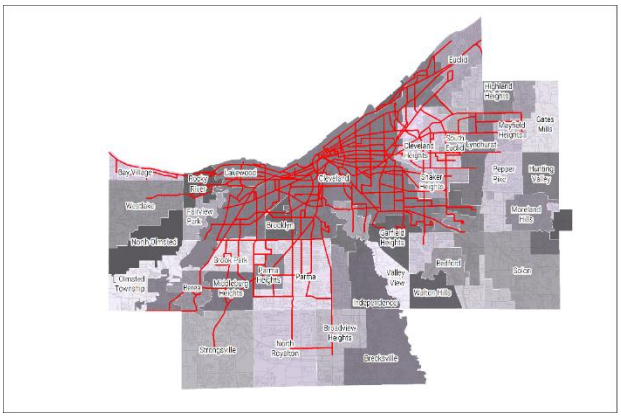
Figure 7: Greater Cleveland's Transit Networks, 1900-2010

1900

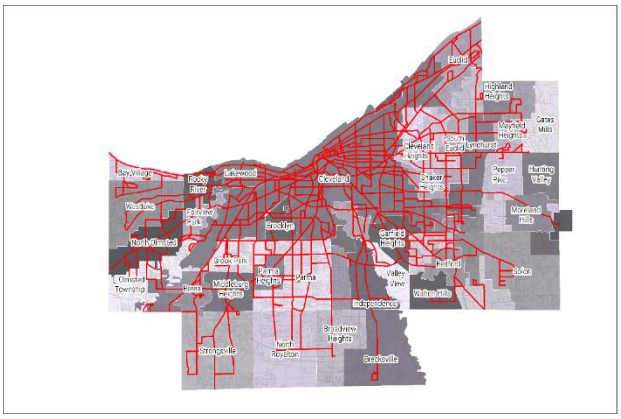


1990

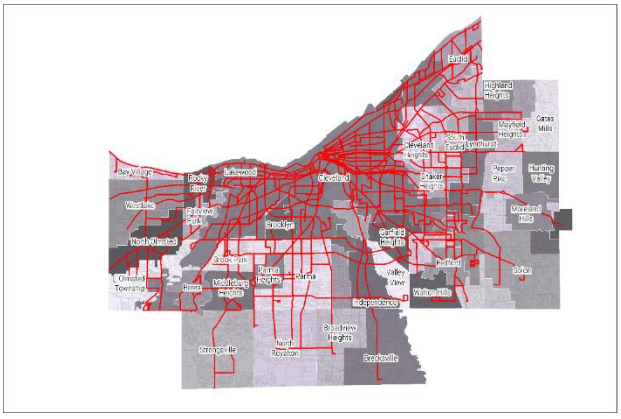
1974



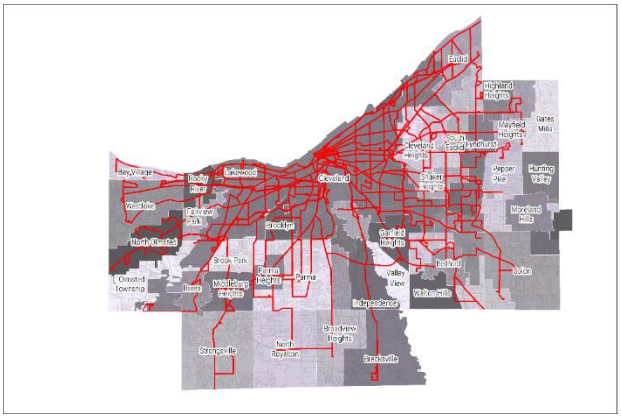
2000



1981



2010



This report quantifies the impact of transit access on spatial distribution of neighborhood characteristics such as employment, property value, and poverty. The analysis takes advantage of data spanning six decades by employing a two-way fixed-effects model with lagged dependent variable, while controlling for factors such as population density, housing age, rental values, manufacturing jobs, and population diversity. The report relies on long-term impacts, since transit infrastructure and services are not a short-term investment and often require time to produce desired benefits for communities.

Increased Employment

One of the primary functions of a transit network—and transportation in general—is connecting employees to workplaces: i.e. commuting. American cities which developed before the 20th century have at their core a dense urban grid connected via pedestrian-accessible streetcar corridors. The rise of the automobile, along with a variety of other socioeconomic factors and policies, left many of these urban cores with disproportionally low-income minority populations.

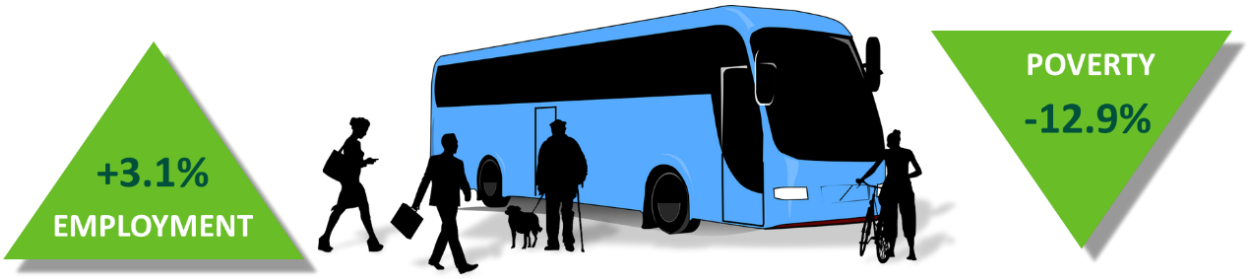
As jobs followed suburban populations outwards, lack of access became a driver of unemployment for minority low-income populations: a phenomenon called "spatial mismatch"[11]. Local transit systems play an increasingly important role in connecting people to jobs, which emphasizes the importance of measuring employment as an outcome of transit access.

The long-term impact of transit services shows **an increase in employment in a decade after a new transit route is established in a previously unserved neighborhood** (Appendix Table A3). Results show that the provision of transit services in a previously unserved neighborhood can increase employment by up to 3.1%.

These findings align with recent studies such as a natural experiment which found a significant relationship between public transit service disruption and unemployment rates in New York City in the aftermath of Hurricane Sandy.[12] Another study found higher unemployment rates for residents living more than a quarter mile from a rail station or bus stop.[13] Positive effects of transit access on employment across 23 U.S. locations exhibited strong regional differences.[14] Lichtenwalter et al. (2006) found mobility to be the most important element of employment for low-income single mothers in Pittsburgh, PA. In the United Kingdom, a group of researchers found that a 10% reduction in bus travel times corresponds to a 0.13-0.3% reduction in employment.[15]

[11] Blumenberg, E., & Manville, M. (2004). Beyond the spatial mismatch: welfare recipients and transportation policy. *Journal of Planning Literature*, *19*(2), 182-205.
[12] Tyndall, J. (2017). Waiting for the R train: Public transportation and employment. *Urban studies*, *54*(2), 520-537.
[13] Sanchez TW, Shen Q and Peng ZR (2004) Transit mobility, jobs access and low-income labour participation in us metropolitan areas. Urban Studies 41(7): 1313–1331.
[14] Thakuriah, P. (2011). Variations in employment transportation outcomes: Role of site-level factors. *Papers in Regional Science*, *90*(4), 755-772.
[15] Johnson, D., Ercolani, M., & Mackie, P. (2017). Econometric analysis of the link between public transport accessibility and employment. *Transport Policy*, *60*, 1-9.

Figure 8: Transit Access Impact on Employment and Poverty



Decreased Poverty

Academic research further suggests that areas with better access to transit have higher concentrations of low-income residents (Bruckner and Rosenthal, 2009; Glaeser et al., 2008), that low-income households living in affordable housing units choose transit-rich locations (Welch, 2013), and that there may be higher concentrations of low-income populations near bus than rail transit (Giuliano, 2005). However, studies that are not based on panel datasets (do not track observations over time) cannot definitively point to cause and effect (Ihlanfeldt and Sjoquist, 1998). A recently published panel-study in the sprawling Atlanta, GA area suggests a positive relationship between bus access and poverty, indicating that low-income people move to bus accessible areas (Pathak, Wyczalkowski, and Huang, 2017).

Our study, relying on long-term analysis, is based on a panel dataset of 443 census tracts in Cuyahoga County over a six-decade period, and its results align with other findings on employment. [16]

This report further finds that poverty decreases by 12.9 percent as transit services are introduced to a previously unserved neighborhood in Cuyahoga County (Appendix Table A6).

Taken together with past research, these results suggest that low-income families tend to gravitate toward neighborhoods with higher concentration of transit services, but the percentage of such individuals decreases over time. Indeed, transportation services allow access to important factors for socioeconomic progress—such as employment, markets, healthcare, social services, and education—while contributing to an increased sense of autonomy and freedom of movement (Martens et al., 2012; Farrington and Farrington, 2005; Steg and Gifford, 2007; Boschmann and Kwan, 2008).

These findings thus point toward an important and significant contribution of GCRTA to poverty reduction in Cuyahoga County. This analysis, however, cannot definitively answer whether (or to what extent) such a decrease is caused by employment and other economic gains, and how much of it is due to the displacement of low-income groups.

[16] Pathak, Rahul, Christopher K. Wyczalkowski, and Xi Huang. "Public Transit Access and the Changing Spatial Distribution of Poverty." *Regional Science and Urban Economics* 66 (September 1, 2017): 198–212.

Figure 9: Transit Impact on Cuyahoga County Property Values

Boosts to Property Value

Property values help determine the economic viability of a neighborhood. In the long-term, we observed a positive and significant impact of access to transit services on property values. Previously unserved neighborhoods experienced up to a 3.5 percent increase in property values after gaining access to transit service (see Appendix Table B3).

This model controls for factors such as population density, housing age, rental values, manufacturing jobs, and population diversity. Based on 2010 median property values for the census tracts in Cuyahoga County with transit access, the 3.5% increase in median property value due to transit access equates to roughly $2 billion in 2017 dollars (see Appendix Table B4). This suggests that access to transit service adds to the attraction of a neighborhood in the long-term.

Past studies have shown that transit accessibility interacts with other factors such as make-up of the neighborhood, housing characteristics, crime, parking, mode of rail transit, and proximity to the city center to impact property prices (Baum-Snow and Kahn, 2000; Billings, 2011; Bowes and Ihlanfeldt, 2001; Debrezion, et al., 2007; Du and Mulley, 2012; Gatzlaff and Smith, 1993; Hess and Almeida, 2007; Ryan, 1999).

Transit access can impact property prices in several ways (Diaz and Mclean, 1999). Providing better access to employment opportunities helps attracts more people to an area—in addition to the peripheral benefits of gaining access to retail and cultural activities—so pedestrian access to transit stations adds to the attraction of a property. Such an impact for residential property values is compounded when commercial offices move to transit-accessible areas to offer easy access to their employees. As a result, such areas increase potential for development when property owners decide to develop vacant parcels or convert properties from low- to high-density use. [17]

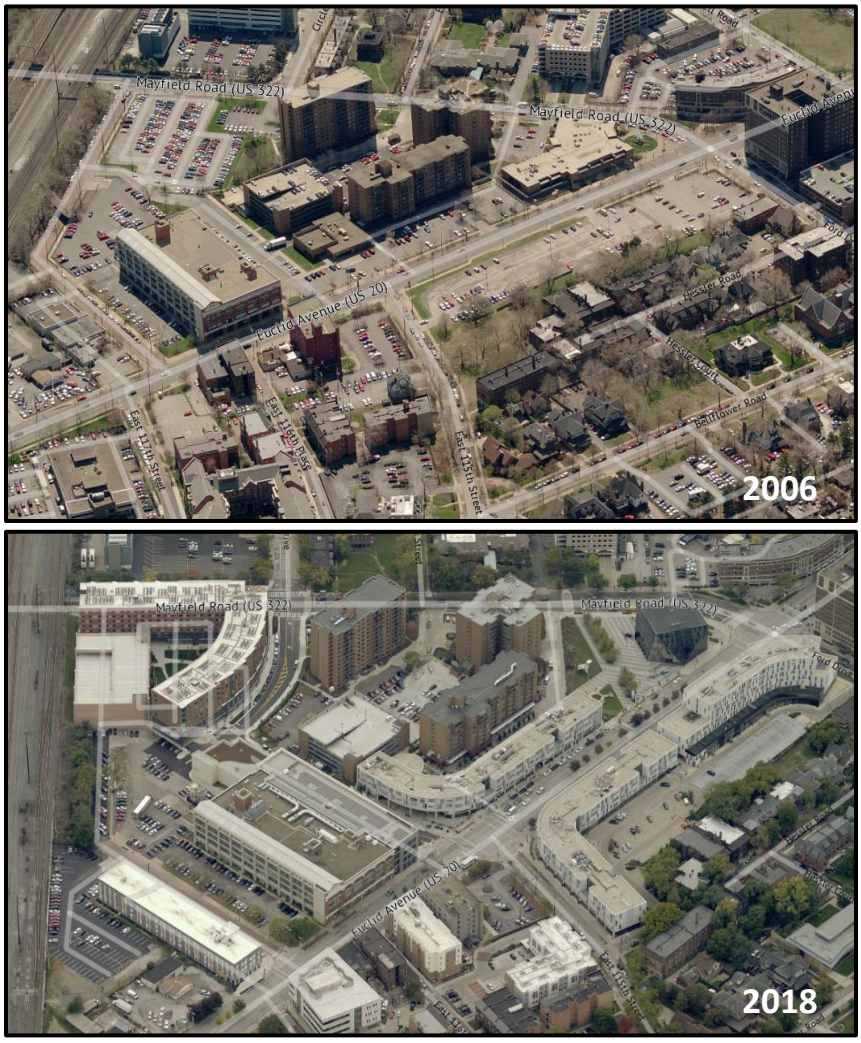
These findings confirm the results of previous research that focused on the effects of transit access on property values. In Charlotte, NC, researchers found a premium of 4% for single family homes and 11% for condominiums within 1 mile of a light rail station.[18] Within a quarter mile of a station, a 4.2% residential property

[17] Diaz, R. B., & Mclean, V. A. (1999). Impacts of rail transit on property values. In *American Public Transit Association Rapid Transit Conference Proceedings* (pp. 1-8).
[18] Billings, S. B. (2011). Estimating the value of a new transit option. *Regional Science and Urban Economics*, *41*(6), 525-536.

premium was observed.[19] Another study conducted in Buffalo, NY found a similar 2-5% premium for single-family homes located near light rail stations.[20]

Outside of the aforementioned academic studies, data suggest similar property premiums for transit access. Redfin—a popular online real estate market that uses a Transit Score® rating for homes[21]—posted a study in 2017 which analyzed more than one million home sales between 2014 and 2016 and found an average 0.6% increase in sale price per one point of transit score. [22]

Figure 10: Development in Uptown District along GCRTA's HealthLine[23]



[19] Debrezion, G., Pels, E., & Rietveld, P. (2007). The impact of railway stations on residential and commercial property value: a meta-analysis. *The Journal of Real Estate Finance and Economics*, *35*(2), 161-180.
[20] Hess, Daniel Baldwin, and Tangerine Maria Almeida. "Impact of Proximity to Light Rail Rapid Transit on Station-Area Property Values in Buffalo, New York." *Urban Studies* 44, no. 5–6 (May 1, 2007): 1041–68.
[21] Transit Score® is a patented measure of how well a location is served by public transit on a scale from 0 to 100. It includes number of trips, location of stations, and more. More at: https://www.walkscore.com/transit-score-methodology.shtml
[22] Finn, A. (2017, March 20). How much is one point of transit score worth? Redfin. Retrieved from https://www.redfin.com/blog/2017/03/how-much-is-one-point-of-transit-score-worth.html
[23] This imagery is a proprietary dataset provided courtesy of Cuyahoga County

PART 3: ACCESS TO WORK

Entry-Level Work at Arm's Reach

The concept of spatial mismatch dates to an original hypothesis in 1965[24], as society grappled with the social unrest stemming from central-city disinvestment, sprawl, and racial segregation. The theory went as follows: sprawl and segregation have moved jobs away from the central-city and into suburbs, and the distance between employers and employees for lower-income minority households has become a barrier to economic participation—serving to widen gaps of racial inequality, degrade communities, and deprive many of opportunity. This acts to the detriment of businesses as well, as the labor pool is effectively lessened and the region loses competitiveness. It is no surprise that one of Amazon's "core preferences" listed in its HQ2 RFP was access to mass transit. [25]

In Northeast Ohio, the spatial problem is acute, and difficulty with job access is widely recognized by experts as a regional deficiency. In the study conducted by the Federal Reserve Bank of Cleveland (2015), research shows that "jobs are least accessible for workers with only a high school degree" and there are "especially large differences in job access across skill levels."[26] To help illustrate job accessibility challenges in Cuyahoga County, one can consider the following situation: a prospective employee with the appropriate skillset for a job in Solon needs to get there from the Central neighborhood in Cleveland. If the prospective employee has a car, he (she) can reach their prospective workplace in 25 minutes. Since many residents of the Central neighborhood in Cleveland do not own cars, with public transit, the same route would take more than 90 minutes, nearly 4 times the duration of travel by car. This lengthy commute might discourage many prospective employees from considering this job, and the employer is less likely to fill the position. On the other hand, the higher-skilled workers at the other end of the labor market have fewer spatial barriers; for them there is generally greater job access via subsidized employee parking and higher household incomes for affording and maintaining vehicles.

Connecting every economic and residential zone in a decentralized region proves a difficult task for transit, which struggles to reorganize infrastructure and services to "follow" the suburbanization of workplaces.[27] Spatial mismatch can be alleviated both by bringing jobs to people (i.e. compact and mixed land use planning) and bringing people to jobs (i.e. lowering hurdles for mobility through equitable and efficient transportation options).[28] The Center sought to explore the effects of transit as it relates to the phenomenon of spatial mismatch in Cuyahoga County.

[24] Kain, J. F. (1992). The spatial mismatch hypothesis: three decades later. Housing policy debate 3, no. 2 (pp. 371–460). Retrieved from https://doi.org/10.1080/10511482.1992.9521100

[25] Amazon.com, Inc. (2017). *Amazon HQ2 request for proposals* [PDF document]. Retrieved from https://images-na.ssl-images-amazon.com/images/G/01/Anything/test/images/usa/RFP_3._V516043504_.pdf

[26] Barkley, B., & Gomes-Pereira A. 2015, November 23). A long ride to work: Job access and public transportation in Northeast Ohio. *A look behind the numbers* (Volume 6, Issue 1).

[27] Tomer, A. (2012). Where the jobs are: Employer access to labor by transit, 16. Retrieved from https://www.brookings.edu/research/where-the-jobs-are-employer-access-to-labor-by-transit/

[28] Gobillon, L., Selod, H. & Zenou, Y. (2007). The mechanisms of spatial mismatch. *Urban Studies* 44, no. 12: 2401–27. https://doi.org/10.1080/00420980701540937

Figure 11: The Disconnect Between Entry-Level Job Hubs and High Poverty Tracts

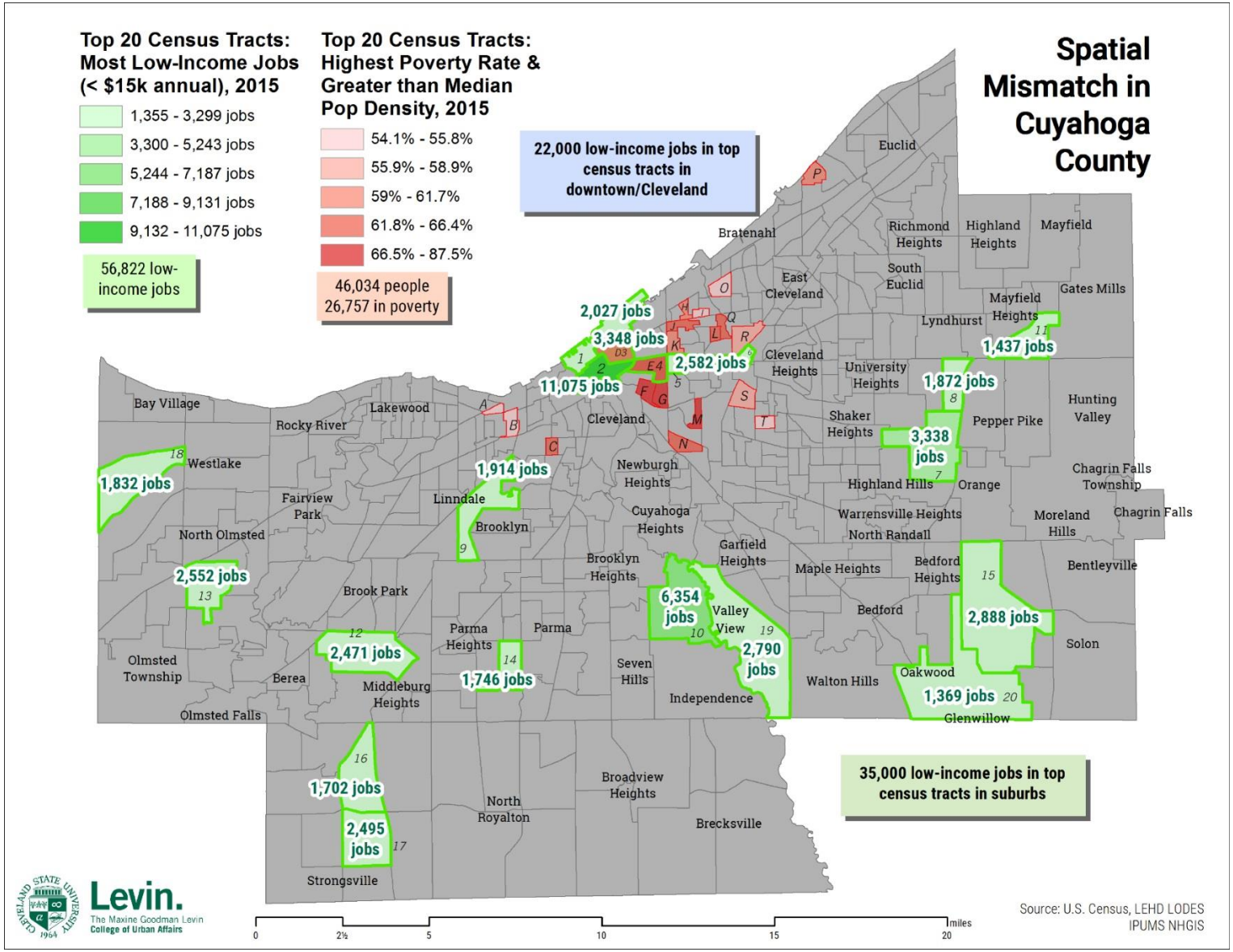
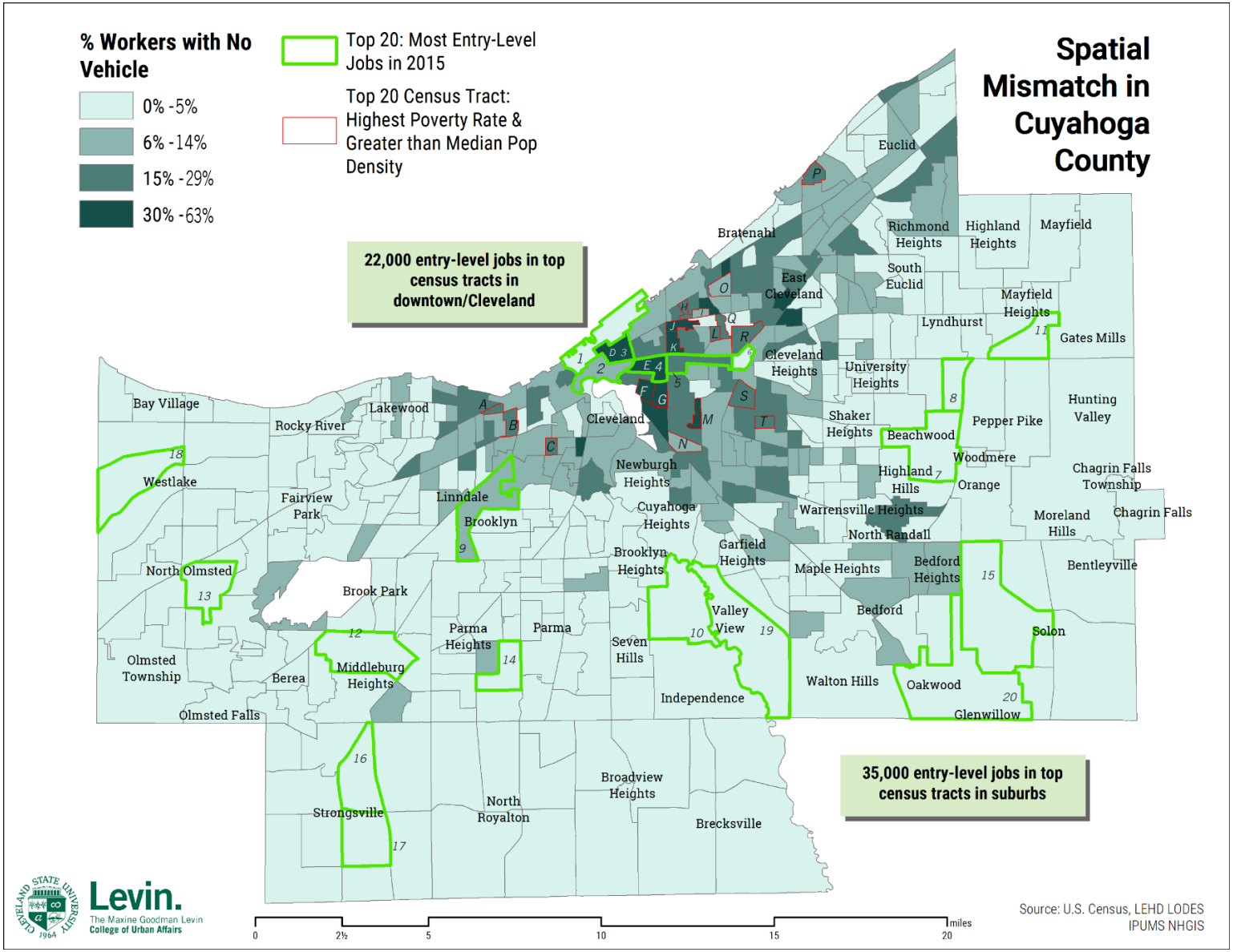


Figure 12: Workers Living in No-Vehicle Households, 2015



Connecting Workers to Workplaces

Figure 13 illustrates the top 20 highest-poverty census tracts with higher than median population density[29] in the county. These census tracts are highlighted in shades of red, getting darker as poverty rates increase. They outline very distressed neighborhoods with up to almost 90% of the population in poverty. They also have the highest prevalence of workers with no vehicles.

The top 20 census tracts with the highest number of entry-level jobs are shown in shades of green; color is darker as the number of those jobs increases. The green tracts were considered as entry-level job "hubs." From first glance, it is clear that most jobs hubs are scattered out away from the core of the city—far from the poorest neighborhoods designated in shades of red.

While downtown was a relatively nearby concentration of entry-level jobs in 2015 (about 22,000 entry-level jobs around the central business district), there were even more entry-level jobs in the suburbs (about 35,000 entry-level jobs scattered in outer-ring suburbs).

Along with distance, financial obstacles and unpredictable risks inherent to car ownership are difficult to overcome in these distressed neighborhoods—which have some of the lowest rates of vehicle ownership in the county. There is a visible association between the red poverty tracts above and low mobility options.

The Center gathered drive time and transit travel time from each of the 20 poverty census tracts to each of the entry-level job hubs. Using LEHD data,[30] we are able to address where workers residing in high-poverty census tracts travel for work. With these data, the Center sought to answer the following question: ***Do high-poverty census tracts with relatively shorter transit travel times to suburban entry-level job hubs tend to have more individuals who have found work in those hubs?*** In other words, does transit service effectively connect these distressed neighborhoods with employers who are looking for entry-level workers?

While (on average) transit travel takes significantly longer than driving (as seen across the U.S.), **our models showed that relatively quicker GCRTA services were affiliated with higher rates of poverty-tract employees working in these job hubs.** This finding aligns with empirical studies of other auto-oriented metros that show greater transit-based job access for low-skilled workers increases the probability of being employed.[31]

Emerging Preferences for Next Generation

In addition to the equity-driven benefits of transit access, there is a growing consensus across the nation that transit-rich areas are better magnets of young talent than an auto-

[29] Steven, M., Schroeder, J., Van Riper, D., & Ruggles, S. (2018). *IPUMS National historical geographic information system: Version 13.0* [Database]. Minneapolis, MN: University of Minnesota. http://doi.org/10.18128/D050.V13.0

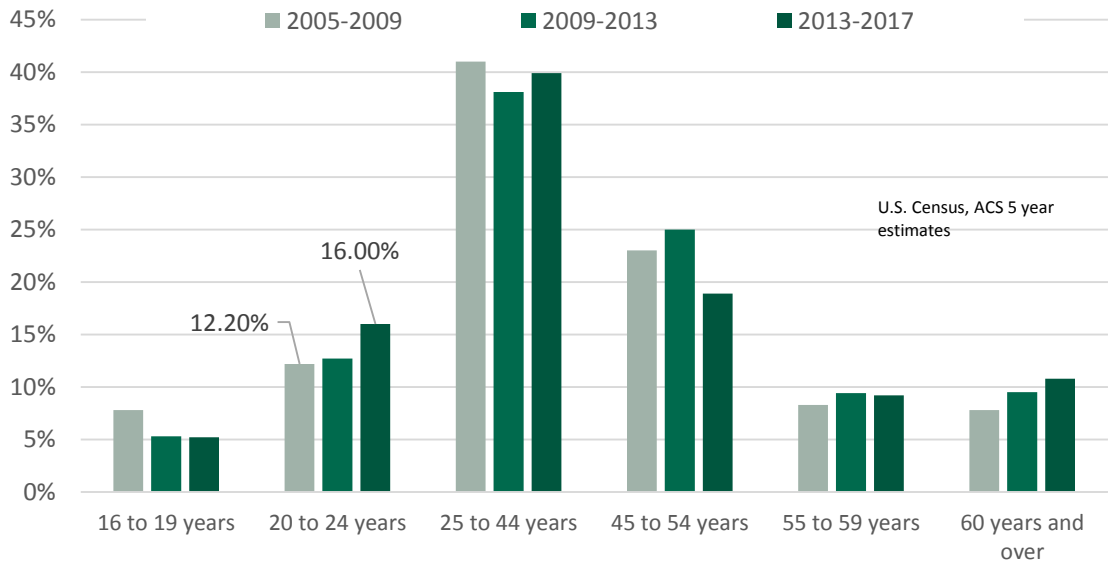
[30] Longitudinal Employer-Household Dynamics (LEHD) data are the result of a partnership between the Census Bureau and U.S. states to provide high quality local labor market information, based on Unemployment Insurance earnings, data, the Quarterly Census of Employment and Wages (QCEW), and censuses and surveys.

[31] Kawabata, M. (2003). Job access and employment among low-skilled autoless workers in US metropolitan areas. *Environment and planning A: Economy and space* 35, no. 9: 1651–68. https://doi.org/10.1068/a35209

centric job market.[32] The Center explored trends in Cleveland's transit commuters and found 20- to 24-year-olds are becoming a larger component of ridership over the years. The later up-tick in 25- to 44-year-olds as a percentage of ridership is possibly the millennial generation crossing into a new age bracket.

Concurrently, older age brackets (55 and up) saw modest percent-total gains in Cleveland metro's public transit commuters. This trend is expected, as the large Baby Boomer cohort have entered the last years of their careers and millennials become the main working generation in the economy.

Figure 13: Cleveland Metro Area, % of Public Transit Commuters by Age



[32] Schaper, D. (2018, November 29). 'Talent wants transit': Companies near transportation gaining the upper hand. *National Public Radio*. Retrieved from https://www.npr.org/2018/11/29/671203167/talent-wants-transit-companies-near-transportation-gaining-the-upper-hand

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PART 4: OTHER LOCAL CONTRIBUTIONS

Cost Savings and Rider Profiles

Local transit systems offer affordable mobility to their customers, resulting in multifaceted cost-savings and efficiencies for individuals, families, companies, and governments who have access to the network. One way to measure affordability of such systems is to compare the cost to utilize public transit against the cost of commuting via private vehicles. This study analyzes the cost savings due to GCRTA by estimating the cost of travel via car (including gas prices, wear-and-tear, depreciation, commute time, and parking) and comparing those costs against GCRTA fares.

All estimates reported below are speculative and do not follow robust econometric analysis due to data restrictions. Some of these estimates are based on the On-Board Transit Survey of 31,753 individuals conducted by the GCRTA in 2013. See Technical Appendix C for further details on how the Center used the survey.

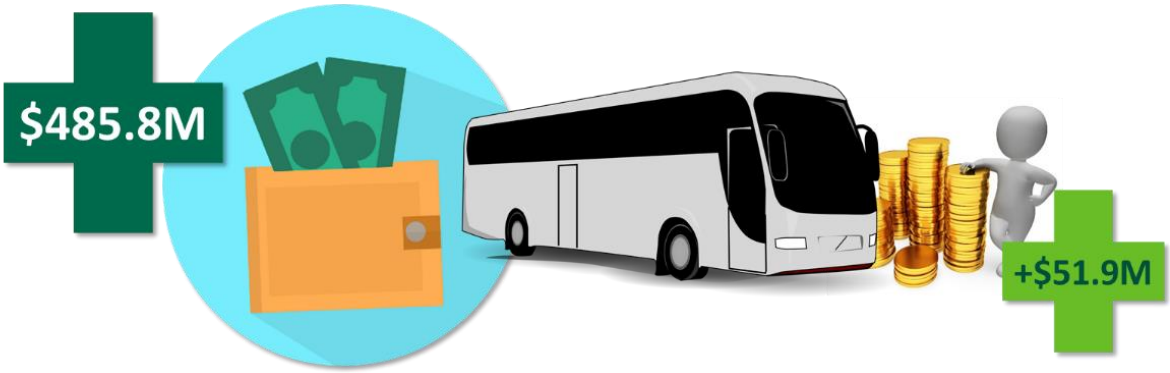
Dependency of County Workforce on Transit & Associated Earnings

GCRTA transports about 34,000 riders to their workplace every day. Of these, about 25,000—or 72% of commuters—are estimated to be dependent on transit services, meaning they do not have access to a vehicle. Further, about 15,000 transit commuters are highly dependent on transit services to get to their workplace, meaning they do not have driver's licenses or vehicles. Cuyahoga County has the 49th highest number of transit commuters in the nation among 3,000+ counties.[33] **The annual earnings of GCRTA transit commuters are estimated to be around $486 million dollars.**

Cost of Losing Jobs in No-Transit Scenario

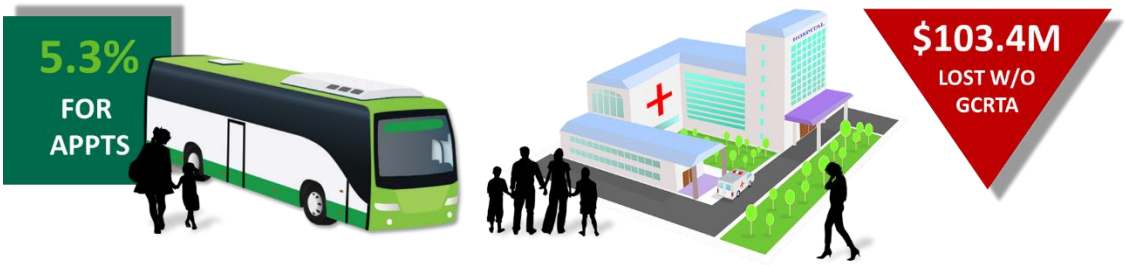
Conservatively assuming that 64% of transit-dependent individuals would lose their jobs without GCRTA services[34], the Center estimated that about 16,000 people would be out of work, at least temporarily. In this case, we can estimate the cost of unemployment benefits for those individuals as $5.8 million dollars.

Figure 14: Transit Access and Customers



[33] U.S Census Bureau, American Community Survey, 2013-2017 5 Year Estimates
[34] Based on Northeast Ohio Areawide Coordinating Agency regional trip analysis mode-shift without transit

Figure 15: Transit and Healthcare



Direct Transportation Cost Savings

The Center estimates that **Cuyahoga County commuters saved nearly $52 million in 2017 by traveling with GCRTA instead of driving their own cars.**[47] This estimate assumes all individuals who rode transit would have switched to driving alone. While only a thought experiment, the figure is demonstrative of the potential for transportation cost savings when people take transit instead of driving alone. This figure does not consider the cost of increased congestion were GCRTA to stop services, which is assessed further on with NOACA's model results.

Avoiding Medical Appointment Cancels and No-Shows

Over 3,000 individuals use GCRTA each day to reach medical appointments.[35] Many of these riders would be at risk of cancelling or missing their appointments in absence of GCRTA services. While the health risks caused by not being able to access healthcare are easy to imagine—especially for some of the most vulnerable members of society—there are also significant operational costs put on the providers. Healthcare institutions in Greater Cleveland are estimated to be at risk of incurring $113 million annually due to potential no-shows at appointments if transit were not available.[36]

Student Transportation Cost Savings

Cleveland Metropolitan School District (CMSD) transports several thousand students from grades 7 to 12 to their campus via an agreement with GCRTA. In fiscal year 2017, 11,020 public pupils were given GCRTA passes to get to school for a cost of $4.9 million dollars to CMSD. Close to half that number—5,883 students—boarded school buses to get to class at a cost of $20.3 million dollars.[37] 4,400 of these students are dependent on GCRTA services. Per pupil, the cost of transportation via busing is substantially higher than public transit passes (Appendix Table A2) across the state and especially in Cleveland.

Based on Ohio Department of Education expense data, the Center determined that **$28.7 million additional dollars a year would be spent by CMSD to bus students without the partnership with GCRTA.** Over 5,000 K-12 students use GCRTA to reach school, out of which 4,400 are dependent on its services.

[35] Based on 2013 GCRTA On-Board Survey
[36] Based on $219 average cost of no-show appointments (see Appendix Table C2 for more details).
[37] Ohio Department of Education. (2018). *F2017 cost analysis report*. Retrieved from http://odevax.ode.state.oh.us/htbin/f2017-cost-analysis.com?irn=043786

Table 9: Annual Transportation Costs, Dollars per Pupil

SCHOOL DISTRICT	SCHOOL / PRIVATE BUSING	PUBLIC TRANSIT
Cleveland SD	$3,048	$272
Toledo SD	$2,308	$329
Cincinnati SD	$1,442	$525
Shaker Heights SD	$1,425	-
Solon SD	$1,382	-
Akron SD	$1,608	$289
Columbus SD	$1,232	$127
OHIO - STATEWIDE	$921	$371

Social Service Savings

Over 3,500 individuals with disabilities are dependent on RTA for travel.

Out of the 7,091 individuals who use GCRTA to access markets, 6,003 are likely to be dependent on its services. Over 14,000 individuals are dependent on RTA to for recreation and family travel.

An estimated 67,000 individuals (or 5.3 percent of the population) in Cuyahoga country use GCRTA; out of these, almost 52,000 are dependent or highly dependent on these services.

GCRTA helps over 34,000 individuals reach work; out of these almost 25,000 are dependent on its services. Removal of RTA services could cost the state of Ohio up to $8 million per year in social service costs for these groups.

Access to Education

GCRTA services are significant for students in Cuyahoga County. Students comprise about one quarter of all ridership, and 3/4^{ths} of them are without vehicles and dependent.

Figure 16: Transit and Students

Table 10: Student Riders of GCRTA (Onboard Survey 2013)

Type of Rider	% of Total Ridership	Dependent (no car)	Highly Dependent (no license)
Students	25%	77%	58%
K through 12	8%	91%	88%
Higher Education	17%	70%	44%

Higher-education students are an even larger subset of ridership than K-12 students. While higher-ed students were less dependent because of their age, many of them used transit to get to campus. GCRTA's U-Pass program allows full-time students to buy reduced-price semester-long passes or receive them with their tuition fees. Large public and private universities participate in the program, including Case Western Reserve University, the Cleveland Institute of Art, the Cleveland Institute of Music, Cleveland State University, and Cuyahoga Community College.

Access to Food and Recreation

Transit services are also important for getting families to supermarkets, social engagements, and recreation. About one in four riders use GCRTA for getting to their friends, family, or recreation. Further, about one in ten riders use transit to buy groceries or purchase food. More than half of commuters in these categories are highly dependent on transit services; this has heavy implications for widening food deserts and limiting access to quality food which are out of walking range for underserviced populations.

Table 11: Access to Food and Recreation Ridership

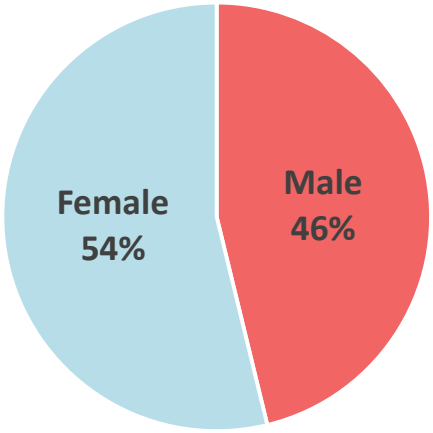
Purpose of Trip	% of Total Ridership	Dependent (no car)	Highly Dependent (no license)
Going to Food/Market	11%	85%	58%
Recreation and Social	26%	83%	58%

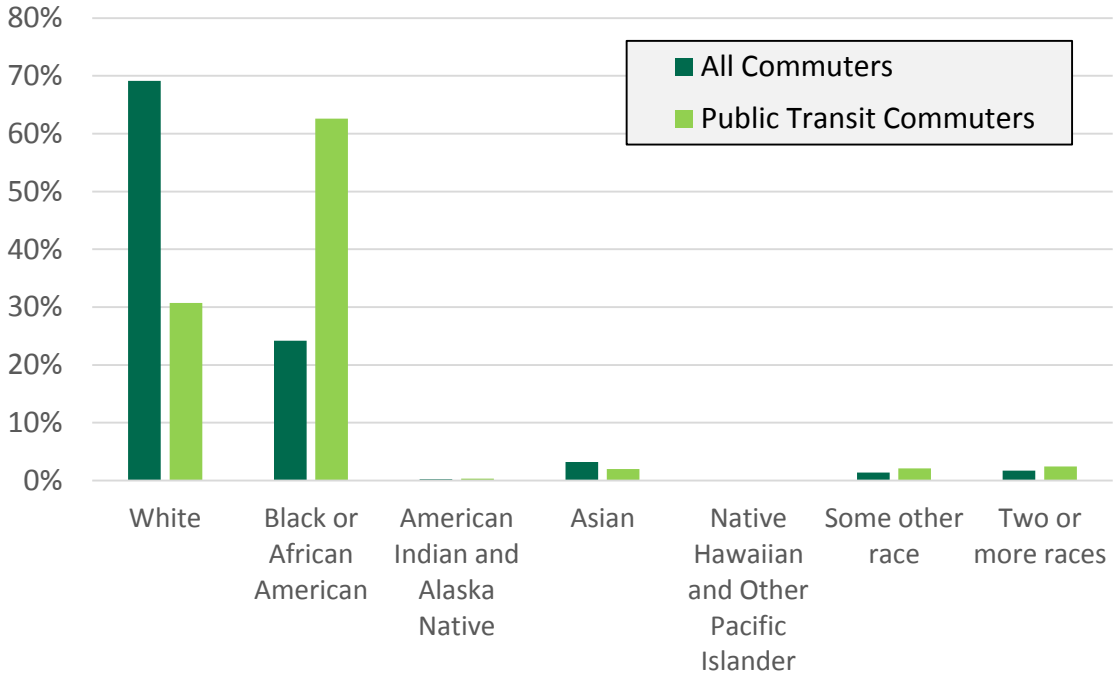
Mobility for Women, People of Color, Minorities and Disabled

RTA serves a proportionally greater number of women and people of color. Census data (shown in Figure 8 below) reveal that nearly 2/3^{rds} of riders in Cuyahoga County who use transit to get to work are African American, effectively the inverse of the overall racial makeup of Cuyahoga County's workforce. There are clear implications from demographic data that transit services play a proportionally larger role in the lives of workers of color, and, to a smaller extent, for female workers. Any efforts toward reinvigorating the economy with inclusion in mind should take these demographic discrepancies into account.

Figure 17: 2013-2017 Cuyahoga County Public Transit Commuters by Sex and Race

Source: U.S. Census Bureau, ACS 5-year estimates, 2013-2017





Source: U.S. Census Bureau, ACS 5-year estimates, 2013-2017

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PART 5: DESCRIPTIVE SALARY ANALYSIS

GCRTA Payroll Contributions to Greater Cleveland

GCRTA's largest annual expense is, by and large, salaries for their labor. Around two thousand employees take their annual salary home to local economies—and to municipal coffers through payment of income taxes. GCRTA regularly ranks among the 100 largest employers in Northeast Ohio; in 2018, it was listed as the 38th largest employer in the region and the 13th largest based out of Cleveland proper.[38]

The Center analyzed the spatial pattern of payroll in Cuyahoga County according to employee ZIP codes and municipality.[39] A total of $112,134,465 in salaries was paid to GCRTA employees residing in Cuyahoga County in 2017.

There were 24 municipalities with at least $1 million dollars of employee salaries, 13 with totals greater than $2 million, and three above $5 million. Cleveland, the largest city in population and a central transit hub, had the highest received payroll—about $35.3 million dollars in total income.

The top ten municipalities (Table 12) had 2017 GCRTA employee payrolls totaling nearly $73 million dollars. Figure 19 illustrates that many GCRTA employees reside in ZIP codes within the eastern suburbs. An exhaustive list of 2017 payroll by municipality is found in Appendix E.

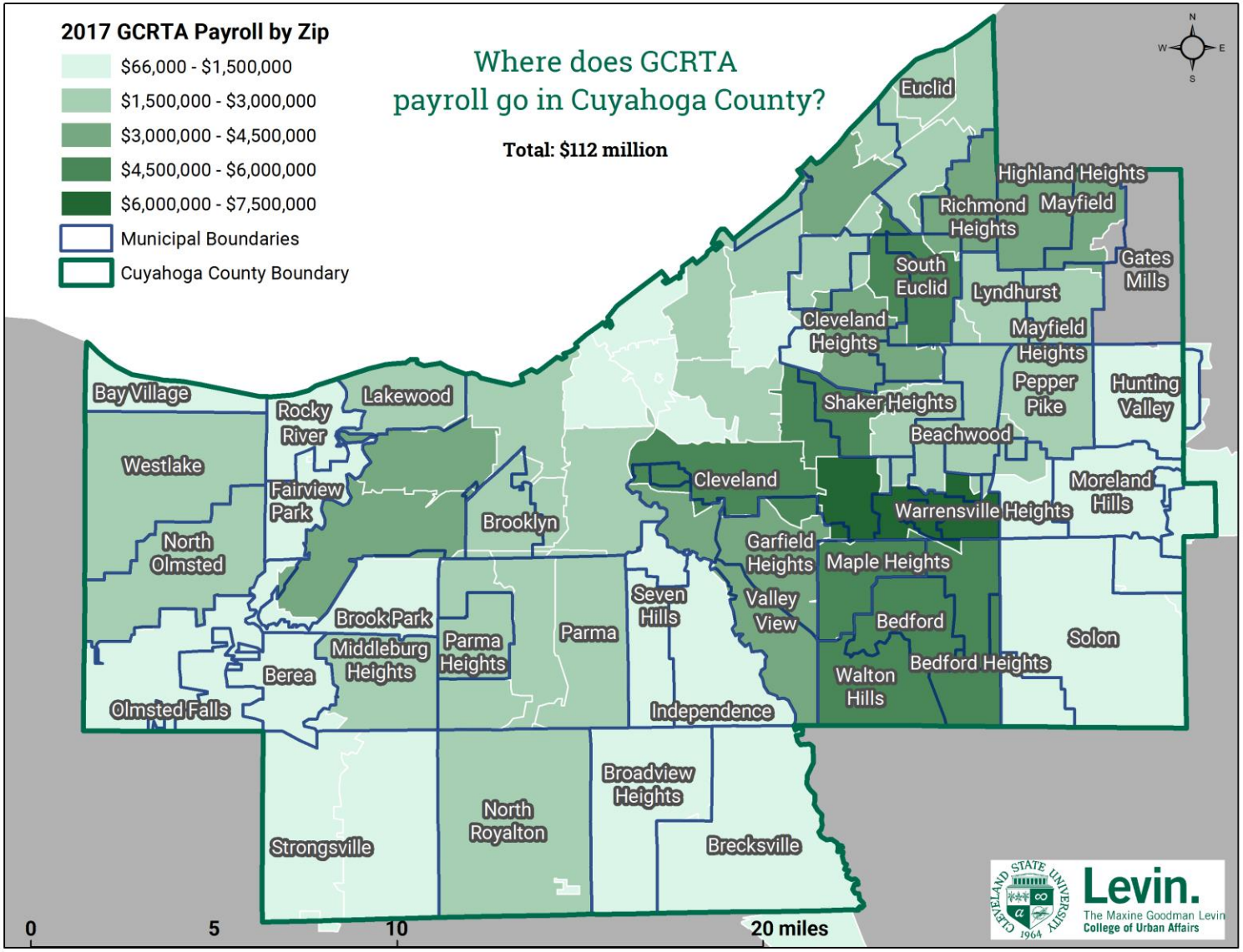
Table 12: Top 10 GCRTA Payroll

Top 10 Municipalities	Estimated Salaries[39]
Cleveland	$35,278,333
Euclid	$7,874,021
Maple Heights	$5,100,236
Parma	$4,610,463
Cleveland Heights	$4,221,016
Walton Hills	$3,771,076
Shaker Heights	$3,741,882
South Euclid	$3,149,444
Warrensville Heights	$2,763,235
North Olmsted	$2,370,678

[38] Employers, Top 100. (2018, August 13). *Crain's Cleveland Business*. Retrieved from https://www.crainscleveland.com/data-lists/10608/employers-top-100

[39] If a ZIP code crosses municipal boundaries, areal proportions were used to attribute salaries to municipalities.

Figure 18: GCRTA 2017 Salaries by ZIP



CONCLUSION

The Greater Cleveland Regional Transit Authority's economic impact is large-scale and multifaceted. Solely on the basis of its annual spending in 2017, GCRTA produced a $322 million-dollar output in Cuyahoga County's economy and secured almost 3,000 jobs. As one of the largest public employers in the County, its local employees take home $112 million a year to their communities across the county, which is then spent on housing, healthcare, education, and other typical household expenses—influencing the economy mostly via induced effects in consumer-driven industries. Most of these dollars are kept within the County, with 82% of employees residing in Cuyahoga County.

The network of transportation services provided by GCRTA has a considerable economic impact, testifying to the universal role of transportation as a pillar of economic activity, whether it be moving goods to markets or people to their workplaces. Our longitudinal models show that neighborhoods gaining transit access saw long-term gains in employment and property values—as well as drops in poverty.

The observed 3.5% increase in property value due to acquiring transit access in Cuyahoga County equates to roughly $2 billion in 2017 dollars. On average, census tract employment increased by 3.1%, and poverty decreased by 12.9% while controlling for other factors.

Employment patterns in Cuyahoga County show that relatively quicker transit services between the highest poverty neighborhoods and entry-level job hubs resulted in greater likelihoods of lower income residents working in those hubs.

GCRTA's ridership is strongly tied to employment; surveys show that 50% of ridership is commuters to and from work. An estimated $486 million of labor income is taken home by those using GCRTA to reach their workplace.

Other contributions of public transportation include commuting cost savings and equitable mobility for many who need carless access to employment, recreation, and food. More than 60% of transit commuters in the Cleveland metropolitan area are African American, demonstrating the role of public transit in the creation of solutions that address racial disparities in the region.[40] Regional transit also serves as an economic attraction tool, as public transportation is increasingly used and preferred by young talent.

GCRTA is estimated to save transit commuters nearly $52 million in transportation costs and healthcare institutions $113 million from avoided appointment cancels and no-shows. The school district saves $28.7 million by using transit passes instead of busing its students.

The results of the current study reflect GCRTA's current operating environment, which includes lower ridership and correspondingly lower levels of capital and operating expenditures. There is an opportunity to consider how much greater the economic impact may be with different levels of service, higher operational maintenance and capital expenditures, and more efficient land uses that fully utilize GCRTA's services and infrastructure.

[40] Warren, Kate. "Racial Disparities." *The Center for Community Solutions* (blog). Accessed March 21, 2019. https://www.communitysolutions.com/research/racial-disparities/.

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APPENDICES

Appendix A: Capital Expenditure Analysis (2013 – 2017)

Salaries and benefits constitute a large percentage of GCRTA's contribution to the economic impact in Cuyahoga County (the County). Individually, GCRTA's payments of salaries and overtime, Medicare, and fringe benefits to County residents each accounted for about 82% of total expenses in this category. In 2017 GCRTA contributed $156.4 million to the payroll of employees in the County (Appendix Table A1).

Appendix Table A1: Operational Expenditures – GCRTA Wages and Benefits, 2017

Salaries, Fringe and Medicare, 1 YEAR, 2017	
GCRTA Data - Total - 2017 Salaries & Overtime	$ 137,314,662
GCRTA Data - Cuyahoga County - 2017 Salary Reports	**$ 112,049,510**
Ratio of CC Salary to Total Salary	82%
Total 2017 Medicare (from OPEX)	$ 1,890,290
Ratio of CC Salary to Total Salary	82%
Cuyahoga County 2017 Medicare (derived with ratio)	**$ 1,562,176**
Total 2017 Fringe Benefits	$ 51,553,465
Ratio of CC Salary to Total Salary	82%
Cuyahoga County 2017 Fringe Benefits (derived with ratio)	**$ 42,067,908**
Liability transferred to Household Income	$ 833,531
Ratio of CC Salary to Total Salary	82%
Cuyahoga County 2017 Household Income (derived with ratio)	**$ 683,495**
2017 Cuyahoga County Salaries, Medicare, and Benefits SUM with transfers	**$ 156,363,089**

All monetary values in 2017 dollars

In 2017, GCRTA paid $14.4 million to vendors in Cuyahoga County to secure its operations (Appendix Table A2). Accrued Medicare, worker's compensation, preventative maintenance costs, liability, and any expenses not in the County were removed from total operating expenditures and transferred to other, more appropriate expenses.

Appendix Table A2: Operational Expenditures – GCRTA Budget, 2017

GCC Object Class #	GCC Object Class Description	2017
503052	Other Maintenance Contracts	$1,697,118
506040	Liability and Property Claims	$298,255
503-049,991,509-0910,090,990	Miscellaneous Expenses	$228,933
512-020,030,120	Leases and Rentals	$107,727
509103	Senior Transportation and Non-ADA Assistance	$130,130
509020-022	Travel and Meal Expenses	$169,022
508-020,024	Purchased Transportation	$8,020,994
50303-1,4,7,9	Court and Legal Expenses	$199,599
507-030,990	Property and Other Taxes	$172,878
503030,506200	Workers Compensation – Administration Fee, Settlement/Lawsuit Expenses	$96,234
5050-19, 21	Utilities	$1,081,951
5040-02,07,10,11,12,31,51,70,80	Parts and Materials	$232,708
50400-1,3,6,5040-50,52,60	Supplies	$114,931
503-046,990	Miscellaneous Professional, Technical, Other Services	$1,001,343
502148,503041	Tuition Reimbursement and Wellness	$69,104
503020-021	Advertising	$824,214
	GCRTA Data for Cuyahoga County - TOTAL	$18,301,492
204063	AP-Accrued Medicare (TRANSFERRED TO SALARIES)	($1,905,093)
502071	W/C - Injuries and Damages to Employees (TRANSFERRED TO SALARIES)	($752,955)
503990, 509111, 509990	Preventative Maintenance (REMOVED TO PREVENT SALARY DOUBLE COUNT)	($425,195)
509990	Not in Cuyahoga County	($523)
506040	Liability (TRANSFERRED TO "HOUSEHOLD INCOME" INPUT)	($833,531)
	Adjusted Cuyahoga County Operating Total - IMPLAN	**$14,384,195**

All monetary values in 2017 dollars

The remaining GCRTA internal accounting classes were combined into like categories and entered into an IMPLAN input-output model for Cuyahoga County (Appendix Table A3).

Appendix Table A3: Operational Expenditures – IMPLAN, 2017

Expense types	2017
Advertising, public relations, and related services	$833,874
Construction and maintenance	$470,359
Federal government enterprises	$3,142
Healthcare services	$31,658
Junior colleges, colleges, universities, and professional schools	$242,547
Legal services	$601,764
Local government electric utilities	$667,164
Manufacturing	$315,480
Marketing research and all other miscellaneous professional, scientific, and technical services	$429,858
Organizations or associations	$222,300
State and local government enterprises	$470,958
Professional support services	$1,322,303
Rental and leasing	$75,437
Retail	$76,382
Transit and ground passenger transportation	$8,141,224
Transportation and automotive	$211,630
Water, sewage and other systems	$233,016
Wholesale trade	$35,098
Total OPEX in Cuyahoga County	**$14,384,195**

All monetary values in 2017 dollars

Appendix Table A4: Top Employment Industries Affected by Total 2017 Impact

Industry	Direct	Indirect	Induced	Total
Transit and ground passenger transportation	1,800	235	3	**2,039**
Construction of other new nonresidential structures	0	82	0	**82**
Hospitals	0	0	48	**48**
Full-service restaurants	0	1	39	**40**
Limited-service restaurants	0	1	37	**38**
Real estate	0	2	29	**32**
Retail - Food and beverage stores	0	0	22	**22**
Individual and family services	0	11	10	**21**
Home healthcare services	0	2	19	**21**
Offices of physicians	0	0	21	**21**
Other Sectors	0	98	516	**614**
Total	**1,800**	**433**	**744**	**2,977**

Appendix Table A5: Capital Expenditures – GCRTA Budget, 2013-2017

Class #	Description	2013	2014	2015	2016	2017
509003	Preventive Maintenance - Labor Reimbursement	$9,845,799	$14,763,850	$17,664,611	$21,198,871	$20,003,674
111011	Road Improvement-BRT	$42,475	$53,708	$29,500	$366,915	-
111010	Vehicles (Non-Passenger)	$839,289	$99,731	$149,881	$13,350	-
111008	Communication Equipment	$679,942	$19,234	$319,015	$10,447	$34,119
111007	Transportation Equipment	$426,607	$816,945	$605,687	$177,374	$75,613
111006	Office Equipment	$69,396	-	$3,700	$24,292	$17,288
111005	Furniture and Fixtures	-	-	$159,286	$667,192	$161,731
111004	Passenger Shelters	-	-	$75,000	$379,935	-
111003	Stations and Buildings	-	-	-	$6,500	$6,499
111002	Land	$884,373	$3,708	-	-	-
105020	CIP-Capital Project (Grant)	$16,485,156	$30,256,114	$16,445,300	$21,158,641	$11,323,818
103010	MAT-Repair Parts/Materials/Supplies	-	-	-	$0,04	-
	GCRTA Data for Cuyahoga County TOTALS	**$29,273,036**	**$46,013,290**	**$35,451,980**	**$44,003,522**	**$31,622,741**
105020	CIP-Capital Project (Grant) - REMOVED "RTA GEN INC" ALREADY IN SALARIES	-$2,080,621	-$735,902	-$1,444,100	-$252,413	-$303,077
509003	Prevent. Maintenance Labor - REMOVED "RTA GEN INC" ALREADY IN SALARIES	-$9,845,799	-$14,756,264	-$17,664,611	-$21,198,871	-$20,003,674
503046	Misc. Prof. & Tech. Services - ADDED TRANSFER IN FROM OPEX	$932,130	-	-	-	-
	Adjusted Cuyahoga County Totals - IMPLAN	**$18,278,747**	**$30,521,124**	**$16,343,269**	**$22,552,237**	**$11,315,990**
	Annual Total of All Capital Expenditures	$70,400,163	$61,133,321	$87,091,044	$54,429,122	$59,867,823
	% Capex in Cuyahoga County	26%	50%	19%	41%	19%

All monetary values in nominal dollars

Appendix Table A6: Capital Expenditures – IMPLAN, 2013-2017

Expense types	2013	2014	2015	2016	2017
Architectural, engineering, and design services	$1,633,711	$717,560	$690,191	$750,005	$743,597
Construction & maintenance	$14,127,988	$29,518,891	$15,061,063	$20,810,524	$9,985,205
Consulting services	$24,475	-	-	$549,875	$118,919
Environmental and other technical consulting services	-	-	-	$6,500	-
Government and utility	-	$13,708	-	-	$84,794
Legal services	$879,298	-	-	-	-
Manufacturing	$13,655	-	$330,930	$19,144	$152,003
Motor vehicles and parts	$845,112	$130,099	$189,357	$23,188	$8,251
Printing services	$36,692	-	-	-	-
Real estate services	$5,075	-	-	-	-
Retail - Building mat and garden equip and supplies	-	-	-	$87,102	$21,110
Security services	$679,942	-	-	-	$34,119
Systems and software	-	$19,234	-	$64,000	
Transportation	-	$12,881	-	-	-
Wholesale	-	$101,165	$71,729	$223,404	$137,108
Wireless and communications	$32,895	-	-	$18,495	$30,885
Valve and fittings, other than plumbing, manufacturing	-	$7,586	-	-	-
Annual Total CAPEX in Cuyahoga County	**$18,278,841**	**$30,521,125**	**$16,343,269**	**$22,552,237**	**$11,315,990**
Annual Total CAPEX	$70,400,163	$61,133,321	$87,091,044	$54,429,122	$59,867,823
% of Capital Spending in Cuyahoga County	26.0%	49.9%	18.8%	41.4%	18.9%

All monetary values in nominal dollars

Appendix Table A7: Total Economic Impact of GCRTA Capital Expenditures, 2013-2017

Impact Year	Employment	Labor Income	Value Added	Output	State & Local Tax
2013	235	$13.6	$19.2	$32.3	$1.1
2014	382	$21.9	$31.2	$53.2	$1.8
2015	201	$11.5	$16.3	$27.8	$0.9
2016	278	$15.9	$22.6	$37.9	$1.3
2017	140	$7.9	$11.2	$18.9	$0.6
Average	**247**				
Total		**$70.9**	**$100.5**	**$170.1**	**$5.8**

All monetary values in 2019 millions of dollars

Appendix Table A8: Annual Capital Impacts on Employment (Full-Time Equivalents)

Employment	2013	2014	2015	2016	2017	Average
Direct	0	0	0	0	0	**0**
Indirect	185	302	159	220	111	**195**
Induced	50	80	42	58	29	**52**
Total	**235**	**382**	**201**	**278**	**140**	**247**

Appendix Table A9: Annual Capital Impacts on Labor Income

Labor Income	2013	2014	2015	2016	2017	Total
Direct	0	0	0	0	0	**0**
Indirect	$11.2	$18.0	$9.5	$13.1	$6.5	**$58.2**
Induced	$2.4	$3.9	$2.1	$2.8	$1.4	**$12.7**
Total	**$13.6**	**$21.9**	**$11.5**	**$15.9**	**$7.9**	**$70.9**

All monetary values in 2019 millions of dollars

Appendix Table A10: Annual Capital Impacts on Value Added

Value Added	2013	2014	2015	2016	2017	Total
Direct	0	0	0	0	0	**0**
Indirect	$14.9	$24.2	$12.7	$17.5	$8.7	**$77.9**
Induced	$4.3	$7.0	$3.7	$5.1	$2.5	**$22.6**
Total	**$19.2**	**$31.2**	**$16.3**	**$22.6**	**$11.2**	**$100.5**

All monetary values in 2019 millions of dollars

Appendix Table A11: Annual Capital Impacts on Output

Output	2013	2014	2015	2016	2017	Total
Direct	0	0	0	0	0	**0**
Indirect	$25.3	$42.0	$21.9	$29.7	$14.8	**$133.6**
Induced	$7.0	$11.3	$5.9	$8.2	$4.1	**$36.4**
Total	**$32.3**	**$53.2**	**$27.8**	**$37.9**	**$18.9**	**$170.1**

All monetary values in 2019 millions of dollars

Appendix Table A12: Annual Capital Impacts on State and Local Tax

State & Local Tax	2013	2014	2015	2016	2017	Total
Direct	0	0	0	0	0	**0**
Indirect	$0.7	$1.2	$0.6	$0.9	$0.4	**$3.8**
Induced	$0.4	$0.6	$0.3	$0.4	$0.2	**$2.0**
Total	**$1.1**	**$1.8**	**$0.9**	**$1.3**	**$0.6**	**$5.8**

All monetary values in 2019 millions of dollars

Appendix B: Transit Service Data Sources and Methods

Historical transit service in Cuyahoga County was modeled from archived paper system maps provided by GCRTA. Some maps predated the formation of GCRTA, with the earliest from 1966 and the latest from 2010. The resulting dataset was a binary variable of transit access on the census tract level, using a standardized tract boundary, allowing for time series analysis of consistent geographies.

After each map was referenced geographically to an accurate map of the county, it was possible to trace over those routes digitally, resulting in an accurate set of bus and rail routes. Many routes stayed the same over the time period, and followed major corridors, while other required more elaborate tracing. This process was repeated for each vintage of transit map.

Census tracts which had no transit routes passing along or through in one year, but had a route passing along or through in the following year, were flagged. Each census tract also had longitudinal socioeconomic data attached, which was used to control for other circumstances and isolate the effect of transit access.

GCRTA/CTS System Maps Used

- 1966
- 1971
- 1974
- 1981
- 1990
- 2000
- 2010

The Digitization Process in 3 Steps (clockwise)

Appendix C: Statistical Model Results

Appendix Table C1: Dependent Variable – Employment (Long-Term Impact)					
	(1)	(2)	(3)	(4)	(5)
TR_ACCESS		0.330***	0.043***	0.028***	0.031***
		(0.052)	(0.013)	(0.010)	(0.011)
POPDENS	0.777***		1.041***	0.782***	0.775***
	(0.029)		(0.019)	(0.029)	(0.029)
H30OLD	0.014**		0.0320***	0.011*	0.011*
	(0.007)		(0.008)	(0.006)	(0.007)
RENTVAL	0.106***		0.128***	0.103***	0.103***
	(0.035)		(0.047)	(0.035)	(0.035)
MANUF	0.241***			0.245***	0.240***
	(0.023)			(0.023)	(0.023)
HH_BLACK	0.005*				0.005*
	(0.003)				(0.003)
Constant	-1.495***	6.975***	-2.534***	-1.549***	-1.466***
	(0.239)	(0.049)	(0.281)	(0.239)	(0.237)
Census Tract FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
Observations	2,143	2,214	2,211	2,208	2,143
R-squared (within)	0.873	0.127	0.835	0.875	0.873
No. of Census Tracts	443	443	443	443	443

Appendix Table C2: Dependent Variable – Poverty (Long-Term Impact)					
	(1)	(2)	(3)	(4)	(5)
TR_ACCESS		-0.162***	-0.124***	-0.111**	-0.129***
		(0.046)	(0.046)	(0.044)	(0.043)
POPDENS	0.023		-0.087	0.122	0.031
	(0.095)		(0.070)	(0.096)	(0.095)
H30OLD	0.014		-0.001	0.012	0.023
	(0.024)		(0.024)	(0.024)	(0.024)
RENTVAL	-0.437***		-0.454***	-0.451***	-0.423***
	(0.113)		(0.112)	(0.116)	(0.114)
MANUF	-0.214***			-0.196***	-0.207***
	(0.051)			(0.051)	(0.050)
HH_BLACK	0.072***				0.072***
	(0.009)				(0.009)
Constant	4.657***	1.913***	4.772***	4.063***	4.537***
	(0.763)	(0.043)	(0.704)	(0.792)	(0.780)
Census Tract FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
Observations	2,143	2,215	2,211	2,208	2,143
R-squared (within)	0.381	0.320	0.342	0.356	0.384
No. of Census Tracts	443	443	443	443	443

Appendix Table C3: Dependent Variable – Median Property Value (Long-Term Impact)					
	(1)	(2)	(3)	(4)	(5)
TR_ACCESS		0.040*	0.042**	0.037*	0.035*
		(0.023)	(0.020)	(0.020)	(0.021)
POPDENS	0.069*		0.110***	0.040	0.066*
	(0.035)		(0.027)	(0.033)	(0.035)
H30OLD	-0.067***		-0.059***	-0.066***	-0.070***
	(0.013)		(0.012)	(0.012)	(0.012)
RENTVAL	0.237***		0.253***	0.236***	0.232***
	(0.059)		(0.061)	(0.058)	(0.059)
MANUF	0.076***			0.072***	0.075***
	(0.018)			(0.018)	(0.018)
HH_BLACK	-0.018***				-0.018***
	(0.004)				(0.004)
Constant	8.222***	9.918***	8.116***	8.412***	8.262***
	(0.345)	(0.022)	(0.327)	(0.326)	(0.344)
Census Tract FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
Observations	2,135	2,205	2,203	2,200	2,135
R-squared (within)	0.932	0.926	0.933	0.935	0.932
No. of Census Tracts	443	443	443	443	443

Appendix Table C4: Median Property Value Derived for 2010

Median-Based Estimate of Total Value for Transit-Served Cuyahoga County Tracts (2010$)	$56,929,469,200
Median-Based Estimate of Total Value for Transit-Served Cuyahoga County Tracts Inflated (2017$)	$63,920,977,312
3.5% Value Attributed to Transit Access (2017$)	$2,237,234,206

Appendix D: Cost Savings Calculations

Over 77 percent of transit commuters are dependent on RTA services, since either there were no cars in their households or they did not access to automobiles to make their trips. Almost 54 percent of commuters reported that they do not possess a driver's license, which makes them highly dependent on RTA to make their trips. In the absence of RTA, such commuters will have to walk, ride bicycles, or pay taxicab or ridesharing services to commute. Walking and bicycling are likely to restrict employment opportunities and other travel options to a short radius of their residence, with the assumption that all such individuals are capable of engaging in physical activities. Taxicabs and ridesharing will put additional pressure on individual finances, which might not be sustainable for many. Removal of RTA services will adversely affect the quality of life of at least 77% of current riders and will severely effect at least 54% of commuters by restricting their mobility.

Sample Size = 31,753. Sample size is highly representative, consisting of 47.10% of randomly selected daily one-way commuters from the population of 67,406.[41]

Appendix Table D1: Individuals Dependent on GCRTA

Situation	Individuals	Percent
Have alternate means (not dependent)	6,875	
RTA is only option (dependent)	23,492	77 %
Do not have driver's license (highly dependent)	16,522	54 %

This accounts for directly restricting 51,902 (67,406*0.7736) and severely effecting 36,393 (67,406*0.5399) individual residents of the Cuyahoga County and their families by extension. Below we provide a breakdown of the impact of RTA services on employment, educational, medical, and social/recreational travel.

Employment

Appendix Table D2: 2013 On-Board Survey, Commuters Using GCRTA for Work

	Individuals	Percent
Workplace	15,527	50.7%
Dependent on RTA	11,223	72.3%
Highly Dependent on RTA	6,633	42.7%

[41] 2017 Unlinked Passenger Trips (2017). *National transit database* [Data file]. Retrieved from https://www.transit.dot.gov/ntd/ntd-data

Appendix Table D3: Commuters Using GCRTA for Work

Cuyahoga County, 2017 (ACS 1-year)	
Public transit commuters median wage	$20,135
# workers dependent on RTA for work	24,127
Low estimate of job income from those dependent on GCRTA for work	$485,797,145

We can conservatively assume that half of the individuals in the dependent category are likely to lose their jobs and require unemployment if RTA services are not present[42], at least temporarily. Unemployment support for 5,611 (11,223*.50) support for a three-month (12 weeks) period would cost the State of Ohio $7,945,176[43] (5,611*118[44]*12).

Healthcare

Appendix Table D4: Commuters Using GCRTA for Healthcare

	Individuals	Percent %
Medical Appointments	1,636	5.3%
Dependent on RTA	1,463	89.4%
Highly Dependent on RTA	992	60.6%

Over 5.3% commuters use RTA to get to their medical appointments, 89.4% of whom are dependent and 60.6% are highly dependent on RTA. This amounts to 3,599 (67,406*0.0534) individuals using RTA for medical purposes in Cuyahoga county daily, at least 3,219 (3,599*0.8943) of whom would be at risk of missing their appointment in the absence of RTA.

Healthcare institutions in the regions will be at some level of risk of losing **$706,280** (3,219*$219.41[45]) per day, or **$177,276,478** (643,800*251 workdays in 2013) per year. Since this figure is speculative, and we do not have a way to determine how many of the dependents will actually miss their appointment, we err on the conservative side by expecting only 64% of such individuals to miss their appointments[46]: **$113,456,946** ($177,276,478 *0.64).

[42] 20 percent of commuters are likely to find other ways to commute like bicycling, walking, and carpooling (https://www.tbf.org/-/media/tbf/reports-and-covers/2018/transportation-dividend.pdf?la=en). While 26 percent of those losing their jobs are likely to be part time employed, not eligible for unemployment support (GCRTA On-Board Transit Survey 2013).

[43] Conservative estimates are adopted due to their speculative nature. These are not robust and are not supported by econometric analysis.

[44] Lowest possible unemployment benefits for per person per week $118 (https://www.nolo.com/legal-encyclopedia/collecting-unemployment-benefits-ohio.html; http://jfs.ohio.gov/pams/PAM-2018-Reports/Updated-PAMS-2018-_01.stm).

[45] On an average, each no show costs $219.41 ($196 in 2008 dollars) to the hospital/physician (https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4714455/; https://www.healthmgttech.com/missed-appointments-cost-u.s.healthcare-system-150b-year)

[46] The estimate of 70 percent is derived from the findings of (https://www.tbf.org/-/media/tbf/reports-and-covers/2018/transportation-dividend.pdf?la=en) that twenty percent of individuals are expected to walk or bike to their

Direct Cost Savings for Commuters

To determine the annual direct cost savings for RTA commuters, we performed a simple three-step estimate: 1) determine the cost of driving a car, 2) determine costs of using transit services, and 3) calculate the difference to find direct cost savings. First, the 2017 GCRTA annual passenger miles—178,748,128 miles—were multiplied by per-mile cost of personal automobile travel. The Center assumed the conservative estimate of $0.5447 per-mile travel via a medium-sized sedan with 15,000 miles/year (as defined by AAA)[47]. This is an overall cost of driving—which covers fuel, maintenance, repair, insurance, license, registration, taxes, depreciation, and finance debt. If RTA passengers had travelled via automobiles, it would have cost them $97,364,105. Commuters collectively paid $45,436,326 in fares to RTA in 2017. The direct annual savings for RTA customers is the difference in travel costs, a total of **$51,927,779.**

Education & Cost Savings to CMSD

Appendix Table D5: Commuters Using GCRTA for Education

	Individuals	Percent
Students	7,659	25.0%
Dependent on RTA	5,892	76.9%
Highly Dependent on RTA	4,454	58.2%
Students K though 12	2,500	8.2%
Dependent on RTA	2,271	90.8%
Highly Dependent on RTA	2,206	88.2%
Students College	5,159	16.9%
Dependent on RTA	3,621	70.2%
Highly Dependent on RTA	2,248	43.6%

25.0% of RTA commuters tend to be students, and 76.9% of those are dependent on RTA services. If RTA services are removed, mobility for 16,872 students (67,406*0.2503) will be adversely affected in Cuyahoga County. 5,003 (67,406*0.0817*0.9084) are likely to be high school students, whereas 7,977 (67,406*0.1686*0.7019) are likely to be college students.

Cleveland Municipal School District (CMSD) transports regular students from grades 7 to 12 mostly through GCRTA transit services. This service is provided according to a contract between CMSD and GCRTA. Approximately 14,000 CMSD students are given RTA passes annually at a cost of $4.6 million dollars.

destinations in the absence of transit. We expect an additional ten percent to be able to get help from others. This is a speculative assumption in the interest of producing conservative estimates.

[47] AAA. (2017). Your driving costs: How much are you really paying to drive? [PDF document]. Retrieved from https://exchange.aaa.com/wp-content/uploads/2018/09/18-0090_2018-Your-Driving-Costs-Brochure_FNL-Lo-5-2.pdf

Food, Recreation, and Social Travel

Appendix Table D6: Commuters Using GCRTA for Shopping, Recreations and Social Visits

	Individuals	Percent of Ridership
Food and Markets	**2,823**	**10.5%**
Dependent on RTA	2,390	8.9%
Highly Dependent on RTA	1,624	6.1%
Recreation and Social	**8,024**	**26.2%**
Dependent on RTA	6,657	21.7%
Highly Dependent on RTA	4,614	15.1%

Commuter Characteristics

Appendix Table D7: Miscellaneous Commuter Characteristics

	Individuals	Percent of Ridership
Commuters with Disability	**1,854**	**6.1%**
Dependent on RTA	1,628	5.3%
Highly Dependent on RTA	1,153	3.8%
Women	**14,648**	**47.7%**
Dependent on RTA	11,039	17.4%
Highly Dependent on RTA	7,235	11.4%
Non-white	**6,336**	**20.8%**
Dependent on RTA	3,548	11.7%
Highly Dependent on RTA	1,537	5.1%

Individuals with disabilities form 6.1% of transit commuters, at least 87.8% of whom are dependent on RTA. On average, 4,085 (67,406*0.0606) individuals with disability travel on RTA, and 3,586 (67,406*0.0606*0.8781) of these are dependent on RTA. Almost 48% of RTA commuters tend to be women, of whom at least 36% are dependent on public transit services. This translates to around 32,261 (67,406*0.4786) women using RTA daily, 11,727 (67,406*0.4786*0.3635) of these women are dependent on this service. Over 20%, or 14,021 (67,406*0.2080), of transit commuters tend to belong to non-white communities. Of these, at least 7,851 (67,406*0.2080*0.5600) tend to be dependent on RTA services.

Appendix E: Spatial Mismatch Analysis

The spatial mismatch analysis methodology was based on an origin-destination matrix of forty census tracts. The origin census tracts were chosen to be the highest-poverty census tracts in the county, which happen to also have some of the lowest vehicle ownership. These tracts were chosen to be the most demonstrative examples of neighborhoods which experience the economic and geographic isolation of spatial mismatch according to the theory of spatial mismatch.

These targeted poverty tracts were acquired by filtering Cuyahoga census tracts meeting the following two criteria:

1) population density above the median census-tract population density for Cuyahoga County
2) top 20 highest percentage of population in poverty (in last 12 months) among Cuyahoga County

The destination tracts were entry-level job hubs, which are the ideal types of employment that are geographically out of reach from the appropriate labor market in the theory of spatial mismatch, making it too difficult to pay for the commute in time and money for prospective workers. The entry-level job hubs were based on U.S. Census LEHD data for 2015. The census tracts with the top 20 highest number of entry-level workers in Cuyahoga County were identified as “job hubs”.

As a result of determining 20 origins tracts and 20 destination tracts, there were 400 origin-destination pairs possible, each of which can serve as an observation. Socioeconomic attributes of each tract (ACS, 203-2017) could be used to control for external variables, while transit travel times and origin-destination employment figures could be used to explore the question: *would quicker GCRTA transit times relative to driving mean higher likelihood of poverty tract residents being employed at job hubs with appropriate skill-level work?*

Using a cross-sectional Poisson model for the 2015 origin-destination matrix described above, we tested for significant patterns and found confirmation of the question above. We found an increase in the likelihood of residents from low-income census tracts to be employed at job hubs with a decrease in GCRTA service time connecting poverty tracts to those job hubs.

Appendix Table E1: 2015, Employees from Origin Working in Destination (<$15k /year)

		Destination "Job Hub" Census Tracts																				
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**Origin Totals**
Origin Poverty Census Tracts	**A**	2	26	1	3	0	3	2	0	1	3	0	4	3	0	0	0	1	1	0	1	51
	B	5	14	2	6	1	1	0	0	3	5	0	2	2	2	1	2	1	0	4	1	52
	C	1	3	2	1	4	2	0	1	1	8	0	3	2	1	6	1	0	0	2	0	38
	D	10	49	34	4	8	1	3	3	1	9	3	4	0	3	1	2	4	1	0	0	140
	E	19	44	15	32	8	5	6	7	0	16	0	1	3	2	1	0	1	1	11	8	180
	F	6	13	3	6	2	3	4	0	1	5	0	0	1	0	3	0	0	0	6	1	54
	G	11	34	9	11	3	1	0	2	3	7	0	1	2	0	2	0	0	1	3	2	92
	H	2	5	1	1	0	1	0	0	3	3	0	0	0	0	0	0	0	1	6	3	26
	I	1	13	4	1	2	7	2	1	0	1	0	0	1	0	0	0	1	0	0	1	35
	J	2	7	0	6	0	0	1	1	0	3	0	0	0	0	1	1	1	0	0	3	26
	K	6	11	3	10	1	2	2	0	1	8	0	1	1	0	0	1	0	0	5	1	53
	L	0	11	4	6	2	2	1	1	0	2	0	0	1	1	0	0	0	0	5	0	36
	M	5	21	3	6	3	0	2	1	1	8	0	0	2	0	1	1	2	0	2	2	60
	N	4	11	3	2	2	1	1	0	3	8	0	2	0	0	0	0	1	0	0	1	39
	O	6	30	8	7	6	2	2	1	2	10	2	1	2	0	1	1	4	2	3	1	91
	P	5	30	8	1	2	0	3	4	1	3	1	2	0	0	2	0	1	0	0	3	66
	Q	2	20	5	5	1	1	2	0	0	4	1	0	0	0	1	0	0	0	0	1	43
	R	1	8	5	1	9	3	7	0	0	5	0	0	2	1	1	0	0	0	0	1	44
	S	8	25	15	2	7	12	6	3	0	8	1	1	0	2	8	1	3	0	13	5	120
	T	0	15	3	1	6	1	3	0	0	3	0	0	0	0	5	1	0	0	3	1	42
Destination Total		96	390	128	112	67	48	47	25	21	119	8	22	22	12	34	11	20	7	63	36	**1,288**

The origin (high-poverty) census tracts and destination (job hub) census can be identified on the spatial mismatch maps earlier in the report.

Appendix F: Salary Analysis

Appendix Table F1: 2017 GCRTA Estimated Salaries by Municipality

Municipality	GCRTA Employee Salary	2017 City Income Tax Rate	Estimate Income Tax Paid by GCRTA EMP	2016 City Collected Income Tax	% of City Income Tax
Cleveland	$35,278,333	2.50%	$881,958	$370,753,947	0.24%
Euclid	$7,874,021	2.85%	$224,410	$31,882,405	0.70%
Maple Heights	$5,100,236	2.50%	$127,506	$6,877,256	1.85%
Parma	$4,610,463	2.50%	$115,262	$39,449,504	0.29%
Cleveland Heights	$4,221,016	2.25%	$94,973	$25,489,983	0.37%
Walton Hills	$3,771,076	2.50%	$94,277	$4,725,765	1.99%
Shaker Heights	$3,741,882	2.25%	$84,192	$32,809,263	0.26%
South Euclid	$3,149,444	2.00%	$62,989	$10,280,618	0.61%
Warrensville Heights	$2,763,235	2.60%	$71,844	$15,458,923	0.46%
North Olmsted	$2,370,678	2.00%	$47,414	$15,160,112	0.31%
Lakewood	$2,262,337	1.50%	$33,935	$23,866,023	0.14%
Garfield Heights	$2,249,014	2.00%	$44,980	$11,302,637	0.40%
East Cleveland	$2,022,706	2.00%	$40,454	$5,627,594	0.72%
North Royalton	$1,690,791	2.00%	$33,816	$15,090,509	0.22%
Brooklyn	$1,670,292	2.50%	$41,757	$19,003,705	0.22%
Strongsville	$1,652,316	2.00%	$33,046	$35,005,722	0.09%
Westlake	$1,577,076	1.50%	$23,656	$27,542,107	0.09%
Bedford	$1,481,125	2.25%	$33,325	$8,542,762	0.39%
Valley View	$1,463,237	2.00%	$29,265	$11,436,078	0.26%
Fairview Park	$1,443,978	2.00%	$28,880	$8,965,078	0.32%
Middleburg Heights	$1,350,898	2.00%	$27,018	$20,225,407	0.13%
Brook Park	$1,338,473	2.00%	$26,769	$19,634,361	0.14%
Bedford Heights	$1,323,179	2.00%	$26,464	$9,317,960	0.28%
Highland Heights	$1,098,496	2.00%	$21,970	$12,419,986	0.18%
Cuyahoga Heights	$995,681	2.50%	$24,892	$8,859,334	0.28%
Olmsted Township	$953,841	0.00%	$0	$0	0.00%
Richmond Heights	$950,309	2.25%	$21,382	$6,033,036	0.35%
Oakwood	$940,281	2.50%	$23,507	$75,998	30.93%
Beachwood	$895,367	2.00%	$17,907	$32,318,136	0.06%
University Heights	$881,506	2.50%	$22,038	$9,664,961	0.23%
Independence	$774,146	2.00%	$15,483	$28,162,973	0.05%
Pepper Pike	$766,990	1.00%	$7,670	$5,771,505	0.13%
Solon	$735,943	2.00%	$14,719	$41,990,456	0.04%
Mayfield	$720,964	2.00%	$14,419	$17,080,525	0.08%
Parma Heights	$718,299	3.00%	$21,549	$8,954,321	0.24%

Municipality	GCRTA Employee Salary	2017 City Income Tax Rate	Estimate Income Tax Paid by GCRTA EMP	2016 City Collected Income Tax	% of City Income Tax
Bratenahl	$694,961	1.50%	$10,424	$1,842,129	0.57%
Highland Hills	$678,927	2.50%	$16,973	$2,687,549	0.63%
Berea	$631,548	2.00%	$12,631	$12,484,319	0.10%
North Randall	$599,496	2.75%	$16,486	$1,122,885	1.47%
Broadview Heights	$586,143	2.00%	$11,723	$11,899,044	0.10%
Rocky River	$583,674	2.00%	$11,673	$12,332,132	0.09%
Bay Village	$574,706	1.50%	$8,621	$6,748,424	0.13%
Lyndhurst	$499,708	2.00%	$9,994	$9,797,231	0.10%
Mayfield Heights	$455,211	1.00%	$4,552	$14,722,994	0.03%
Olmsted Falls	$398,463	1.50%	$5,977	$3,029,444	0.20%
Seven Hills	$383,821	2.50%	$9,596	$6,025,056	0.16%
Brecksville	$319,832	2.00%	$6,397	$17,558,619	0.04%
Newburgh Heights	$308,306	2.00%	$6,166	$784,611	0.79%
Orange	$190,359	2.00%	$3,807	$3,452,311	0.11%
Brooklyn Heights	$157,742	2.00%	$3,155	$4,988,571	0.06%
Glenwillow	$103,472	2.00%	$2,069	$3,051,277	0.07%
Woodmere	$55,735	2.50%	$1,393	$3,141,696	0.04%
Linndale	$26,051	2.00%	$521	$63,407	0.82%
Moreland Hills	$15,682	1.00%	$157	$3,821,794	0.00%
Hunting Valley	$14,779	0.00%	$0	$0	0.00%
Bentleyville	$9,188	1.00%	$92	$856,874	0.01%
Chagrin Falls	$4,510	1.85%	$83	$3,578,860	0.00%
Gates Mills	$3,482	1.00%	$35	$1,742,973	0.00%
Chagrin Falls Twp.	$1,040	0.00%	$0	$0	0.00%

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