Existing Conditions

History of RTA Planning Efforts

RTA has planned for the future throughout the past several decades with continual analysis and stakeholder engagement. The first plan was in the 1990's and laid the groundwork for expansion of the system to include suburban park-n-rides, building of the transit station network, and study of expansion of all rail lines. Westlake, Euclid, and Strongsville Park-N-Rides create free parking for customers to easily access transit services. Westgate Transit Center in Fairview Park, Southgate Transit Center in Maple Heights, and Parma Transit Center provide hubs for customers from which to access multiple routes. The Waterfront Line, Red Line and light rail station reconstructions, and daycare at Windermere were all built from this plan. The 1,050-foot Walkway

from Tower City to Rocket Mortgage Fieldhouse that provides convenient access to sports events for RTA customers came out of this plan.

An update to the 1990's plan scaled back potential future rail extensions. In 2007 Transit-Oriented Development guidelines were published that highlighted the necessity for planned growth around transit stations. The most recent Strategic Plan covered the years 2010-2020. It created vision and goals discussed previously, as well as an emphasis on Priority Corridors based on transit propensity. This plan resulted in the Cleveland State Line, MetroHealth Line, and study of W. 25th for BRT.

This Strategic Plan for 2020-2030 is updating the expiring 2010-2020 plan.

Previous strategic plans have led to implementation of improvements.

CLEVELAND STATE LINE

DOWNTOWN CLEVELAND
Chester Ave.
Stephanie Tubbs Jones Transit Center
Superior Ave.
Tower City-Public Square Rapid Station
Lakeside Ave
CLEVELAND
Edgewater Park (Saturdays Only)
N
Clifton Blvd.
LAKEWOOD
Lakewood Park
ROCKY RIVER
Clague Park-N-Ride
Cahoon & Wolf
Westgate Transit Center
Detroit Rd.
Crocker Park
BAY VILLAGE
Wolf Rd.
WESTLAKE

METROHEALTH LINE – W. 25-STATE

E. 12th and Rockwell
E. 3rd and Rockwell
DOWNTOWN CLEVELAND
Superior Ave.
Detroit Ave
Tower City-Public Square Rapid Station
MetroHealth Corridor
W. 25th St.
CLEVELAND
MetroHealth Medical Center
N
Pearl Rd.
W. 33rd Loop
Brookpark Rd.
State Rd.
PARMA
Day Dr.
Ridge Rd.
Parma Transit Center
Pleasant Valley Rd.

METROHEALTH LINE – W. 25-PEARL

DOWNTOWN CLEVELAND
E. 12th and Rockwell
E. 3rd and Rockwell
Superior Ave.
MetroHealth Corridor
Detroit Ave
Tower City-Public Square Rapid Station
CLEVELAND
W. 25th St.
MetroHealth Medical Center
N
Pearl Rd.
W. 130th St
PARMA HEIGHTS
Pearl Rd.
Southland Shopping Center
Normandie
MIDDLEBURG HEIGHTS
Strongsville Park-N-Ride
Pearl Rd.
Drake and Howe
STRONGSVILLE

METROHEALTH LINE – W. 25-BROADVIEW

E. 12th and Rockwell
E. 3rd and Rockwell
DOWNTOWN CLEVELAND
Superior Ave.
Detroit Ave.
Tower City-Public Square Rapid Station
W. 25th St.
CLEVELAND
N
MetroHealth Medical Center
MetroHealth Corridor
W. 33rd Loop
Brookpark Rd.
Rockside Rd.
Turney Rd.
Broadview Rd.
PARMA
Garfield Commons
GARFIELD HEIGHTS
BROADVIEW HEIGHTS
MetroHealth Brecksville Health and Surgery Center
Royalton Rd.
BRECKSVILLE

Planning History of Partner Agencies

RTA and other government agencies rely on one another for planning support and collaboration. Noteworthy recent reports include those completed by Northeast Ohio Areawide Coordinating Agency, Northeast Ohio Sustainable Communities Consortium, City of Cleveland, and Cuyahoga County. Additional relevant report summaries are referenced in the Appendix.

AIM FORWARD 2040, (2017)

The Northeast Ohio Areawide Coordinating Agency (NOACA) is the Metropolitan Planning Organization (MPO) serving the counties of and municipalities and townships within Cuyahoga, Geauga, Lake, Lorain and Medina. NOACA's Longe-Range Transportation Plan for the region was approved in 2017. AIM Forward 2040 is the framework for directing investment for all forms of transportation in Northeast Ohio, including motor vehicle, bridge, transit, bicycle, walking and the movement of freight. The plan offers a vision of the region's transportation system through the year 2040 and identifies $15.8 billion in transportation investments that address accessibility, safety and mobility for people who live and work in Northeast Ohio. The plan identifies investments to address the needs of the region. It notes that almost 7 million trips are taken daily in the NOACA region; 82% of the region's population commutes to work alone; and 62% of the region's population is within a half-mile of a transit station. The plan discusses transit services provided by the Greater Cleveland Regional Transit Authority (RTA), Laketran (Lake County's regional public transportation authority), Lorain County Transit (LCT), Medina County Public Transit (MCPT), and Geauga County Transit. The plan notes that RTA is the largest transit system operating in the region and accounts for more than 94% percent of the region's operating and capital needs. The plan calls for enhancing and investing in transit across the region.

VIBRANT NEO 2040, (2013)

Northeast Ohio Sustainable Communities Consortium (NEOSCC) was established in 2011 and included 23 member organizations across Northeast Ohio. Members included Metropolitan Planning Organizations, counties, cities, universities, metropolitan housing authorities, and others. NEOSCC created Vibrant NEO 2040 as a regional visioning and decision-making framework. It aimed to create a shared vision for the future, developed through a robust community and stakeholder engagement process. NEOSCC's purpose centered on creating conditions for a more Vibrant, Resilient, and Sustainable Northeast Ohio.

The plan created seven goals:

1. Enable Inclusive & Transparent Public Planning
2. Reflect Shared Values
3. Respect Choice
4. **Promote Informed Decision-Making**
5. **Coordinate Efforts & Investments**
6. **Enable & Promote Action**
7. **Improve Quality of Life**

REGIONAL TRANSIT-ORIENTED DEVELOPMENT SCORECARD AND IMPLEMENTATION PLAN, (2016)

This NOACA report highlights four ingredients to successful walkable development near transit: development that is compact and dense relative to surrounding area; mix of land uses; safe, inviting, interconnected public realm; and a new approach to parking with fewer cars, shared facilities, and district design standards. This report assessed all rail stations on the Red Line; all stations on the Blue, Green, and Waterfront Lines, either individually or in clusters of closely spaced stations; HealthLine BRT service, in clusters of closely spaced stops; ten Priority Bus Corridors designated by RTA, including the Cleveland State Line BRT service; and a sampling of suburban town centers and bus transit centers. Considerations included place typology, connectivity, market strength, land availability, and government support.

CLEVELAND CLIMATE ACTION PLAN, (2018)

The City of Cleveland, community leaders, and a Climate Action Advisory Committee reaffirmed the city's commitment to the goals of the Paris Climate Agreement. The 2018 update was built on the initial 2013 plan. The 2013 Cleveland Climate Action Plan established an overarching greenhouse gas (GHG) reduction goal of 80% below 2010 emissions by 2050,

with interim goals of 16% reduction by 2020 and 40% reduction by 2030. Those goals were retained in the 2018 plan. The plan notes that 16% of GHG emissions in Cleveland come from transportation. One of the five focus areas of the plan is Sustainable Transportation. The objectives include:

- Drive cleaner, more efficient vehicles
- Build transportation systems that prioritize safety for all
- Increase use of public transit through regional collaboration
- Make Cleveland a premier cycling city
- Continue to green Cleveland's ports

The plan notes that RTA's Commuter Choice Advantage program expanded from 696 companies in 2013 to 856 companies in 2017. This payroll deduction plan allows workers to prepay transit fares on a before-tax basis, saving employees and employers money. The Climate Action Plan advocates for more transit funding from the state, enhanced partnerships, technology to improve user experience and reduced emissions, transit-oriented development, and equitable access to transit.

CUYAHOGA COUNTY CLIMATE CHANGE ACTION PLAN, (2019)

The County and its partners created this plan that focuses on five areas: energy, land use, transportation, ecosystem, and health. The County aspires to a 45% overall reduction in GHG emissions from its 2010 baseline by 2030 and net-zero emissions by 2050. The plan calls for cleaner fuel vehicles and more public transit, biking, and walking. It notes that Cuyahoga County is particularly auto-dependent, with 79.8% of commuters driving alone to work, above the national average of 76.4%. The plan calls for repurposing overbuilt road infrastructure for alternative modes of transportation (e.g. dedicated bus lanes, bike lanes) without creating major congestion issues. It recommends electrification of school and transit bus fleets. It aims to return public transit service and ridership to 2006 levels by 2025 and increase the transit mode share.

Summary of Transit Services

EXISTING CONDITIONS

Greater Cleveland Regional Transit Authority (RTA) provides public transportation across Cuyahoga County.

457	Square miles
59	Municipalities
1.26M	Residents

Rail

RTA provides almost 2 million revenue miles of rail service. Rapid transit rail service includes:

- **Red Line**: Service between the Louis Stokes Station at Windermere and Cleveland Hopkins International Airport, via Downtown Cleveland
- **Green Line**: Service between the Tower City Rapid Station and the Green Road Rapid Station
- **Blue Line**: Service between the Tower City Rapid Station and the Warrensville-Van Aken Rapid Station
- **Waterfront Line**: Operates as an extension of the Green and Blue lines beyond the Tower City Rapid Station to the South Harbor Rapid Station

The Red Line has 19 route miles of track and more than 6 million annual passenger trips. The Red Line includes 18 high platform stations and utilizes 52 heavy-rail cars. The Green, Blue, and Waterfront lines have 15 route miles of track and approximately 1.6 million riders served by 40 light-rail cars and 34 low platform stations.

Bus Rapid Transit

RTA markets three bus rapid transit (BRT) services across the region.

- **HealthLine**: Service between Tower City - Public Square and the Louis Stokes Station at Windermere, via Euclid Avenue and University Circle.
- **Cleveland State Line**: Routes 55 A-B-C provide

service via Clifton Boulevard between downtown Cleveland and through the West Side to the suburb of Fairview Park.

- **MetroHealth Line**: Twenty branded buses and over 400 customized signs along the route connect five MetroHealth locations via W. 25th Street, Pearl Road, and State Road.

HealthLine recently celebrated its 10-year anniversary and is acclaimed for stimulating more than $9.5 billion in economic development.

Trolley

RTA has four free downtown trolleys:

- **NineTwelve Trolley**: Service between the Muny Parking Lot and the area of Chester Avenue & East 9th Street, via East 9th Street.
- **E-Line Trolley**: Service between many entertainment destinations along Euclid Avenue.
- **B-Line Trolley**: Service focused on quick travel to businesses for workers across downtown.
- **C-Line Trolley**: The Convention and Casino trolley travels between the Warehouse District, Tower City - Public Square, Playhouse Square, Cleveland State University, the Huntington Convention Center and the Flats East Bank.

Bus

RTA has about 50 bus routes with 14 routes operating 24 hours a day and 7 days a week. There are approximately 390 buses that provide over 12 million revenue miles per year across 1,459 shelters and 5,720 bus stops. More than 22 million trips are taken annually on RTA's buses, the workhorses of the agency's service.

Paratransit

RTA provides almost 600,000 trips annually on paratransit service for individuals with disabilities. The service uses approximately 80 agency-owned vehicles and 70 contracted vehicles for paratransit service.

DATA TRENDS

RTA ridership has decreased in line with national trends. When the agency began in the 1970's, the region was a different place with higher population density across a smaller geographic reach and land use supportive of transit. Ridership increased in the first half of this decade to hit almost 50 million rides in 2014, but has never hit the pre-recession levels of over 57 million annual rides.

In general, the factors influencing transit ridership can be broken down into two categories:

Internal factors (i.e., those over which RTA managers exercise some control, such as the fare structure). Examples include:

- Quality of service
- Fares
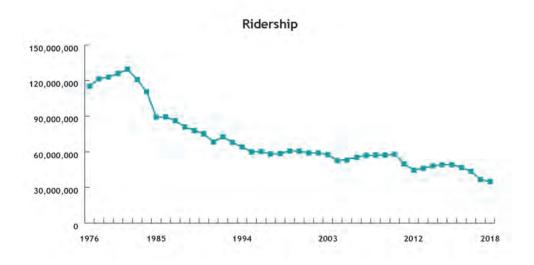- Policies and other forces such as strikes or misuse of public funds

External factors (which are largely exogenous to the transit system and its managers, such as demographic trends). Examples include:

- Population
- Economic conditions
- Gas price
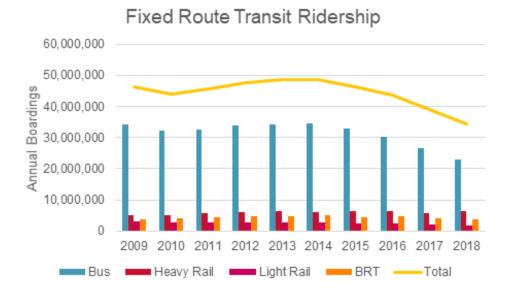- Alternate transportation options

This is not a comprehensive analysis of factors influencing ridership. For example, weather and seasonality can impact ridership in any given month. Rather, this discussion aims to provide a cursory look at general trends to help provide context to RTA's ridership decline.
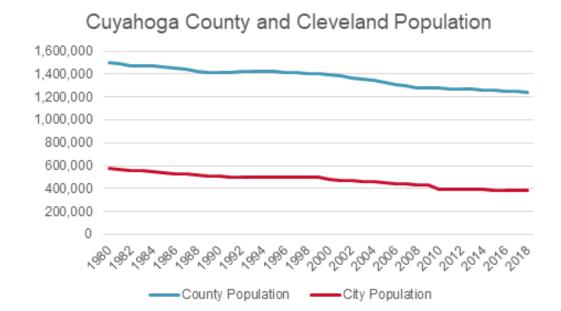
The provision of fixed route transit service declined at the start of the decade during the Great Recession. Service peaked in the past decade in 2015 with over 17 million vehicle revenue miles. Service has been reduced each year since 2015.
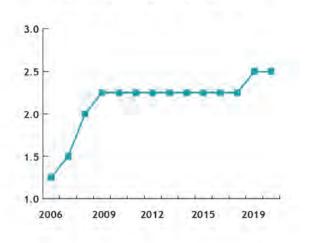
Ridership

Transit Service Provided

Fixed Route Transit Ridership

Cuyahoga County and Cleveland Population

— County Population   — City Population

Bus Fare (Bus, BRT, Rapid)

Year	Population
2011	1,270,224
2012	1,266,080
2013	1,265,478
2014	1,263,283
2015	1,258,923
2016	1,254,482
2017	1,248,371
2018	1,243,857

Fares have remained relatively unchanged for much of the past decade. Fares increased in the growing years prior to the Great Recession. Fares increased in recent years so that the cost of a one-way fare for bus, BRT, and rail is currently $2.50.

Cuyahoga County's and Cleveland's populations have decreased over recent decades. Since 2010, the county's population has lost tens of thousands of residents.

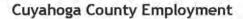**Cuyahoga County lost 34,000 residents from 2010 to 2018.**

At the same time population has decreased, employment in Cuyahoga County has decreased. **Decreases experienced during recessions have had long-term impacts on the region's employment.** Employment decreased by tens of thousands of jobs over the past decade, but has remained relatively stable in recent years.
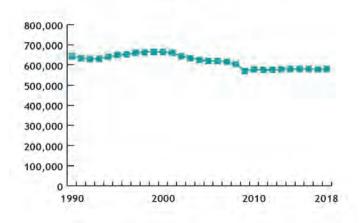
Over time the location of jobs has shifted in Cuyahoga County. There are six main hubs of employment in the five-county NOACA region, with all six located within Cuyahoga County. Cuyahoga County accounts for a significant majority of jobs in the five-county region, **and the largest job hub is Downtown Cleveland.** University Circle is the second largest job hub.

The six hubs are:

- Downtown
- University Circle
- Solon Cochran Corridor
- Chagrin Highlands
- I-77-Rockside
- Hopkins Airport Area

Though it is the largest hub in the region, **Downtown has** experienced a decrease in employment, while the other job hubs in outlying areas of the county have increased jobs. Jobs have spread across the region in ways that make transit service more difficult.
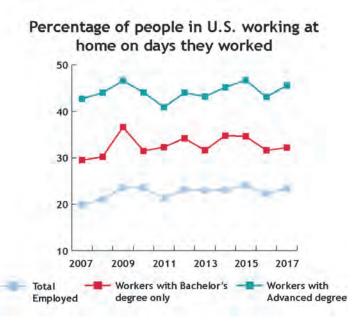

Cuyahoga County Employment

Source: NOACA

Footnotes

[1] US Census

At the same time population and employment have decreased and expanded across the county, the number of employees working from home has increased. Over the past decade, the percent of workers in the U.S. working from home has increased over three percent. In 2017, over 23 percent of workers had no commute when they were working. **This number is higher for professional workers - 46 percent of those with advanced degrees, and 32 percent of those with bachelor's degrees, performed some work at home on days they worked.**

In the Cleveland metropolitan region, working from home has increased. The percent of workers who work **full-time at home increased from 2.8% in 2005 to 3.7% in 2010. It is estimated that 4.3% of workers worked full-time from home in 2017.**

Percentage of people in U.S. working at home on days they worked

Legend:
- Total Employed
- Workers with Bachelor's degree only
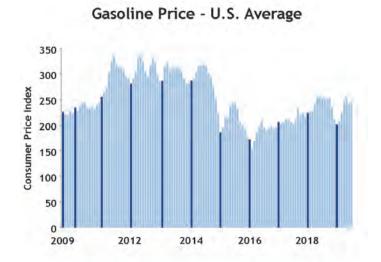- Workers with Advanced degree

Gasoline prices impact the perceived cost of transportation. Gas prices nationwide reached highs at the start of the decade. After a drop in 2014, gas prices have remained low for travelers.

Data from the Federal Reserve and U.S. Bureau of Economic Analysis reveals that vehicle sales have increased over the past decade across the country.
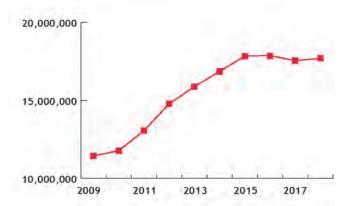
This increase in vehicles has been experienced locally in Cuyahoga County. While population has decreased by tens of thousands of residents, there has been an increase of tens of thousands of vehicles.

At the same time a confluence of factors have impacted RTA ridership, disruptive technologies and new mobility business models have changed the public's perception on the cost and value of transportation. Those topics are discussed later.

RTA is taking positive steps towards stemming declining ridership through its system redesign study that is assessing the best options for providing transit services. The redesign results are incorporated into the Strategic Plan along with the other Pillar studies.

Gasoline Price - U.S. Average
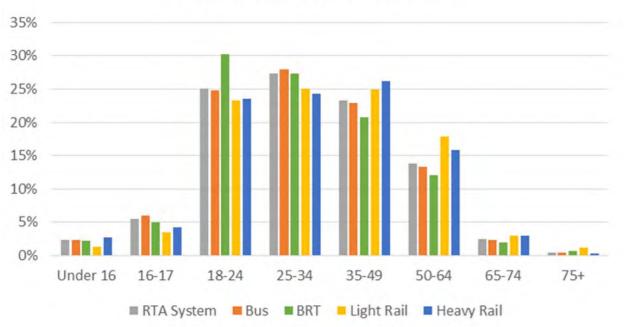

Vehicle Sales in U.S.

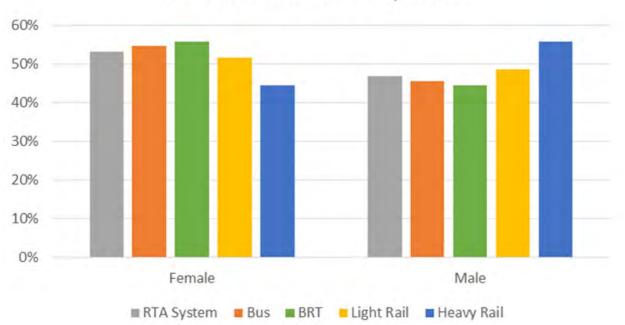| YEAR	CUYAHOGA COUNTY VEHICLE REGISTRATIONS
2014	1,077,088
2015	1,095,601
2016	1,102,794
2017	1,094,151
2018	1,111,137
Increase over 5 years	34,0499

DEMOGRAPHICS

Demographic data highlights who uses RTA's services based on the most recent on-board survey. RTA customers range across people of all backgrounds and socioeconomic characteristics, but some trends are apparent.

A majority of RTA riders are of working age, female, African American, employed full-time, and make less than $25,000 per year. Between 30-40% of riders do not have access to a car. The following charts highlight the similarities and differences among customers using RTA's various transportation modes.
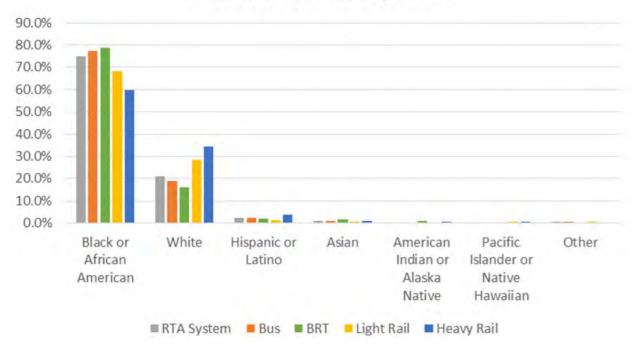
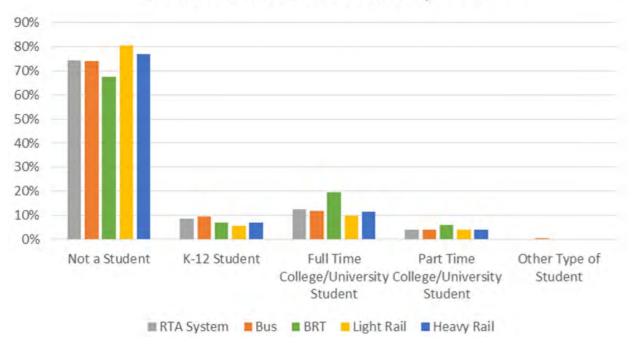### Age of RTA Riders by Mode

Gender of RTA Riders by Mode

Race of RTA Riders by Mode
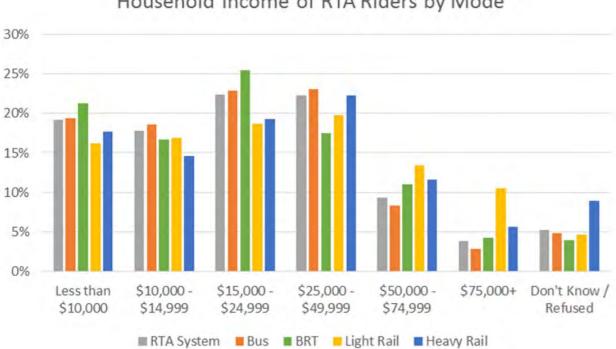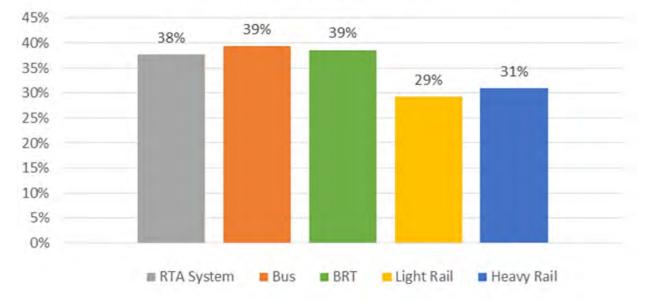

Student Status of RTA Riders by Mode

Employment Status of RTA Riders by Mode

Legend: RTA System, Bus, BRT, Light Rail, Heavy Rail

Household Income of RTA Riders by Mode

Legend: RTA System, Bus, BRT, Light Rail, Heavy Rail

RTA Riders without a Driver's License and Living in a Zero-Car Household

Bar chart: RTA System 38%, Bus 39%, BRT 39%, Light Rail 29%, Heavy Rail 31%

SWOT Analysis

SWOT stands for Strengths, Weaknesses, Opportunities, and Threats. Strengths and weaknesses are internal to the organization —things that RTA has some control over and can change. Opportunities and threats are external—things that are going on outside the agency. The following issues help frame the forces that impact RTA's future.

STRENGTHS

- As a legacy transit system with robust history, local residents and businesses are aware of what RTA is. The brand recognition is high.
- Staff members have deep institutional knowledge.
- Rail lines and BRT services provide a backbone for additional system improvements.
- Past investments provide value to customers
- New leadership paves the way for innovative changes.

WEAKNESSES

- Passenger experience is degraded by unreliability and a poor image.
- Infrastructure needs are not being met as highlighted by the breakdown of the Red Line in summer 2019.
- Ridership has decreased for several years.
- Technology adoption is slow compared with peers.

OPPORTUNITIES

- Job hubs drive transit ridership and the largest hub remains downtown where transit service is greatest.
- Partnership is increasing among public and private agencies on transportation issues.
- Disruptive technologies and business models can be harnessed to advance RTA goals.

THREATS

- The region is losing population and jobs.
- Competition for travel service in urban areas is increasing with new options providing door-to-door service for relatively cheap costs to customers.
- Job locations are spreading across Cuyahoga County and the region.

Concurrent Planning Efforts

The Strategic Plan aims to create understanding of the current and future issues facing RTA's service. Its goal is to build consensus around prioritized strategies to the year 2030. Essential to the Strategic Planning process are several Pillar Studies that are underway.

The Pillar Studies that are inputs into the Strategic Plan are:

• Economic Impact Study

• Fare Equity Study

• Rail Car Study

• Efficiency Study & Operational Review

• System Redesign Study

ECONOMIC IMPACT STUDY

Cleveland State University's Center for Economic Development completed an analysis to quantify the economic benefit RTA generates annually for Cuyahoga County. In addition to the direct economic impact resulting from RTA employees residing in the County, the study also measured the economic effect of RTA's annual in-county expenditures as well as the economic benefit of purchases made by RTA and supplier employees.

Findings conclude that RTA has a massive economic impact on the region.

• Transit Impact on Cuyahoga County Property Values: $2.2 Billion

• RTA's Economic Impact to Cuyahoga County: $322 Million Annually

• Transit Impact on Employment: $485.8 Million

• Community Loss Without Transit: $448.7 Million

The study highlights the importance of RTA's services to the region's residents and employers. Without RTA's services, thousands of people would be negatively impacted in their ability to get to work, school, healthcare, and other destinations across the region.

FARE EQUITY STUDY

The goal of this study is to enable RTA to better understand its ridership, and the relationships between changes in fares, fare structure, fare collection, ridership and revenue. It includes:

• Comparison of current fare structure to peer agencies

• Survey of RTA Riders

• Process and model to analyze impacts of fare changes

• Assistance in analyzing fare alternatives

• Fare Equity Analysis

This study, concluded in December 2019, recommends a variety of ways to promote equity and enhance the customer experience regarding fare payments. Increased use of technology, revised policies to cap fares, and other recommendations are made that are incorporated into the Strategic Plan.

RAIL CAR STUDY

RTA recently completed a Rail Car Replacement Study to perform a comprehensive evaluation for heavy rail fleet (Red Line) and light rail fleets for the Blue, Green, and Waterfront lines. Both the heavy rail and light rail car fleets have exceeded the 30-year useful life.

The heavy rail car fleet is estimated to have a remaining life of 5 years. The study recommended replacing the heavy rail car fleet rather than attempting to further rehabilitate existing cars since the cost of rehabilitation would far exceed the replacement cost. The light rail car fleet is estimated to have a remaining life of 10 years. The study recommended replacing the fleet rather than attempting to further rehabilitate for the same reason – the cost of rehabilitation would exceed the cost of replacement.

The study recommends procuring 34 heavy rail cars in 2020 with delivery in 2023 at a cost of approximately $102 million. It recommends procuring 24 light rail cars in 2025 with delivery in 2028 at a cost of approximately $96 million.

With all cost including vehicles, rail shop infrastructure improvements, and contingency, the total cost is projected to be approximately $240 million.

EFFICIENCY STUDY & OPERATIONAL REVIEW

The Greater Cleveland Partnership (GCP), Northeast Ohio's Chamber of Commerce, completed a financial analysis and economic forecast for the Greater Cleveland Regional Transit Authority. The following results came from this study.

1. **Benchmarking**: RTA's operational performance offers a mixed picture, with high-performing services (Bus Rapid Transit: the HealthLine) countered by services that are not performing in line with peers with respect to cost (local bus) or ridership (rail services). Additionally, administration cost appear to be higher than most peers. From a governance standpoint, RTA's Board would benefit from limiting terms and eliminating the stipend for Board members.

2. **Economic and Market Risk**: RTA is facing risks related to its funding, its operation, its assets and broad regional trends. Opportunities to mitigate these risks, based on stakeholder input, include new CEO leadership, a recently completed bus system redesign study, and while less certain, the recent growth in downtown population.

3. **Financial Issues**: RTA's financial outlook shows limited deficits in the operating budget. However, projected cost of procuring a new rail fleet and meeting other unfunded capital needs, primarily related to the rail system, far exceeds available capital reserves.

4. **Cost Efficiencies and Revenue Enhancement Strategies**: Cost reduction strategies, relying on privatization and internal reorganization, could lead to a potential cost savings of $21 million a year, while additional revenue could amount to $8 million through ridership recovery with local bus redesign and reinvestment in the rail system. To support its rail infrastructure, the region should consider as a priority, long-term coordination of RTA's service development and capital investments with governmental, business and non-profit entities to direct economic development toward rail station areas, which are currently under-utilized.

5. **Key Performance Indicators**: RTA has successfully developed advanced performance reporting systems. To enhance its performance-based management, reputation and transparency, RTA should share its goals and results both internally with all its employees and externally with its riders and the public.

6. **Revenue Sources and Options to Bridge Funding Gaps**: RTA has the ability to levy sales-and-use and property taxes at the county level. Based on RTA's assessment of its capital needs, substantial funding increases are needed to recapitalize its rail infrastructure and replace its rail fleet. What

is uncertain is if that increased funding to cover the capital shortfall will yield a high return-on-investment in terms of increased ridership.

SYSTEM REDESIGN STUDY

The redesign study aims to analyze bus route data and get public input on potential systemwide redesign alternatives. The study resulted in two conceptual networks showing how the transit network could look if it were designed to focus slightly more on generating high ridership. One network highlights a redesigned network with current levels of funding, while an expanded network displays increased services with new funding. These results are incorporated into the Strategic Plan.

Each of the Pillar Studies offer valuables insights and conclusions about RTA's services, customer experience, operational performance, funding issues, infrastructure, and more. The Strategic Plan's recommendations identify prioritized strategies that form a cohesive plan.

Ongoing RTA Efforts

RTA is continuously working toward efficiencies while advocating for support from outside resources.

ACTIVE FUNDRAISING

At the local level, RTA advocates for more funding and support for transit. There are numerous organizations that RTA engages regularly, some of which include:

- Editorial meetings with TV, print and radio to discuss pertinent issues
- Meetings with Greater Cleveland Partnership (GCP) Advocacy Committee and the GCP Board of Directors
- Downtown Cleveland Alliance Advocacy Committee
- University Circle Inc., Transportation Committee University Circle Inc.,
- NOACA External Affairs Committee Meeting, Board of Directors, Transit Council, among others
- Cleveland City Council meetings and transportation committee meeting
- Cuyahoga County Council Meetings, including their transportation committee, and meet with Cuyahoga County leadership
- Cuyahoga County Council's Regional Transportation Advisory Subcommittee
- Cleveland Mayor's Office and staff
- Mayors and Managers Association meetings
- Clevelanders for Public Transit
- NEOSCC The Northeast Ohio Sustainable Communities Consortium
- GCP's Civic Connections
- Business members of Commute Advantage program

At the state level, continuous engagement includes:

- Local State Representatives and State Senators
- Ohio Public Transit Association
- ODOT Office of Transit and ODOT leadership
- Testifying before the Ohio House and Ohio Senate regarding more funding for public transit
- Governor's Director of Workforce Transformation to discuss transit

- Advocacy and statewide partnership with OPTA assisted in getting more funding in recent State budget

RTA engagement at the federal level in recent times includes:

- Meetings with Congressional Representatives and Senators
- Meetings with Federal Transit Administration leadership as well as FTA Administrator for Region 5
- Testifying before the Senate Finance Committee on the subject of clean fuels
- Testifying before the Senate Banking Committee on the subject of more funding for transit and rail car replacement

TRANSITSTAT

TransitStat is a data-driven performance management initiative implemented by RTA in 2008. TransitStat reviews areas identified by management as problems and then assigns responsibility to teams that propose and implement solutions. The TransitStat panel authorizes action and then follows up relentlessly to see that results are achieved. Since this internal program began, RTA has held over 300 TransitStat meetings, with over 1,000 presentations aimed at improving process. It has reduced costs by over $75 million. This program has been replicated at other transit agencies and assess topics such as ridership, revenue, safety, on-time performance, reliability, customer satisfaction, and employee attendance. Efficiency programs like this show that RTA is continuously trying to improve internal operations.
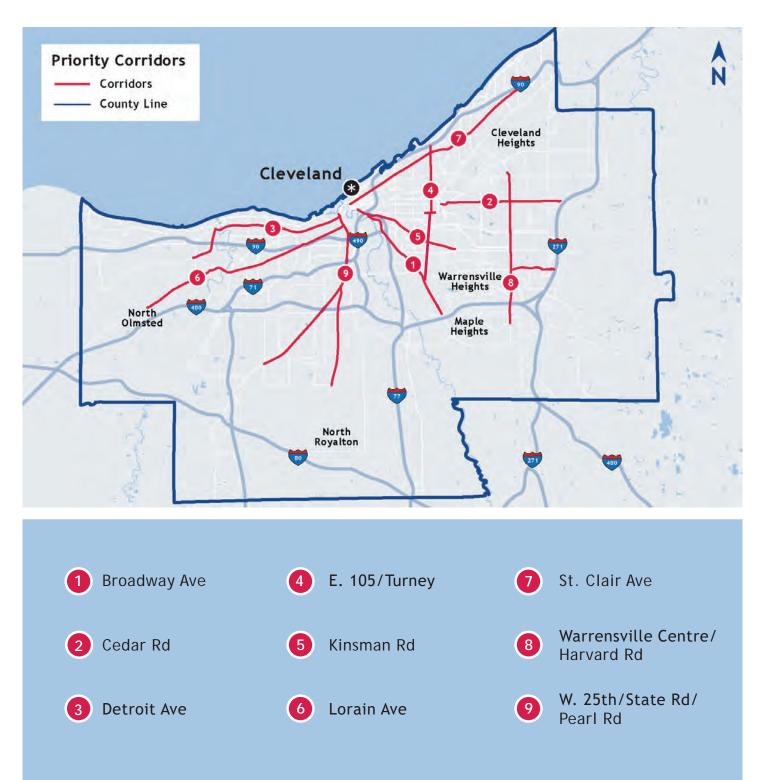
FUEL PROGRAMS

RTA has been hedging fuel and slowly moving to Compressed Natural Gas (CNG) in order to reduce costs. The Energy Price Risk Management Program (aka Fuel Hedging Program) has helped to stabilize diesel fuel, one of RTA's most volatile expenses. Through this program, the cost of diesel fuel has remained steady. The U.S. has increased production of crude oil in the last few years and is now less dependent upon foreign sources. Between 2015 and 2018, RTA placed over 100 CNG buses into operation and retired older diesel buses, reducing fuel by nearly

$883,000 in 2017 and an additional $167,000 in 2018. By 2020, 27 new CNG buses are planned to be placed into operation and diesel fuel costs are expected to continue to decrease.

MOBILE TICKETING

In 2016, RTA launched the RTA CLE app for mobile ticketing that lets riders pay from their phones. This form of payment is an additional way to optimize transit's impact on the environment and provide a greater convenience to riders. Powered by a company called Passport, the app lets riders easily plan and pay for their trip on their phone. Transit riders can use the app's interactive map screen to coordinate their RTA ride ahead of time. Bus, rail, and paratransit customers can buy 1-Ride, All-Day, 7-Day, and Monthly Passes on the app.

Priority Corridors

The previous RTA Strategic Plan identified several Priority Corridors across Cuyahoga County that were recommended for investment. This section reviews these corridors by summarizing transit service, roadway features, connectivity, and adjacent land use. This review is a means of establishing the characteristics of past planning efforts and the potential for future opportunities.

1 Broadway Ave

2 Cedar Rd

3 Detroit Ave

4 E. 105/Turney

5 Kinsman Rd

6 Lorain Ave

7 St. Clair Ave

8 Warrensville Centre/ Harvard Rd
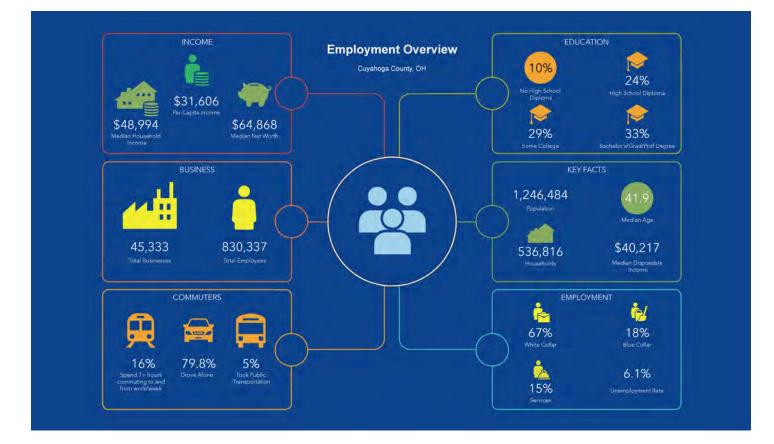
9 W. 25th/State Rd/ Pearl Rd

The table below summarizes the historical population trends for Cuyahoga County as well as the areas within the Priority Corridors. The following page displays an employment overview for Cuyahoga County.

OVERALL HISTORIC POPULATION						
		2000	2010	% change	2019	% change
Cuyahoga County	Population	1,393,979	1,280,122	-0.08	1,246,484	-0.03
	Households	571,457	545,056	-0.05	536,816	-0.02
	Housing Units	616,903	621,763	0.01	624,218	0.00
Broadway Ave	Population	18,623	15,135	-0.19	14,009	-0.07
	Households	7,064	5,994	-0.15	5,645	-0.06
	Housing Units	8,017	7,688	-0.04	7,800	0.01
Cedar Ave	Population	22,758	21,592	-0.05	21,869	0.01
	Households	10,037	9,298	-0.07	9,543	0.03
	Housing Units	10,632	10,391	-0.02	10,621	0.02
Detroit Ave	Population	40,586	37,539	-0.08	38,158	0.02
	Households	18,809	18,023	-0.04	18,509	0.03
	Housing Units	20,485	20,888	0.02	21,111	0.01
E. 105/Turney Rd	Population	29,012	19,683	-0.32	17,918	-0.09
	Households	10,513	8,306	-0.21	7,708	-0.07
	Housing Units	12,444	11,147	-0.10	11,396	0.02
Kinsman Rd	Population	17,674	13,075	-0.26	12,215	-0.07
	Households	6,466	5,047	-0.22	4,689	-0.07
	Housing Units	12,444	7,989	-0.36	6,613	-0.17
Loraine Ave	Population	41,122	37,067	-0.10	35,841	-0.03
	Households	16,715	15,815	-0.05	15,462	-0.02
	Housing Units	18,593	18,376	-0.01	18,375	0.00
St. Clair Ave	Population	36,450	28,444	-0.22	26,096	-0.08
	Households	13,773	11,544	-0.16	10,763	-0.07
	Housing Units	16,411	16,131	-0.02	16,250	0.01
W. 25th/ State Rd/ Pearl Rd	Population	40,361	38,584	-0.04	37,514	-0.03
	Households	16,357	16,180	-0.01	15,897	-0.02
	Housing Units	17,903	18,401	0.03	18,459	0.00
Warrensville Center/Harvard Rd	Population	20,131	17,846	-0.11	17,745	-0.01
	Households	8,207	7,807	-0.05	7,823	0.00
	Housing Units	8,638	8,663	0.00	8,752	0.01

Employment Overview
Cuyahoga County, OH

INCOME
$31,606 Per Capita Income
$48,994 Median Household Income
$64,868 Median Net Worth

EDUCATION
10% No High School Diploma
24% High School Diploma
29% Some College
33% Bachelor's/Grad/Prof Degree

BUSINESS
45,333 Total Businesses
830,337 Total Employees

KEY FACTS
1,246,484 Population
41.9 Median Age
536,816 Households
$40,217 Median Disposable Income

COMMUTERS
16% Spend 7+ hours commuting to and from work/week
79.8% Drove Alone
5% Took Public Transportation

EMPLOYMENT
67% White Collar
18% Blue Collar
15% Services
6.1% Unemployment Rate

OVERALL EMPLOYMENT INFORMATION

Corridor/Area	Businesses	Employees	Residential Population	Employee/ Residential Population Ratio (per 100 Residents)
Broadway Ave	818	15,934	14,009	114
Cedar Ave	903	22,357	21,869	102
Detroit Ave	1,621	18,117	38,158	47
E. 105/Turney Rd	426	23,001	17,918	128
Kinsman Rd	299	5,009	12,215	41
Lorain Ave	1,539	16,689	35,841	47
St. Clair Ave	3,040	67,761	26,096	260
W. 35th/ State Rd/ Pearl Rd	1,699	21,438	37,514	57
Warrensville Center/Harvard Rd	993	23,141	17,745	130
Cuyahoga County	45,333	830,337	1,246,484	67

The tables below display commuter information for Cuyahoga County as a whole and each of the individual Priority Corridors as well as the land use distribution in Cuyahoga County.

OVERALL COMMUTERS		
Corridor/Area	% Drive Alone	% Take Public Transit
Broadway Ave	76.6	7
Cedar Ave	76.7	3
Detroit Ave	73.5	8
E. 105/Turney Rd	67.6	18
Kinsman Rd	62.2	22
Lorain Ave	74.7	7
St. Clair Ave	61.5	15
W. 35th/ State Rd/ Pearl Rd	77.3	4
Warrensville Center/Harvard Rd	76.8	5
Cuyahoga County	79.8	5

CUYAHOGA COUNTY LAND USE	
Land Use	Percent Area
RESIDENTIAL	54%
PASSIVE GREEN SPACE	10%
INDUSTRY	7%
RETAIL	5%
TRANSPORTATION	5%
OTHER (<5% EACH)	19%

Individual analyses of previous Priority Corridors is located in the Appendix. Updated Priority Corridors for the next ten years are described later in the Strategic Plan report.

Capital Projects and State of Good Repair

RTA's focus in recent years has been on maintenance of its current assets and infrastructure rather than major new capital projects. Constrained finances require the agency to balance State of Good Repair with enhancing the transit system through new projects. The agency has maintained a balance prudently in recent years, with a number of system rehabilitation and enhancement projects completed.

Recent Capital Improvements

A brief timeline of key capital projects in recent years are shown below.

2010 — New Stephanie Tubbs Jones Transit Center at Cleveland State University

2011
- New Puritas Rapid Transit Station on the Red Line
- New station at East 55th Street and I-490
- Track repairs between W. 25th St. Station and Tower City Station

2013 — Major Red Line track improvements at Hopkins Airport and Red Line

2014
- New Cedar-University Rapid Station
- Cleveland State Line opens along Clifton Boulevard

2015
- New Little Italy-University Circle Rapid Station
- New Lee-Van Aken Station on the Blue Line

2016
- Upgrade to Warrensville-Shaker Green Line Station
- Renovated rail service as a result of track work at Tower City

2017
- Rehab of Mayfield Road streetscape in Little Italy
- New Brookpark Rapid Station
- MetroHealth Line opens along the #51 routes
- New Lee-Shaker Station on the Green Line
- Red Line track upgrade on the West Side

2018 — Station reconstruction at East 34th Street and East 116th Street stations

2019 — Pillar studies including Rail Car Replacement Study plan for future major projects in the years to come

At the same time new stations were opened and major infrastructure repairs were made, less visible improvements to the system were also completed. Track bridge improvements, facility enhancements, purchases of new buses, transition to compressed natural gas vehicles, installation of bicycle racks on buses, ticket app development for customers' smart phones, equipment updates – these are just some of the items on a long list of enhancements in recent years.

State of Good Repair

RTA completed a Transit Asset Management (TAM) plan in 2018 in accordance with federal regulations. The plans must include capital asset inventories, condition assessments and investment prioritization. The agency manages over 15,000 capital assets, including:

350+	Buses
90+	RTA-owned demand response vehicles
92+	Rail Cars
68	Miles of One-Way Track
49	Rail Stations

The plan highlights that significant investment is needed to maintain the agency's infrastructure and additional funding will be needed. When transit assets are not in a state of good repair, the consequences include increased safety risks, decreased system reliability, higher maintenance costs, and lower system performance.

RTA implemented an Enterprise Asset Management System in 2004 and has updated assessments of assets repeatedly since then.

RTA is committed to conducting asset validation and condition assessment physical audits every two years. As of 2018 the assets included approximately 250-40' buses, over 60-60' buses, 12 trolley vehicles, over 20 MCI over-the-road coaches.

Bus Replacement Program

RTA has a plan in place to purchase new buses and retire old ones over the next five years. Below is a brief summary of purchases that are planned.

2019
- 45' MCI Commuter Diesel – Buy 9 vehicles

2020
- 60' low-floor artic - BRT (5-Door) – Buy 10 vehicles
- 40' low-floor CNG – Buy 25 vehicles
- Paratransit Coach 24' – Buy 20 vehicles
- Paratransit Van – Buy 3 vehicles

2021
- 60' low-floor artic - BRT (5-Door) – Buy 10 vehicles
- 40' low-floor CNG – Buy 20 vehicles

2022
- 60' low-floor artic Diesel (3-Door) – Buy 13 vehicles
- 40' low-floor CNG – Buy 20 vehicles
- Paratransit MV-1 type – Buy 20 vehicles

2023
- 45' MCI Commuter Diesel – Buy 6 vehicles
- 40' low-floor CNG – Buy 15 vehicles
- Paratransit Coach 25' – Buy 15 vehicles
- Paratransit Coach 27' – Buy 7 vehicles

2024
- Paratransit Coach 25' – Buy 15 vehicles

NOACA's Long-Range Transportation Plan AIM Forward 2040 identifies RTA bus replacements on its list of major projects. Between the years 2018-2040, NOACA plans for $20 million annually for bus purchases. A total of approximately $460 million for RTA bus vehicles aims to maintain the bus fleet in line with the plan's goals to invest in transit.

As the Strategic Plan progresses towards recommendations, discussion will pertain to the potential to transition RTA's fleet towards zero-emissions vehicles in order to promote sustainability.

Facilities

NOACA's Long-Range Transportation Plan identifies Cleveland's Multimodal Transportation Facility on its list of major projects. This new facility aims to enhance the transportation network and has a total estimated cost of approximately $47 million. Planned to be located west of E. 9th Street near the lakefront, the facility will include Amtrak, Greyhound, RTA Services (Waterfront Line, Downtown Trolleys, and regional express buses), regional transit buses (RTA, Akron Metro, Laketran), other transportation services (shuttle buses, taxis, rental cars, bike share, etc.), associated services and amenities, and potential joint development opportunities.

NOACA's major projects list also includes approximately $50 million in the year 2020 for new transit facilities as part of the Thrive 105-93 project. This project will develop a transit corridor along East 105th, Woodhill Road, and East 93rd Street to link people, place and opportunity. It will link key economic and community assets, leveraging land flanking the corridor and extend the economic development benefits of the planned Opportunity Corridor. This project is sponsored by City of Cleveland in order to enhance the transit system.

Intelligent Transportation Systems (ITS)

The NOACA Regional ITS Architecture is a roadmap for transportation systems integration in the five county NOACA region (Cuyahoga, Geauga, Lake, Lorain, and Medina counties) over the next 15 years. The Regional ITS Architecture provides a starting point for project definition. Planned projects listed for RTA include:

RAIL TRANSIT OPERATIONS - LIGHT RAIL OPERATIONS CENTER
Light rail option for special events occurring at the stadiums to help alleviate special event traffic congestion downtown.

RTA / LAKETRAN AVL SYSTEM
Installation of AVL on all RTA and Laketran vehicles.

RTA KIOSKS AT TRANSFER POINTS
RTA to establish kiosk inside CVG airport to assist out of town users in finding their way using public transit.

RTA / LAKETRAN TRANSIT VEHICLE UPDATES
Installation of Wireless Internet Feed on buses, automated signs, and annunciators.

RTA BUS TRAFFIC SIGNAL PRIORITY
Study key transit corridors for applicability of bus traffic signal priority to improve transit travel time. Implement transit signal priority on traffic signals on identified corridors.

RTA PASSENGER MANAGEMENT SYSTEM
System that provides fare reconciliation between peer agencies using a common travel card.

RTA SURVEILLANCE CONTROL
To include CCTV at certain locations to provide surveillance at stations and surrounding areas along Euclid Corridor.

LAKETRAN ADVANCED PARA-TRANSIT SCHEDULING AND DISPATCH SYSTEM
Implement an advanced para-transit scheduling and dispatch system at Laketran coordinated with RTA.

Capital Improvement Plan

RTA's 2020-2024 Capital Improvement Plan (CIP) plans for a total of almost $600 million in capital project needs.

2020 - 2024 COMBINED CAPITAL IMPROVEMENT PLAN

Project Category	2020 Budget	2021 Plan	2022 Plan	2023 Plan	2024 Plan	2020-2024
Bus Garages	$0	$0	$700,000	$4,312,665	$1,662,800	$6,675,465
Bus Improvement Program	$21,305,000	$21,906,000	$22,062,000	$20,960,000	$20,960,000	$107,193,000
Equipment & Vehicles	$1,459,702	$1,645,418	$3,065,687	$1,143,984	$952,000	$8,266,791
Facilities Improvements	$14,779,683	$13,913,599	$12,214,094	$15,002,330	$15,229,500	$71,139,205
Other Projects	$2,459,576	$2,459,576	$2,459,576	$2,459,576	$2,459,576	$12,297,880
Preventive Maint./ Oper. Reimb.	$20,000,000	$20,000,000	$20,000,000	$20,000,000	$20,000,000	$100,000,000
Rail Projects	$32,954,362	$30,030,973	$31,250,000	$31,250,000	$23,250,000	$125,000,000
Rail Car Repl. Program	$8,000,000	$31,250,000	$31,250,000	$31,250,000	$31,250,000	$125,000,000
Transit Centers	$300,000	$300,000	$300,000	$300,000	$300,000	$1,500,000
TOTALS	$101,258,321	$121,505,566	$121,249,037	$123,020,841	$122,502,957	$589,536,722

The CIP identifies $445 million in unfunded projects to the year 2024.

- Rail Vehicles: $192M
- Rail Facility & Infrastructure: $ 28M
- Track Rehabilitation: $ 31M
- Bus Improvement: $ 63M
- Engineering, Passenger, Facilities: $ 61M
- Technical Support: $ 46M
- Bus/Rail Maintenance Facilities: $ 6M
- Bridges, Stations, Equipment, Other: $ 18M

As the Strategic Plan progresses, recommendations will summarize future priorities.

Transit Technology

The RTA's Strategic Plan aims to refresh the agency's vision and goals to reflect the current and future needs of the stakeholders. Technology plays a major role in many aspects of today's transit operations. Transportation technologies are changing on a daily basis with new technologies emerging all the time. Technologies once considered state of the art only a few years ago are reaching obsolescence or being surpassed by improved products. At the same time, transit agencies need to adopt established, proven technologies that have a definable benefit to improve the operation, efficiency, and customer experience of the transit system. Technologies can provide a variety of benefits, such as increasing access to transit options, improving safety, increasing trip speed, and improving travel time reliability. A simple and seamless transit system provides freedom for travelers to use the transit network to meet their daily needs.

TYPES OF TECHNOLOGIES

Transit technologies are abundant and wide-ranging, so one way to guide a discussion is to utilize general categories. Established, new, and emerging technology available to transit agencies include a variety of categories:

- Safety systems designed to reduce collisions with vehicles, cyclists, and pedestrians;
- Accessibility features and services that make trips easier for the elderly and travelers with disabilities;

- Environmental Sustainability technologies that reduce fuel consumption and emissions;
- Fare Collecting and Processing systems that enable easier payments across multiple modes;
- Traveler Information and technologies that provide users with actionable trip planning options prior to and while completing transit trips;
- Emerging Mobility that may complement traditional transit service.

There are many more categories across transit operations that could be addressed, but these categories provide a broad overview of technologies that help provide fast and reliable trips to improve the customer experience and enhance RTA's service. This overview of technology considerations will foster discussion of potential recommended technologies for RTA to consider.

Safety

Safety systems are designed to reduce collisions with vehicles, cyclists, and pedestrians as well as provide personal safety for passengers. To accomplish this, different technologies exist to enhance safety within the transportation system. Traditional safety technology is either an active system with direct monitoring at a central hub or a passive system where the technology surveys the environment and provides notification only if there is a problem. On the emerging technology front, autonomous and connected vehicle technologies have the potential to decrease human error and replace it with different levels of autonomy with built-in safety protocols. Smart transportation infrastructure also provides information to ensure that all users of the system are aware of accidents, incidents, or other disruptions.

Traditional transit safety technology includes monitoring of the system and environment to provide warnings if obstacles are detected. Cameras, vehicle diagnostic systems, and supporting infrastructure provide active monitoring of the system and report information for review and action back to a central hub. Other systems scan the space surrounding the transit vehicles to deliver warnings to the operator or other individuals when the system detects an unsafe action or conditions. Transit providers can use this information to make quick decisions to

respond to incidents such as detours, dispatching additional resources, and/or customer notifications in order to improve the travel options and experience for passengers.

Accessibility

Accessibility features and services are those that make trips easier for older adults, travelers with disabilities, or others who lack the resources to travel freely. Customer-facing technologies are those hardware and software packages that focus on improving the ease of seniors and disabled individuals to interact with and access the system. Traditional technologies that fall into this category include but are not limited to: trip reservation systems, stop announcements, and audible signals. Emerging customer-facing accessibility technologies include the introduction of interactive wayfinding technologies for persons with disabilities and older adults as well as other assistive information devices.

One example of emerging technologies can be seen in USDOT's Integrated Dynamic Transit Operations (IDTO) project. This technology includes several smartphone applications that would increase accessibility of users to transit providers. Applications under IDTO include Connection Protection (T-CONNECT), Dynamic Transit Operations (T-DISP), and Dynamic Ridesharing (D-RIDE) – each application is designed to enhance coordination between riders and transit services to improve accessibility to transit options and service efficiency through the use of cellular technology. These applications increase the accessibility to accurate transit data and ultimately mobility services.

Accessible Transportation Technologies Research Initiative (ATTRI) is one program used to increase accessibility throughout transit services. This project seeks to enhance mobility for people with disabilities through the use of emerging technologies. Some of the technologies that may be used to improve accessibility include wayfinding and navigation applications, V2V/V2I technology, real-time trip planning services, intelligent transportation systems (ITS), assistive technology, one-fare payment applications, automation, robotics, data integration, and enhanced human services transportation. Implementing these technologies can improve quality of life by providing greater accessibility to seniors and people with disabilities. There are also some challenges associated with integrating transit technologies through the use of smartphones, as some individuals may not be able to afford smartphone data plans to utilize apps.

Environmental Sustainability

Environmental technologies improve sustainability by reducing fuel consumption and emissions. They are designed to improve the operational efficiency of the system to reduce greenhouse and carbon gas emissions. In its basic form, environmental technology options consist of improving overall fuel economy through more efficient engine designs and lighter vehicles, reduced particulate pollution through advancements in catalytic converters, and alternative fuel vehicles. Emerging environmental technologies

focus on improvements to the overall transportation network through vehicle-to-infrastructure communications. Specifically, eco-signal preemption/ priority applications evaluate traffic and environmental parameters at each intersection in real time and adapt to ensure the traffic network is optimized using available green time to serve the actual traffic demands while minimizing the environmental impact.

Traditional environmental technology applications in transit focus primarily on addressing the environmental impacts associated with the transit vehicles. Overall, transit vehicles today are much cleaner and more efficient than previous design iterations. New emission standards and fuel economy requirements for transit vehicles have resulted in a significant reduction in the amount of pollution they produce. This does not stop the transit industry from exploring and implementing alternative fuels to achieve greater efficiency and reduction in the environmental impact of the transit system. An alternative fuel vehicle is a vehicle that runs on substances other than the conventional petroleum gas and diesel. Examples of alternate fuels include electric, solar, biodiesel, ethanol, propane, compressed air, hydrogen, liquid natural gas, and liquid petroleum.

Compressed natural gas is a prominent fuel alternative that RTA is transitioning toward, with conversion from diesel to CNG fueling at the Triskett District facility. The east-side Hayden Garage has had the capability to refuel CNG buses since 2015. RTA now has well over 100 CNG buses in its vehicle fleet. While CNG emits reduced levels of greenhouse gases, many agencies are aiming higher by investing in zero-emissions vehicles. A strong trend in the transit industry is a gradual shift towards electric buses.

Fare Collection & Processing

Fare Collection and Processing refers to systems that enable payments for transportation services. Advancements include payments that are seamless and easy across multiple modes, as well as enhanced access for unbanked households.

Transit fare payment is the compensation provided by the customer in return for use of the service. Fares are either paid on the transit vehicle or at the transit station/stop/terminal prior to boarding the vehicle. Cash-based systems limit fare options to one-way passes with or without transfer tickets, with some systems offering multiple-ride tickets verified by manual ticket punches. As technology has improved, a number of cash lockboxes have been replaced with smart fare boxes that include automatic bill/coin validators and bus pass readers via magnetic strip, smart chip, and/or radio frequency identification devices (RFID). A major benefit of upgrading fare systems is improved efficiencies and decreased passenger delay at transit stops. The major drawbacks are the back-end support programs that must be added to implement a smart fare system and the challenges associated with encouraging customers to use a new fare type.

Technology opens the door to new fare types such as unlimited-ride or value-added cards, where customers can choose the amount of fare they want to purchase. Fare technologies improve the efficiency of the system by replacing single ticketing booths to multiple ticket vending machines and reduction of passenger delay at transit stops by speeding up the customer interactions with the fare boxes. In addition to quicker and easier transit boarding, emerging processes for fare collection open up the potential for seamless integration of mobility services across multiple modes and providers.

Traveler Information

Traveler Information technologies provide users with actionable trip planning options prior to and while completing transit trips. Traveler Information for transit systems focuses on providing front facing applications and programs to help customers navigate the fixed-route or paratransit system. The goal is to provide reliable and accurate systems that enable customers to plan their trips and know when their bus is coming. Traditional technology employed by transit agencies in this space includes trip planning software, trip reservation programs, and real time location. In addition, it includes automatic stop announcements on the bus. Traveler information is provided through geographic position system (GPS) based technology with the information relayed to supporting applications that distribute it to customers through websites, digital displays at stops/stations

and smartphones. Emerging technology integrates the traveler information with the connected vehicle infrastructure to improve the accuracy of the information as it relates to real-time traffic information and broadcasts the information directly to the customers.

Trip planning programs changed all of this by using GPS information contained in scheduling software used by transit agencies. First developed by Google, General Transit Feed Specification (GTFS) provided the standard format to display scheduling and runcutting outputs used by transit operations in a customer-friendly format. Now, customers could plan transit trips from their house to their destination to get over-the-road directions. This eliminated some of the confusion associated with transit, and opened the door for new riders to try the system.

While trip planning software laid the foundation to demystify transit, automatic vehicle location makes the system easier to use. Real-time vehicle location uses either information provided by MDTs or standalone devices to track schedule adherence to show customers where their bus is and when it is expected to arrive at their location. With this technology, customers are no longer bound to the ride guide or even trip planners to prepare their itineraries and are allowed to be more spontaneous in using transit. Real-time bus locations provide more freedom in using transit by allowing customers greater flexibility regarding when they need to leave their location to arrive at their bus stop. It also quickly provides customers information on any delays, detours, or other obstacles affecting the operation of the system. In current applications, real-time bus location is available online, in smartphone applications, and at bus stops on variable message boards.

Emerging Mobility

Emerging Mobility refers to new technologies that are giving rise to service that may complement traditional transit. One technological trend that has been growing in recent years is the rise of shared mobility providers. Shared modes of transportation include rail, bus, bike-sharing, car-sharing, and ridesourcing. Ridesourcing companies, such as Lyft and Uber, offer an efficient way for people to travel

when other transportation options may not be feasible. Car-sharing companies, such as car2go and Zipcar, offer an opportunity for people to freely use a rented automobile without the commitment of owning a personal car. Additionally, bike-sharing companies offer an opportunity to resolve first- and last-mile gaps while promoting healthy and sustainable mobility solutions.

Shared mobility services can often be utilized and scheduled through the use of mobile apps, which increases accessibility for a wide range of consumers. While data is limited, shared modes of transportation have the potential to provide multiple benefits, such as reducing overall transportation costs, complementing existing public transit services, and resolving many first- and last-mile gaps, which ultimately increases overall mobility in communities. As the use of shared mobility technology continues to become more integrated in society, continued coordination between public and private agencies appears inevitable. Many organizations are also hoping to improve mobility options for transportation disadvantaged populations, and improving paratransit services through emerging transit service models is a viable option for agencies.

Mobility as a Service, discussed elsewhere in this report, is an exciting concept to improve ease of access and paying for transportation.

NEW RTA TECHNOLOGIES

RTA was awarded a grant to upgrade its existing on-board vehicle equipment and radio system in 2017. A key customer service result of these upgrades is complimentary wireless connection access for mobile devices on all buses and trains. With upgrades set to be complete in late 2019 and 2020, the project has four main objectives:

- Increase rider and operator safety – replacing existing onboard technology will improve communication with RTA's integrated communications center (ICC) and public safety forces (police/fire/EMS) in real time. A turn-by turn navigation system will better assess operator driving performance, more accurately monitor emissions, and provide navigation services to

operators, while interfacing with existing RTA computer systems.

- **Provide real-time information** – new software will provide passenger updates including live tracking and estimated departures from specific stop locations for bus and rail. Upgrades will allow for passenger updates every 15 seconds (as compared to the previous three minutes). Data will be in an "open" format where application developers can utilize information. Real-time weather, news, and community information will be delivered through LCD screens at train stations, transit centers, and on vehicles.

- **Enhance the rider experience** – onboard audio announcements will be updated in a timely manner and announcements will be made in multiple languages. Travel times will be more accurately monitored and will allow for RTA to identify areas to improve on-time performance. Buses will be equipped with monitoring software that will identify maintenance issues, reducing repair costs and decreasing vehicle failures on the road. Automatic passenger counters (APC) will be used to record passenger loads on specific routes and times of day to effectively plan scheduling to meet riders' needs.

- **Implement connected communication** – RTA will replace the current radio system with cellular technology. The computer aided dispatch and automated vehicle locator (CAD/AVL) system will utilize voice over internet protocol (VOIP) and better communicate within the organization itself, as well as with each community that RTA services.

These upgrades create exciting opportunities in customer enhancements and connected vehicle technologies to improve transit service in the years ahead.

AUTONOMOUS VEHICLE PILOTS

Of all vehicle technologies, the idea of autonomous vehicles captures the most headlines. There are many companies that have been developing and deploying autonomous technologies on a global scale, such as 2getthere, EasyMile, and Daimler. These autonomous technologies have the potential to improve safety, reduce the overall cost of transit implementation, decrease congestion, and be more eco-friendly than the majority of vehicles commonly used today. Additionally, they have the ability to complement existing transit systems to resolve first- and last-mile barriers. Many of these AV vehicles are being deployed in urban centers, transportation hubs, healthcare hubs, retirement communities, convention centers, recreation spaces, theme parks, universities, business parks, and industrial areas.

Las Vegas was the first city in the U.S. to test a fully-autonomous shuttle within real-time traffic in November 2017. The shuttle was created by Navya, an autonomous vehicle manufacturer. The shuttle operated on a 0.6 mile loop around downtown Las Vegas and stopped at three locations to provide free rides to people within the city's Innovation District.

One agency that has been making notable progress into the realm of AV technology is the Jacksonville Transit Authority. Since JTA's existing Skyway system (an automated people mover) was due for a complete overhaul of its vehicles, JTA decided to research alternatives to replacing the monorail vehicles that would also promote future plans for expanding the Skyway system to surface level. Ultimately, JTA determined that investing in an AV system was a viable option given the technology's capabilities, emerging trends, and overall financial savings of its integration and has conducted limited testing of autonomous shuttles.

There are a variety of transit agencies that are partnering with technology providers to enhance mobility and safety in their communities. In one example, the Contra Costa Transportation Authority (CCTA) in San Ramon, California initiated a project to deploy AV shuttles to be used within a local business park. CCTA partnered with an autonomous vehicle manufacturer and property development company to deploy two EasyMile Shuttles.

Each year, more transit agencies and cities create headlines by launching autonomous shuttle pilots. From Columbus, Ohio to Boston, Massachusetts to Lincoln, Nebraska and many others, autonomous pilot projects are testing technologies using real-world environments. In many ways, these tests show the limitations of autonomous shuttles in their current

state, with slow speeds and difficulty navigating common roadways. On the other hand, the rapid advancements in autonomy point to a continual evolution of technology to enhance the variety of services that transit agencies provide.

New Mobility

There are fundamental changes for transportation underway and on the horizon. Emerging technologies are coming together at an unprecedented pace in ways that will shift the underlying assumptions about and operation of our transportation network. New mobility options are beginning to emerge as massive corporate investment is pairing with technological advancement and new approaches in transportation network analysis and design.

Below is a general overview that serves as a summary snapshot in time. Since things are changing so rapidly, it is certain that progress will quickly remake what we see today. There are many factors in new mobility that will affect transit service both positively and negatively. The following are some of the most impactful.

TRANSPORTATION NETWORK COMPANIES

Companies such as Uber and Lyft use online platforms to connect passengers to drivers who use their own vehicles. These ride-hailing or ridesharing companies are codified by regulatory agencies as Transportation Network Companies (TNCs) in California and many other locations. They are referred to by other names as well such as Transportation Network Providers (TNPs) in Chicago.

Uber provides approximately 14 million trips a day across six continents and over 700 cities.

Success at a Price

To remain competitive among transportation providers, Uber and Lyft have lowered fares and service fees to customers. At the same time, they have offered driver incentives and consumer discounts and promotions. These companies and competitors have distorted the cost of transportation as they compete in the rapidly evolving, but as yet unprofitable, transportation market. Both companies state that their future innovative offerings aim to include autonomous vehicles. Uber is also exploring delivery drones, and vertical takeoff and landing vehicles. Once autonomous vehicles are feasible, Uber's and Lyft's business models will theoretically be on much more solid footing. Each company went public in 2019, but at the time of this writing the

future of each company's financial outlooks are uncertain. Even so, it is impossible to deny that these companies and their technologies have been a massive success for customers and have left an impact on the transportation landscape. Pilot partnerships with transit agencies and integration with transit services have become more prominent in recent years and the relationship between transit agencies and TNCs continues to evolve.

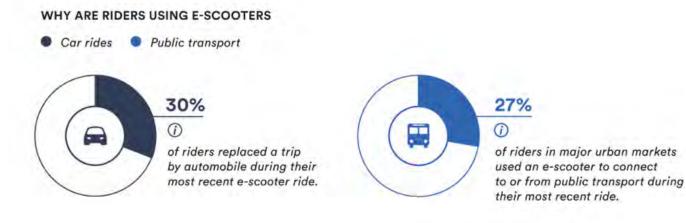## HARNESSING INNOVATION FOR PUBLIC GOOD

In 2018, RTA entered into a partnership on a pilot program with Lyft to provide paratransit customers with a new transportation option. By supplementing RTA service with Lyft, RTA was able to drive down the average cost of service from $40 per trip to $8.49. From April 4th to June 30th, 2018, there were 1,676 total rides as part of this pilot program with a savings of $52,000. It is prudent to continue to explore innovative partnerships that build on this success in ways that advance RTA's goals while also minimizing potential risk.

MICROMOBILITY

For many decades, we have relied on a limited set of travel modes and vehicle types. The personally owned automobile has become vastly dominant in most cities followed by buses, trains, bicycles and walking. For the delivery of goods, trucks of various sizes eventually carry almost everything that we use. Now we are seeing the introduction of different vehicle types – scooters, e-bikes - and use patterns that are impacting traditional transportation modes.

Micromobility is typically thought of as smaller personal transportation devices that are part of a shared network. These docked and dockless bikes, e-bikes (bikes with electric assist motors), and scooters function in different ways than other more prevalent modes such as cars and buses. They are small in size (hence "micro" in the name) which allows people to increase the capacity of roads. While there have been concerns over these devices being left throughout the public ROW and private property in inappropriate locations, it is also true that they require a small fraction of the storage space needed for the equivalent number of automobiles. In addition, the shared use model provides another option that doesn't require a round trip for a specific vehicle, freeing consumers to switch modes at will. While personal bicycles certainly fit into this broad category, using a personal bike means that you have to manage the location of your device at all times. Shared use micromobility allows each leg of a journey to be considered independently.

One goal of increased micromobility usage is the potential to deal with the "first mile / last mile" concerns that often make it difficult for people to effectively use and access modes like transit. Micromobility also presents opportunities to reduce car trips and gain more roadway network capacity. Information released by Lyft indicates that 30% of riders used their scooter ride to replace a car trip and that 27% used the ride to connect to transit.

In only the last 12-18 months have scooters been introduced to cities across the nation. In some cities it was truly overnight that hundreds or thousands

WHY ARE RIDERS USING E-SCOOTERS

● Car rides   ● Public transport

30%
ⓘ
of riders replaced a trip by automobile during their most recent e-scooter ride.

27%
ⓘ
of riders in major urban markets used an e-scooter to connect to or from public transport during their most recent ride.

UPS Tricycle Delivery Vehicle

of scooters appeared on streets. And they didn't just appear, but were immediately embraced by users even while giving heartburn to cities who were forced to scramble to create policies and practices to deal with the negative aspects. In 2018 alone, over 38.5 million scooter rides (out of 84 million shared micromobility trips) were taken in the US.[1] The speed with which scooters appeared in many cities indicates how quickly new changes in transportation can now occur.

MICROMOBILITY IN FREIGHT AND DELIVERY

Related to micromobility beyond transportation for people, small-scale delivery devices will quickly alter the way package delivery works, having further effects on the overall function of urban traffic, freight, and related land uses. There are two categories currently being tested in markets throughout the world. The first are small-scale delivery devices that include a human participant to drive the vehicle and make deliveries. In one example, UPS is in the process of testing electric tricycles for delivery in Seattle. This type of smaller, slow-speed vehicle intermixes easily with other

slow-speed vehicles on the roadways, and can also blur the lines between public rights-of-way use with the ability to travel on sidewalks and other pedestrian areas.

The second are "terrestrial drones" that operate autonomously for package delivery. At the larger size of these devices, Kroger is testing autonomous delivery with Nuro self-driving vehicles. This is now occurring in Houston as an added city to the successful pilot project in Scottsdale, Arizona[2].

The development of autonomous delivery vehicles coincides with a rapid increase in online sales and the related spike in package delivery to homes and businesses. This includes not only retail goods, but also meal delivery with options such as Uber Eats and Grubhub reframing the typical perception about the variety of options and convenience of home food delivery.[5] And the deployment of these vehicles might come in ways that we don't currently envision with Amazon contemplating roving "home base" trucks that can then deploy these small drones to blanket a neighborhood with deliveries and then return to the truck to reload.[4]

The potential future of increased urban delivery devices of all shapes and sizes raises questions about the possible impacts to fast, reliable, safe transit service. Policies that delineate RTA's and municipalities' use and regulations of public right-of-way will become more important in a future so ripe with innovation.

CONNECTED VEHICLES AND 5G

Connected Vehicles (CVs) are cars, trucks or other mobility devices that have embedded technology to allow communication with each other (vehicle to vehicle – V2V) and/or with surrounding infrastructure. This allows vehicles to work in an integrated and predictive system, accomplishing many improvements to operation and safety. Previous efforts have used a variety of technologies to accomplish this connectivity, most frequently with dedicated short range communication (DSRC) devices. However, recent advances in 5G technology, coupled with private sector investment and federal changes in spectrum allocation indicate that 5G may become the leading technology for 5G.

5G is the latest iteration of cellular technology, engineered to exponentially increase the speed (up to 100 times current levels) and responsiveness of wireless networks. 5G will facilitate a massive increase in the amount of data transmitted over these networks. 5G is designed from the ground up to support the Internet of Things (IOT) and in addition to delivering faster and more data, it will help connect everything from autonomous vehicles and medical equipment to smart trash cans and intelligent lighting. This increased speed and capacity will require extensive infrastructure investments including "vertical real estate," like towers and other tall structures and new data centers to process the increased information load.
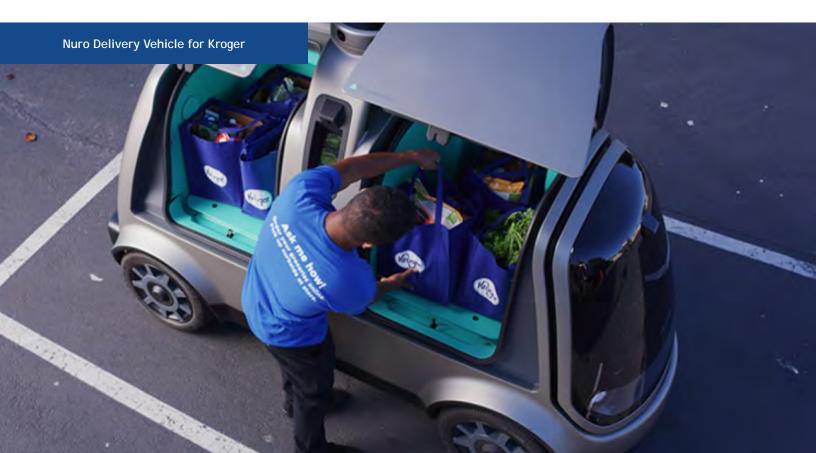
5G is an enabling technology that allows communication between devices, but C-V2X is the critical application that allows for the connectivity between vehicles and everything else. C-V2X, which was standardized in 2017, is designed to connect vehicles to each other, to roadside infrastructure, to other road-users and to cloud-based services. The application of C-V2X will have a wide ranging impact on transportation and the provision of transit.

C-V2X allows for critical applications to be deployed which will potentially allow for a decrease in congestion, a reduction in roadside crashes and fatalities and the ability to create real-time demand-based tolling systems to change driving behavior in highly dense urban areas. C-V2X applications are now being tested by an assortment of leading automotive companies such as Audi, Toyota and the PSA Group along with technology infrastructure companies such as Qualcomm, AT&T, Verizon and Nokia. Ford announced at CES 2019, that all of their global fleet will adopt C-V2X technology by 2022.

AUTONOMOUS VEHICLES

Autonomous Vehicles (AVs) are rapidly advancing through a large number of real-world tests, and we now see every major auto manufacturer developing driverless technology. Waymo, Cruise Automation, Tesla, Apple, Zoox, Aptiv, May Mobility, Pronto.ai, Aurora, and Nuro, are some companies developing autonomous vehicle technologies, either alone or through collaborations with car manufacturers. While there is uncertainty about the pace of rollout and AV adoption, it is a technology that could have a profound impact on cities in many ways. Adaptation of our transportation network, infrastructure and site design are some of the tasks that will be required. While the effects on transit, roadway usage, demand and capacity, along with parking and site design

Nuro Delivery Vehicle for Kroger

won't be seen immediately, the rapid development of the technology should compel communities to begin planning for the potentially substantial changes that it will bring.

Overview of deployment models

The speed of adoption and eventual adoption rate of each of these models will have far-reaching consequences. At this time, there are three emerging models of future autonomous vehicle deployment.

- **Ownership model** – An ownership deployment model is centered around individually or family-owned vehicles, each capable of a high level of autonomous driving. While similar in some ways to our current system, it offers more flexibility in managing parking at certain destinations. With this system, parking no longer is necessary within close, walkable proximity to the destination land use. If the car is capable of fully-automated driving, individuals would drive or be driven to a destination, and the car could then drive autonomously to a parking area, or even back to its origin. This model could allow better distribution and management of parking, and a better use of underutilized areas.

- **MaaS / TaaS** - Mobility as a Service (MaaS) or Transportation as a Service (Taas) is a model that operates as an on-demand taxi service. The current deployment of this model is the Transportation Network Company (TNC) or a Mobility Service Provider (MSP), currently embodied by companies such as Uber and Lyft.

Fedex Delivery Robot[5]

In this model, mobility is no longer achieved through owning a vehicle, but rather utilizing a transportation service. The direction of this technology eventually suggests a fleet of privately operated autonomous cars able to orient themselves to ferry users around the city. Rides can be shared among multiple users to reduce cost. Even the format or shape of the vehicle can change dramatically from the current format of consumer vehicles. A hallmark of this system would be an increase in the utilization of employed vehicles (individually owned vehicles are currently averaged at 5% utilization), with a potential reduction in the total amount of vehicles needed by a substantial amount. Two models of MaaS/TaaS vary slightly. A subscription service may provide access to a certain on-demand vehicle owned by a certain company, for example. On the other hand, MaaS/TaaS can be envisioned as access to integrated services across modes with easy trip planning and payment combined in a single user interface on a smartphone, for instance. The model driving current rideshare businesses is the former, and it is expected that initial automated vehicle deployment will follow a similar subscription model. Conversely, many public agencies are aiming to support access to integrated services as a matter of public policy to increase access to transportation and enhance the efficiency of the overall transportation system.

- **Transit** – The current models of transit have potential to be affected by the rise of autonomous technology. While it is unlikely that fixed-asset transit such as inter-city rail, streetcars, or heavily used buses will be seriously transformed, the current model of bus transit will likely change. The current generation of autonomous microshuttles give us a glimpse into the direction of future autonomous transit models. Various companies are already producing vehicles capable of carrying 10-14 passengers in open traffic scenarios. A microshuttle system would be able to deploy more vehicles at times of higher demand, making better use of each trip, and offering riders more frequent service. Microshuttle transit options are being tested around the country and continue to evolve.

Amazon Scout Delivery Robot[6]

CURB MANAGEMENT

Curb management is a topic gaining more and more interest as mobility modes shift. It is centered around the idea that there will be more and more competition for the curb as more shared mobility and various levels of autonomy become prevalent. For individuals, once you no longer have to stay with the vehicle you arrive in to find it parking, you'll prefer to be dropped off closer to the door of your destination. We are already seeing this with the use of ride-hailing services such as Uber and Lyft. The issue will increase as individual cars become able to park themselves as standard practice, and as autonomy makes the shared model the dominant choice in denser areas. Urban freight delivery mechanisms such as the micro-delivery robots discussed earlier, along with likely even more delivery trucks, are arriving at the same time that passenger mobility is changing.

Management of curb space has great implications for transit agencies such as RTA. Buses rely on dedicated locations on the curb that are free of obstruction for passengers to be able to quickly board and alight. Policies and technological enforcement solutions will become more important in a future where curb space becomes more valuable.

UNKNOWN FUTURE DISRUPTORS

The pace of transit technology change is rapidly moving ahead to ideas thought inconceivable just a few years ago. Some trends lean toward a continual merging of modes, with the potential for seamless integration between traditional mass transit and personal vehicles. Behind new ideas are the age-old desires of the traveling public – fast, easy, and comfortable transportation between point A and point B. The following sections describe the potential for exciting developments in transit technology.

Hyperloop

Rarely does a transit technology emerge so quickly in the public consciousness and receive so much media coverage as hyperloop has in the past few years. Simply put, hyperloop is a system composed of a vacuum and magnets to propel vehicle pods through a tube for long distances at speeds over 700 miles per hour. Since Elon Musk revived the longstanding concept of high speed travel in a vacuum in recent years, multiple companies have emerged and public agencies have taken notice.

Virgin Hyperloop One and Hyperloop Transportation Technologies are two of the companies beginning to partner with local governments on research and evaluation of potential routes. Local government agencies have announced partnerships for hyperloop feasibility studies and are beginning to provide public funds towards planning for this technology. For example, NOACA is working with Hyperloop

Transportation Technologies to study a potential route between Cleveland and Chicago.

Ideas for Aerial Innovation

A company called skyTran has introduced an idea for technology that uses magnetic levitation to move two-person passenger pods along an elevated guide rail. Unlike skyTran, which plan for pods traveling along an aerial track, other companies are testing an idea that is more in line with a combination of a car and a helicopter. UberAIR is being jointly developed by Uber and NASA, with prototypes that include four rotors on wings that will allow the vehicles to fly 1,000 to 2,000 feet in the sky. A competitor is named Kitty Hawk and is backed by Alphabet, the parent company of Google. Uber plans for commercial service beginning in 2023.

The list of technologies under development that aim to transport people in new ways, big and small, is seemingly endless. While emerging concepts can be untested and raise many questions, excitement for new technologies abounds.

Footnotes

[1] https://nacto.org/shared-micromobility-2018/

[2] https://www.supermarketnews.com/online-retail/kroger-expands-driverless-delivery-houston

[3] https://www.washingtonpost.com/technology/2019/02/27/your-next-fedex-delivery-could-be-pizza/

[4] https://www.bizjournals.com/seattle/news/2018/03/27/driverless-delivery-amazon-patent-trucks-drones.html

[5] https://about.van.fedex.com/newsroom/thefuturefedex/

[6] https://www.theverge.com/2019/1/23/18194566/amazon-scout-autonomous-six-wheeled-delivery-robot

2020 Disruptions

The transit riding experience, like so many of life's experiences, was thrown into disarray in early 2020 with the COVID-19 global pandemic. RTA took responsible actions that are national best practices. Among multiple safety measures, RTA enacted:

- Enhanced cleaning and disinfecting of vehicles and facilities
- Barriers and separators for operators and staff
- Personal protective equipment
- Collaboration with Health departments and Centers for Disease Control

In addition to safety measures, the COVID-19 pandemic has thrust an economic downturn upon Northeast Ohio and the world. Past economic recessions have had a long impact on Cuyahoga County, with challenging decreases in population, jobs, and transit ridership. These considerations drove RTA and all transit agencies into unknown territory as ridership has decreased on transit nationally and transit funding remains insufficient nationwide.

On top of COVID-19 and economic challenges, there has been a renewed acknowledgment of the importance of transit in moving society forward. Calls to action for social justice have highlighted the challenges facing people of color. There is an increased realization of the importance of transit for essential services and workers.

At the time of the conclusion of this Strategic Plan, the global pandemic continues.

- There is uncertain travel demand for all modes
- Health concerns drive all aspects of life
- School remains remote for many students, from elementary school to universities
- Utilization and acceptance of working from home accelerates a previously growing trend

Against this backdrop, uncertainty is prevalent. However, scientific consensus is that the COVID-19 virus will be overcome in time. Through it all, transit has and will continue to be the backbone of economic opportunity for those who need it most and those essential workers who drive society forward.