SCOPING PAPER ON TRANSIT SYSTEM INNOVATION AND RESEARCH EFFORTS

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ABSTRACT

The objective of this scoping paper is **to highlight some of the varied efforts that transit system leaders have initiated, or been involved in, to support innovation and R&D in their organizations.** These include:

Innovation Initiatives and Programs Developed by Transit Systems

- LA Metro Office of Extraordinary Innovation
- Chief Innovation Officers in Transit Systems
- TransLink Tomorrow
- New York MTA Transit Innovation Partnership and Transit Tech Lab
- WMATA Academic Research Partnership

Transit System Participation in R&D Collaboration Programs

- MIT Transit Lab
- University of Toronto Transit Analytics Lab
- CUTRIC
- Chicago City Tech Collaborative

Related web resources are provided where available. The scoping paper also discusses the **U.S. Federal Transit Administration's COVID Transit R&D Awards**.

1. Background

The transit industry is by and large operations-driven, rather than data-driven. It operates in the public sector, under strict mandates concerning accountability and transparency, and is as a result very risk-averse. This makes it difficult to innovate, since innovation entails risk-taking by its very nature. In addition, transit is a highly labour-intensive industry, with over 80 % of costs stemming from personnel; it is not capital-intensive, making the introduction of new technology often challenging. As a result of the risk-adverse nature of the industry, there has also been relatively little focus in the transit industry on research and development (R&D).

Nonetheless, the industry has been slowly evolving and the majority of medium to large transit agencies have deployed by now mature core transit Intelligent Transportation Systems (ITS) technologies (e.g., computer-assisted dispatch and automatic vehicle location (CAD-AVL), automatic passenger counting (APC), real-time information, video surveillance, etc.). A small but growing number of transit systems are experimenting with or deploying more innovative technology-based systems such as application-based on-demand microtransit service, account-based open payment systems, ITS-based data analytics, etc. A very small number of transit systems have in recent years gone much further, fully embracing the concept of innovation and even R&D through the implementation of programs to support and stimulate innovation and research.

The COVID-19 pandemic has had dramatic impacts on the transit industry, creating great turbulence and uncertainty. Transit systems have responded to the threats and challenges posed by the pandemic in numerous ways, which in many cases illustrated their ability to act with agility and to use innovative thinking. Some of the responses included:

- Rapid deployment of physical distancing and multiple other safety measures to protect operators and customers
- Rapid deployment of remote operations control and customer communications
- Rapid redesign of networks and rescheduling of services to meet an everchanging demand and ensure physical distancing
- Installation of bus priority and pop-up bus lanes
- Expanded use of on-demand services as a substitute for fixed route bus services
- More flexible procurement processes to accelerate the acquisition of personal protective equipment, IT and/or technology systems, etc.
- Rapid deployment of touchless fare collection systems in several transit systems

The strategic value of technology and data was made all the more evident through the experience of transit systems responding to the COVID-19 pandemic. Transit systems equipped with sophisticated Transit ITS platforms were able to react quickly and more effectively to enable remote control of their operations, and had the data needed to nimbly re-cut schedules or redesign networks on the fly. Passenger counting data was also invaluable to help communicate to customers historic levels of crowding, or in some cases real-time crowding levels if sufficient bandwidth existed, which helped to allay the fears of transit customers.

The pandemic also led to another interesting development among some transit systems, which has received less attention: it stimulated a multi-dimensional search for innovative solutions through R&D as well as creative organizational changes to address the challenges that transit systems were facing. Some of this innovation effort has been led by transit systems themselves, typically in collaboration with university researchers or private start-up or other firms, while other R&D programs were initiated by governments. In some cases, transit innovation leaders were able to pivot their existing R&D collaboration programs to focus on pandemic-related solutions.

All of these efforts that have taken place in recent years by transit systems to stimulate and conduct R&D should be of interest to the Advanced Public Transit Systems (APTS) Technical Committee of ITS Canada; the objective of this scoping paper is **to highlight some of the varied efforts that transit system leaders have initiated, or been involved in, to support innovation and R&D in their organizations.** These include initiatives and programs developed by transit systems themselves, as well as examples of transit system participation in R&D collaboration programs. Related web resources are provided where available.

2. Innovation Initiatives and Programs Developed by Transit Systems

The following section identifies five types of initiatives or programs initiated by transit systems themselves:

- LA Metro Office of Extraordinary Innovation
- Chief Innovation Officers in Transit Systems
- TransLink Tomorrow
- New York MTA Transit Innovation Partnership and Transit Tech Lab
- WMATA Academic Research Partnership

2.1. LA Metro Office of Extraordinary Innovation

https://www.metro.net/about/partnerships-ups/

LA Metro (in Los Angeles) was a precursor in focusing on the concept of innovation in a transit system. It created in 2015 the Office of Extraordinary Innovation (OEI) to champion new ideas for improving mobility throughout Los Angeles County, while helping Metro set an innovative and fiscally responsible course for the future. The small OEI team serves as the clearinghouse for inventive plans, practices and thinking and conduct a comprehensive strategic planning process that will include input from the Metro Board of Directors, employees, stakeholders and local and national partners in order to set the strategic direction of the agency for the next decade or more.

The office evaluates and improves procurement practices to open the doors for creative and unique partnering arrangements, such as public-private partnerships.

Responsibilities of the office include:

- Informing the high-level vision for Metro through exposure to innovative people, organizations and industries.
- Supporting Metro departments in piloting new and experimental programs and policy.
- Serving as the primary liaison for new ideas relevant to Metro and the transportation industry coming from entrepreneurs, established private sector entities, academia or individual citizens.

Unsolicited Proposals

The standard approach to developing projects at public agencies is largely internal; the agency identifies a need, develops a project, and seeks a contractor to carry out the scope of work. Unsolicited proposals present an opportunity for external parties to bring forward project proposals for consideration, expanding Metro's horizons and sparking conversations about alternative approaches and solutions.

Since the inception of the Unsolicited Proposals Policy in 2015, Metro has received over 250 unsolicited proposals leading to 20 unique projects and eight proofs of concept. Unsolicited proposals have influenced over $15 billion worth of Metro projects, including the following:

- Metro Micro
- Sepulveda Transit Corridor Predevelopment Agreement (PDA) project delivery
- West Santa Ana Branch P3 project delivery
- Zero Emission Bus P3 project delivery
- Los Angeles Aerial Rapid Transit
- Camera Bus Lane Enforcement
- Vehicle to Infrastructure Technology
- Unmanned Aircraft Systems (Drones) for Data Collection
- Travel Rewards Research Pilot
- Navilens wayfinding for the visually impaired

2.2. Chief Innovation Officers in Transit Systems

Following the lead example of LA Metro, several other transit systems in the U.S. have created senior positions for innovation (e.g., Chief Innovation Officer or Director of Innovation) and related divisions. These include SEPTA in Philadelphia, Dallas Area Rapid Transit, Houston Metro, Cincinnati Metro, COTA in Columbus OH, Valley Transportation Authority in Santa Clara, CA, etc. The responsibilities or focus areas of these new positions and offices vary somewhat from agency to agency but can include the following:

- Manage the unsolicited proposal process
- Facilitate and support public private partnerships, and in particular those related to technology projects
- Manage the systems engineering and deployment of customer-facing technologies and applications
- Prepare proposals for federal and/or state funded R&D projects
- Manage the planning and deployment of non-traditional services, such as on-demand microtransit
- Monitor corporate performance and key performance indicators
- Manage cross-departmental innovation teams focusing on strategic objectives
- Serve as internal consultants
- Prepare an agency's strategic plan (e.g., Cincinnati's "Reinventing Metro" plan)

2.3. TransLink Tomorrow

https://www.translink.ca/plans-and-projects/programs-and-studies/translink-tomorrow#new-mobility-lab

TransLink in the Metro Vancouver has deployed a multi-pronged approach to stimulating and supporting innovation and R&D, entitled "TransLink Tomorrow". TransLink Tomorrow provides an approach to continuously explore, test, and implement innovative ways to improve mobility in Metro Vancouver. It also seeks a more open and nimble approach to collaborating with industry, entrepreneurs, and academia to identify worthwhile new ideas and technologies that:

- Enable seamless and efficient door-to-door mobility for people and goods
- Promote safe, healthy, clean, and compact communities
- Ensure affordable and equitable access for all

TransLink Tomorrow has several components:

- Open Call for Innovation
- New Mobility Lab
- New Mobility Research Grant Program
- Project Greenlight

Open Call for Innovation

TransLink initiated in 2018 an annual Open Call for Innovation. Each Open Call invites submissions from the public and private sectors to address a transportation-related challenge facing the region. The intent is to partner with industry leaders, innovators, academics, and policymakers to collaborate on new mobility solutions that will help enhance the livability of Metro Vancouver. For successful submissions, TransLink offers funding and collaboration to incubate, develop, pilot, and implement the concept or application.

Open Call for Innovation themes have been as follows:

- **2018 - Seamless Mobility**: The inaugural Open Call for Innovation focused on bringing the opportunities of seamless mobility to Metro Vancouver – how it can be achieved and how barriers can be overcome. TransLink received 90 submissions and announced a joint initiative with Modo Co-op, Mobi by ShawGo, and BCAA (Evo Car Share) in January 2019 as an outcome of this Open Call.
- **2019 - Customer Services and Amenities**: The second Open Call for Innovation asked for ideas on how innovative technologies, solutions, processes, business models and partnerships can enhance customers' transit experience. TransLink evaluated 45 submissions and announced its partnership with PigeonBox, a shared smart-locker service at three SkyTrain stations in Metro Vancouver.
- **2020 - Our Region's Recovery**: The third Open Call for Innovation asked for ideas on how to improve health, safety, and public trust post COVID-19. It resulted in projects on:

    - Use of photocatalytic oxidation (PCO) for disinfection, involving circulating low levels of hydrogen peroxide in HVAC system
    - Copper coatings on high-touch surfaces to kill virus cells
- **2021 – Better Travel Experience for Diverse Customers:** How can we make the public transit system easier to use for each of our diverse customer groups across the region as travel patterns evolve in 2021 and beyond?

New Mobility Lab
https://www.translink.ca/-/media/translink/documents/plans-and-projects/programs-and-studies/translink-tomorrow/new-mobility-lab/new_mobility_compendium_final.pdf

The New Mobility Lab, established in 2018, is TransLink's effort to establish the necessary collaborations with the academic sector in order to help shape and support an active program of applied transportation research. These research findings will directly inform and shape transportation policy and programs in our region and help us more effectively navigate the coming transport revolutions. Research projects have covered a wide range of themes, including: electrification of vehicle fleets and charging infrastructure strategies, Mobility as a Service (MaaS) trip planning and booking platforms, automated connected electric and shared (ACES) vehicles, dockless electric micromobility devices, artificial intelligence (AI) for big data, the future of curb management to accommodate a multitude of uses both physically and digitally, and many more.

Funding is provided through two programs:

- The **New Mobility Research Grant Program (NMRG)** provides research grants of up to $50,000 to well-defined projects undertaken by Canadian post-secondary researchers and their partners. NMRG projects may range from one year to two years in duration and can span a range of disciplines, including, engineering, planning and policy, urban design, computer science, environmental and resource science, business, psychology, sociology, and economics.
- The **TransLink/UBC Sustainability Scholars Program** connects UBC graduate students with applied research questions in the area of sustainability and new mobility that TransLink has identified as priorities. The Lab provides funding for 250 hours of work per scholar.

Project Greenlight
https://projectgreenlight.io/our-challenges/translink/

In addition, TransLink participates in Project Greenlight, which is a membership-driven collaborative demonstration platform that forges strategic partnerships between public and private enterprises ("members") and technology companies ("innovators") to support decarbonization, optimize asset performance, and accelerate smart and sustainable transformation. Project Greenlight offers a pathway to pilot tech with public and private enterprises ("members") seeking to solve challenges right here in Metro Vancouver.

TransLink has developed under Project Greenlight an Innovation Demonstration Program to help TransLink improve sustainability, operational performance, and customer experience with new solutions for infrastructure, energy, and mobility systems.

2.4. New York MTA Transit Innovation Partnership and Transit Tech Lab

https://transitinnovation.org/about

The Transit Innovation Partnership is a public-private initiative launched by the Metropolitan Transportation Authority (MTA) and the Partnership for New York City in 2019 with the mission to make New York the global leader in public transit. An advisory board of leaders from academia, business, civic organizations, government and labor guides the Transit Innovation Partnership. Programs include the Transit Tech Lab, which has executed more than 20 innovative technology pilots with transit agencies, and the pro bono creation of the MTA's live interactive subway map.

Transit Tech Lab

https://transitinnovation.org/lab

The Transit Tech Lab is an accelerator program for public transportation solutions. Successful companies have an opportunity to pilot their technology with participating transit systems.

How the Lab Works:

- Step 1: Transit Tech Lab announces challenges based on transit leadership goals.
- Step 2: Growth-stage companies apply online, detailing evidence of product-market fit.
- Step 3: Experts from transportation and tech sectors review applications. Transit agencies select promising companies for accelerated proof of concept.
- Step 4: Proof of concept kicks off with companies and transit partners collaborating to implement and evaluate innovative technology.
- Step 5: Successful companies may be chosen to engage in a yearlong pilot demonstrating technology at scale.
- Step 6: Selected companies may be eligible for commercial opportunities with transit agencies.

There have been two separate challenges in each year from 2019 to 2022:

- 2019 - Subway Challenge: How can we better predict subway incident impacts and serve customers?
- 2019 - Bus Challenge: How can we make buses faster and more efficient, especially in bus lanes?
- 2020 - Curb Coordination Challenge: How can we reduce traffic by improving coordination at the curb?
- 2020 - Accessibility Challenge: How can we make New York’s public transit system more accessible?

- 2021 - Signaling Challenge: How can we modernize the subway signaling system faster and at lower cost?
- 2021 - COVID-19 Response Challenge: How can we make transit safer, healthier and more responsive amid the COVID-19 pandemic?
- 2022 - Sustainability Challenge: How can we build a more climate resilient transportation system and increase energy efficiency of fleets and facilities?
- 20232 - Recovery Challenge: How can we support the recovery of public transit and deliver service that gets customers back?

It should be noted that the pre-existing Transit Tech Lab Challenge was repurposed in 2021 to develop R&D to address COVID-19 challenges. The following outlines some of the resulting demonstrations that were conducted:

- Proprietary antimicrobial light to reduce bacteria/microbes from surfaces. This technology will be tested on an Access Link paratransit minibus, a local transit bus, and within common areas throughout corporate buildings (i.e., elevators, restrooms)
- A three-stage air filtration and purification system to mitigate COVID-19. The air filtration technology will be piloted on various vehicles.
- Integration of video analytics and APC data from trains and platforms for with mobile apps to provide crowding information. This can also be used to report on time performance.
- Wearable technology that emits physical distancing alerts and can be used to collect data for contact tracing.

2.5. WMATA Academic Research Partnership

The Washington Metropolitan Area Transit Authority (WMATA or Metro) developed its own collaborative program to partner with a university or other research-oriented organization (academic partner) for the express purpose of creating a long-term, Metro-funded research program focused on the analysis of Metro's operational data sources and resulting in actionable recommendations for changes to business practices, operational policies, and mid- and long-range plans. The academic partner is expected to produce quarterly research progress reports in addition to final reports and/or academic theses and dissertations based on this research using Metro data. The academic partner and Metro will collaborate regularly on the research agenda, focusing on projects and lines of inquiry that provide both compelling research topics and value to Metro. Metro shall provide funding to the academic partner to enable this research.

Academic research developed in, and applied to, a transit operator environment provides benefit to Metro in a variety of ways. Researchers can take the time to fully explore what can be learned from a data source, generate ideas applicable to practice, and develop recommendations outside the daily business pressures faced by an operator. Researchers are

also well-positioned to bring new skill sets and analysis methods to transit topics. Metro seeks to benefit from this kind of research by establishing a long-term research program.

As background, Metro's Office of Planning established an internal research group called Applied Planning Intelligence (API) in calendar year 2013. This team is charged with performing applied research, connecting to Metro's archived operational data sources, posing questions of interest to these data sources, and documenting and socializing findings. This research team analyzes a wide variety of data sources, including: automatic fare collection (AFC) system data, point-of-sale network and online sales data sources; rail station- and circuit-level rail train movements; bus automatic vehicle location (AVL) and automatic passenger counter (APC) systems; incident management systems; rail and bus surveys; rail and bus schedule data distributions (GTFS); geographic information systems (GIS). One goal of the academic research partnership is to increase the throughput of this team and deliver high-quality tailored analyses to internal clients.

Research topics of the Academic Research Partnership must be highly relevant to Metro operations or capital programming, and may be selected from the following list of current and future research questions:

- Transit market sizing and segmentation: who is riding, how often, opportunities for increasing trip-making from existing riders
- Station- and stop-area land use drivers of rail and bus transit ridership
- Identification of factors influencing regional bus and rail ridership trends, including:
    - Fare levels, fare products, and fare payment technologies
    - Rush Hour Promise (RHP) rail system reliability guarantee program
    - Introduction of and changes to bus and rail customer information (routes, schedules, arrival predictions)
    - Exposure to delays, either short-term (rail system incident) or long-term (planned weekend/weekday outage)
- Development and assessment of performance metrics for bus and rail arrival prediction data
- Development of additional customer-focused rail and bus performance metrics
- Bus runtime analytics for bus travel speeds and service levels; identification and evaluation of bus-priority treatment opportunities
- In-depth analysis of fare product purchase and usage patterns
- Interpretation, synthesis, and visualization of Trace ODX (origin, destination and transfer) inference model outputs
- Ranking of transit asset maintenance needs
- New revenue opportunities, including: sale of transit usage data, station-area commercialization; video and audio advertisements; mobile technology
- Additional research topics as jointly identified by Metro and the academic partner

WMATA will work with the academic partner to ensure research topics are feasible and highly relevant to Metro decision-making. The academic partner and/or research associate shall maintain ownership of any intellectual property (IP) such as software or algorithms that results from the Metro-funded research. Metro shall retain unlimited and perpetual usage rights to

any IP resulting from the Metro funded research program. The Massachusetts Institute of Technology (MIT) Transit Lab was selected in 2021 as the academic partner.

3. Transit System Participation in R&D Collaboration Programs

In addition to efforts and programs initiated by transit systems themselves, as discussed in the previous section, transit systems also participate in collaborative R&D partnerships that are initiated and administered by academic institutions or non-profit organizations. There are many examples of single R&D projects between individual academics and local transit systems, but the following highlight three examples of multi-partner collaborations to support innovation and R&D:

- MIT Transit Lab
- University of Toronto Transit Analytics Lab
- CUTRIC
- Chicago City Tech Collaborative

3.1. MIT Transit Lab

https://www.transitlab.mit.edu/

The MIT Transit Lab is a unique research group focusing on innovative public transit research. The lab staff and students partner with transit agencies around the world to solve practical problems using state of the art methods. Since 1980, the MIT Transit Lab has pushed the boundaries of public transit research in collaboration with some of the worlds' largest transit agencies on four different continents, enabling cross-cultural learning by agencies and students alike. Students and staff embed within the agencies to understand needs and produce actionable research.

Specific research topics are defined jointly with each agency sponsor on an annual basis, and each topic has a designated transit agency liaison who provides essential data and who works closely with the research team in formulating the problem, evaluating alternatives and implementing results. MIT faculty take the lead in interactions with the agency, based on years of professional experience directing the planning, design, financing, construction and operation of public transportation systems. These projects enable the students to develop in-depth knowledge of a particular area, and their research provides new thinking on topics of importance to the transit agency.

A few examples of collaborative research projects with transit systems from around the world include:

- Uncovering individual mobility patterns from Transit Smart Card data
- Analyzing the balance between reliability and speed in bus operations
- Identification of systematic service deterioration in urban rail systems
- Estimation of left-behind passengers during periods of near-capacity service

- Disruption management on high-frequency lines: measuring the effectiveness of recovery strategies
- Use of automated data to improve transit fare policy decision making

3.2. University of Toronto Transit Analytics Lab (TAL)

https://uttri.utoronto.ca/tal/

More recently, the Transit Analytics Lab (TAL) of the University of Toronto was established in 2020. TAL brings together:

- Transportation and technology researchers from across the University of Toronto;
- Transit systems in the Greater Toronto & Hamilton Area; and
- Private sector software providers.
- TAL builds on the strength of the University of Toronto Transportation Research Institute (UTTRI), one of Canada's largest transportation research institutes and a recognized world leader in developing analytical tools and models of transport demand and performance.

TAL aims to undertake a wide range of activities including R&D, creation of a data analytics platform, workshops, an international symposium, education, and professional development training. TAL facilitates:

- Fostering innovation in transit data-driven tools (analytics) using advanced methods of data science, machine learning, artificial intelligence, simulation and statistics
- Developing standards & integration methods to accelerate the advancement of transit analytics
- Training of U of T students (across the university) in advanced data-driven methods and their application to public transit decision-making
- Developing collaborative R&D with transit systems or private partners to explore the use of transit data and the development of advanced analytics.
- Exposing the practitioner community through knowledge transfer activities to advanced analytics

A few examples of collaborative research projects with transit systems or private organizations include:

- Advanced Transit Signal Priority (TSP) with deep learning
- Social-semantic analysis of social media (twitter) interactions
- Synthesis of On-Demand Transit practice
- Optimizing bus bridging during subway disruptions
- Modeling rail delays and performance
- Pedestrian movement and crowd flow models,
- Optimization approaches to the multi-depot vehicle scheduling problem, etc.

In addition, TAL hosted the TransitData 2020 International Symposium on the Use of Public Transit Automated Data for Planning and Operations. The three-day virtual event featured nine plenaries, and 13 parallel lightning sessions comprising 71 presentations from both practitioners and academics. In all, over 100 presenters and speakers from 19 countries took part. TransitData 2020 online attracted over 250 registrants, of which 66% were practitioners (transit agency staff, consultants and suppliers), while 34% were university-based researchers. All the recordings from the plenary and parallel sessions as well as the presentations can be found at the Symposium website.
TransitData2020.ca

3.3. Canadian Urban Transit Research & Innovation Consortium (CUTRIC)

https://cutric-crituc.org/

The Canadian Urban Transit Research & Innovation Consortium (CUTRIC) is a member-based non-profit organization that spearheads, designs, and launches technology and commercialization projects that advance next-generation zero-carbon mobility and transportation solutions across Canada.

Its mission is to support the commercialization of technologies through industry-led collaborative research, development, demonstration, and integration projects that bring innovative design to Canada's low-carbon smart mobility eco-system.

Members include transit agencies, industry partners, academics, government agencies, and not-for-profit organizations.

Its pillars of innovation are:

- Zero- and low-emissions propulsion technologies and systems integration
- Smart vehicles and smart infrastructure technologies for automated and connected vehicles on road and on rail
- Big Data for mobility analytics and Mobility as a Service applications
- Cybersecurity in advanced mobility applications

3.4. Chicago City Tech Collaborative

https://www.citytech.org/

The Chicago Transit Authority (CTA) is a key member of the City Tech Collaborative in the Chicago region. The City Tech Collaborative is an urban solutions accelerator that tackles problems too big for any single sector or organization to solve alone. As a non-profit organization, their mission is to accelerate technology-enabled solutions to make cities happier, healthier, and more productive. As a member-driven consortium, City Tech combines the best tools and thinking from leading corporations, local governments, start-ups, civic and academic institutions, and community organizations. The partners' broad and deep expertise enables the understanding of complex industry trends, creates world-class collaboration, and drives

scalable market impact. City Tech and 25+ industry partners created a more seamless and frictionless transportation system with increased accessibility and reach for urban residents.

Examples of transit-related R&D conducted under the City Tech Collaborative include the following:

- **Transit Capacity Management**
  Building on CTA's existing measures to keep bus and train service timely, efficient, and safe, City Tech Collaborative, together with the CTA, Genetec, Intel, and Microsoft, developed new tools to provide real-time insights on bus occupancy across multiple vehicles. A pilot implementation on CTA's 79th street bus line allowed CTA to proactively meet route ridership demand, reduce both passenger crowding and wait times, and provide a safe, socially distanced rider experience.

- **Public Transit Lab: UIC Innovation Center**
  City Tech's partnership with the University of Illinois at Chicago's Innovation Center explored how technology can address urban mobility challenges. The collaborative effort between City Tech, UIC, Bosch, Microsoft, and HERE Technologies helped students across multiple colleges develop mobility solutions and encouraged Chicago residents to prioritize high-capacity transit systems as part of their daily journey.

- **Reducing Peak Transit Demand**
  City Tech partnered with Mastercard, CTA, Syniverse, and ideas42 to design low-cost, efficient, and consumer-friendly text message reminders to alleviate public transit congestion during peak use periods - in this case, during Chicago Cubs games.

4. FTA COVID Transit R&D Awards

https://www.transit.dot.gov/research-innovation/public-transportation-covid-19-research-demonstration-grant-program-selected

This scoping paper focused primarily on initiatives and programs created by transit agencies to encourage or support innovation or R&D, or that involved partnerships with academic, civic, or non-profit organizations to develop collaborations. However, the U.S. Federal Transit Administration (FTA) created a rather unique R&D funding program to seek innovative potential R&D-based solutions to address the challenges posed by the COVID-19 pandemic. It seemed worthwhile to include this program since it stimulated much innovative thinking among U.S. transit agencies concerning R&D and innovation, and illustrates the wide range of R&D projects proposed by transit agencies themselves. FTA awarded in January 2021 US$15.8 million to 37 projects to support strategies that develop, deploy and demonstrate solutions that improve the operational efficiency of transit agencies and enhance rider mobility during the COVID-19 public health emergency. This program had a specific focus on the following areas:

- Vehicle, facility, equipment and infrastructure cleaning and disinfection
- Exposure mitigation measures

- Innovative mobility such as contactless payments
- Measures that strengthen public confidence in transit services

The complete list of FTA COVID-19 transit R&D awards are listed in the Appendix, but the following provides some examples of the R&D projects that were awarded, many of which involved the use of ITS technologies:

- Strategies to minimize bus crowding through dynamic vehicle staging, dispatching and scheduling that will be integrated into a trip planning and crowding real-time feed
- Deployment of an on-demand microtransit service to improve transportation options for essential workers
- Comprehensive data model, including incorporating cell phone data to understand travel patterns, to drive decision-making based on travel changes pre- and post-COVID.
- Contactless payment system, allowing riders to purchase tickets and passes using mobile devices or credit cards
- Contactless, voice-activated ticket vending machines
- E-vouchers that will allow contactless payments with mobile fares as well as transportation network companies
- Use of video analytics and artificial intelligence to address COVID-19 exposures on transit vehicles via heat mapping, face mask detection and capacity management
- Testing of portable UVC light disinfectant systems
- Enhanced air filtration and purification technologies on subway cars
- Research on how COVID-19 travels by studying aerosol dispersion in transit
- Automated wheelchair securement system

5. Conclusions: Creating a Culture of Innovation

As is well known, the pandemic has had a dramatic impact on public transportation demand and operations, but as the pandemic is hopefully subsiding, transit systems are questioning themselves as to what will be the *new normal* and how to support recovery efforts. There are several important factors that will affect the future of urban mobility in general and the demand for transit and shared-use modes more specifically. Many questions exist for which no clear answers exist to date:

- To what extent has Work from Home (WFH) become a permanent feature of the post-pandemic future?
- To what extent, will WFH patterns result in permanent office real estate realignment?
- Will office-based commuting return, and if so to what extent and how?
- How much will congestion grow?
- What will be the future public / political perception of transit and how will it affect support for transit funding?
- Is the future of mobility shared?
- What will happen to major transit investments planned before the pandemic? etc.

The future of public transportation is clearly both turbulent and uncertain. What do organizations do when faced with turbulent and uncertain environments? They do not lift the drawbridge and retreat into an internal operations-driven focus! They engage with the new environment, enhance intelligence gathering, and emphasize or develop new analytic tools and flexible and responsive concepts and services! If not, they often disappear.

Public transportation organizations need to focus more on innovation, which requires risk-taking, a difficult challenge in the risk-averse public arena. Some organizations, as identified in this scoping paper, have nonetheless embarked on paths to support innovation and R&D, including: continuous monitoring of best practices in the industry, creating Chief Innovation Officer positions, reviewing the procurement process and requirements to enable more flexibility and innovative approaches; and developing collaborative relationships with academic institutions and start-up private firms.

It will be increasingly important for public transportation organizations to create a culture for innovation, and this should involve:

- A willingness to take risks and innovate
- More flexible procurement processes
- Internal processes to stimulate innovation through organizational change (e.g., creating Chief Innovation Officer post and departments).
- External partnerships with private innovating firms and university research centres; these may be stimulated through unsolicited proposal programs and/or structured Calls for Innovation or collaborative partnerships with universities:

This scoping paper offers some examples of approaches that have been developed and deployed by leading transit systems that will hopefully encourage others to invest in innovation and R&D.

6. Disclaimer

This Scoping Paper was prepared for information purposes on behalf of the Advanced Public Transit Systems Technical Committee by its Chair, Dr. Brendon Hemily. Any opinions expressed in this document are strictly those of the author, and do not reflect any position of ITS Canada.

Appendix

U.S. Federal Transit Administration Public Transportation COVID-19 Research Demonstration Grant Program Selected Projects

https://www.transit.dot.gov/research-innovation/public-transportation-covid-19-research-demonstration-grant-program-selected

AL Alabama Department of Transportation The Alabama Department of Transportation will receive funding to work with 10 transit agencies, nine of them rural, to design solutions that improve cleaning protocols, respond to and mitigate exposure and develop contactless fare payment systems to improve operations and restore public confidence during the COVID-19 public health emergency. $300,000

AR Rock Region Metropolitan Transit Authority (METRO) Rock Region Metropolitan Transit Authority in Little Rock, Arkansas, will receive funding to purchase portable UVC light disinfectant systems for use in its fleet to combat the spread of COVID-19 and help ensure a safe environment for operators and riders while strengthening public confidence in transit. $288,750

AZ City of Tucson The City of Tucson, Arizona, will receive funding to upgrade SunTran's fare payment systems to allow riders to use mobile and other touchless fare payment options and install automated wheelchair securing systems on buses to allow riders to secure themselves, reducing contact with operators and improving mobility, confidence, and independence. $600,000

CA San Francisco Municipal Transportation Agency (SFMTA) The San Francisco Municipal Transportation Agency (SFMTA) will receive funding to develop a customer information system that will include tools such as customer profiles, service planning and ridership projection models as part of a focused strategy to identify mobility needs, target market segments and develop messaging to drive up ridership, including targeted media outreach and information campaigns to rebuild confidence in public transportation. $450,000

CO City of Colorado Springs (Mountain Metropolitan Transit) The City of Colorado Springs (Mountain Metropolitan Transit) will receive funding to implement fixed-route vehicle enhancements such as automatic people counters on all vehicles, greater availability of PPE and an improved on-board air filtration system, all of which will help mitigate the risk of exposure to COVID-19 and strengthen rider confidence. $600,000

CT Connecticut Department of Transportation The Connecticut Department of Transportation will receive funding to conduct a pilot program to include testing of contactless, voice-activated ticket vending machines for seven CTrail Shoreline East (SLE) passenger rail stations in Connecticut. $450,000

DC Washington Metropolitan Area Transit Authority (WMATA) The Washington Metropolitan Area Transit Authority (WMATA) will receive funding to test and evaluate the effectiveness of enhanced air filtration and purification technologies on its subway cars as part of efforts to improve operations and restore public confidence during the COVID-19 public health emergency. $600,000

DE Delaware Transit Corporation (DTC) The Delaware Transit Corporation will receive funding to install protective barriers on part of its fixed route bus and paratransit fleet and evaluate the results on public health and operator protection as part of efforts to improve operations and restore public confidence during the COVID-19 public health emergency. $450,000

FL South Florida Regional Transportation Authority The South Florida Regional Transportation Authority, which serves Miami-Dade, Broward and Palm Beach counties, will receive funding to deploy an on-demand microtransit service to improve transportation options for essential workers in the Cypress Creek area as part of efforts to increase access to transit and provide convenient and reliable service during the COVID-19 public health emergency. $167,603

GA Georgia Department of Transportation The Georgia Department of Transportation will receive funding to develop a contactless payment system that will allow riders to pay for trips using the Internet or a

mobile app, enhancing safety, improving the rider experience and encouraging regional coordination to make transit more accessible to all Georgians during the COVID-19 public health emergency. $450,000

IA Ames Transit Agency - CyRide (City of Ames) Ames Transit Agency (CyRide), with project partners Syncromatics and Nelson Nygaard, will deploy automatic passenger counter technology throughout its bus fleet and complete an independent evaluation of the project. This technology is designed to allow potential transit riders to view the capacity of buses and strengthen rider confidence to return to transit during the COVID-19 public health emergency. $450,000

IL Rock Island County Metropolitan Mass Transit District (MetroLINK) Rock Island County Metropolitan Mass Transit District (MetroLINK) in Illinois will receive funding to develop a transit-specific cyber resilience assessment tool to understand and manage cyber risks and meet operational challenges, including cybersecurity of assets, systems and networks in response to increased risks under remote agency operations and system upgrades. $400,000

IN South Bend Public Transportation Corporation (Transpo) South Bend Public Transportation Corporation in Indiana will receive funding to implement a new, contactless payment option for riders, streamlining the boarding process and operational efficiency of each route and reducing contact between operators, riders and fareboxes, improving safety during the COVID-19 public health emergency. $122,638

KS/MO Kansas City Area Transportation Authority (KCATA) The Kansas City Area Transportation Authority in Missouri will receive funding to implement contactless, electronic fare validation to replace its current visual validation approach that requires riders to be in close proximity to the bus operator. This technology will be used on RideKC buses serving the Kansas City region and on Omnitrans buses serving San Bernardino County, California. $450,000

LA Capital Area Transit System Capital Area Transit System in Baton Rouge, Louisiana, will receive funding to support the integration of contactless bus fare payments through smart card technology via card-based or account-based fare payments, mobile phone payments, and barcoded ticketing technology, reducing contact between operators, riders and the farebox, and improving safety during the COVID-19 public health emergency. $300,000

MA Montachusett Regional Transit Authority (MART) The Montachusett Regional Transit Authority in Massachusetts will receive funding to implement a multi-provider, integrated, app-based electronic system for booking and paying for on-demand paratransit. The tool will help institutions such as healthcare providers and employers to improve managed transportation and reduce dependence on call centers, dispatch and billing. $337,500

MD Baltimore County, Maryland The Baltimore County, Maryland Department of Public Works Transportation division will receive funding to purchase and install protective shields on its CountyRide vehicles, which will enhance safety for riders and operators during the COVID-19 public health emergency. $12,096

MD Montgomery County Montgomery County, Maryland will receive funding for its Ride On transit service to provide real-time bus loading and crowding information to increase public safety and confidence and encourage social distancing during the COVID-19 public health emergency. $450,000

MI Michigan Department of Transportation The Michigan Department of Transportation will receive funding for automated wheelchair securement systems on buses at five transit agencies in rural and urban service environments throughout the state. MDOT also will deploy a smart phone app that integrates dispatching, scheduling and fare payment to lessen exposure to the COVID-19 virus and improve efficiency. $600,000

MN Minnesota Department of Transportation The Minnesota Department of Transportation will receive funding to test contactless fare payment systems to better understand the impact on passenger safety during the COVID-19 public health emergency. MnDOT will work with a University of Minnesota research team to gauge public perceptions and attitudes around safety and impacts of contactless systems. $450,000

MO Missouri Department of Transportation The Missouri Department of Transportation will receive funding to launch a statewide vanpooling program to get individuals to and from work, which will expand job

access, create safe and reliable ways to commute, and use state-of-the-art technology to help riders match and pay for fares in real time. $450,000

MP Commonwealth Office of Transit Authority The Commonwealth Office of Transit Authority in the Northern Mariana Islands will receive funding to hire a consultant to examine COTA's current bus services, resources and data, and recommend how to improve management practices while operating during a global pandemic. COTA will adopt innovative solutions that will improve access and mobility and support the re-opening of the economy in the Commonwealth. $300,000

MS Mississippi Band of Choctaw Indians (Choctaw Transit) The Mississippi Band of Choctaw Indians will receive funding to deploy innovative solutions in equipment, cleaning and disinfection supplies and contactless payments to address safety concerns for Choctaw Transit drivers, riders and administration during the COVID-19 public health emergency and to enhance mobility and access to public transportation for tribal communities. $300,000

NC City of Fayetteville The City of Fayetteville, North Carolina, will receive funding to purchase and deploy a contactless transit fare payment system that will eliminate the collection of cash for fares on board the Fayetteville Area System of Transit paratransit and fixed route bus transit system. This project is designed to enhance public safety and impove the rider experience during the COVID-19 public health emergency. $355,000

NJ New Jersey Transit Corporation New Jersey Transit will receive funding to use video analytics and artificial intelligence to address COVID-19 exposures on transit vehicles via heat mapping, face mask detection and capacity management. NJT will launch and evaluate this pilot program on the RiverLINE light rail line in South Jersey. $600,000

NV Regional Transportation Commission of Southern Nevada The Regional Transportation Commission of Southern Nevada will receive funding to install innovative contactless payment systems in its fixed route transit buses, which will improve mobility and access, and reduce the risk of COVID-19 exposure for both drivers and riders. $500,000

NY New York Metropolitan Transportation Authority (MTA) The New York Metropolitan Transportation Authority will receive funding to examine how people move and how COVID-19 travels throughout the metropolitan region by studying aerosol dispersion in transit. This project is designed to improve passenger safety and strengthen public confidence to return to mass transit during the COVID-19 public health emergency. $600,000

OH Central Ohio Transit Authority (COTA) The Central Ohio Transit Authority in Columbus will receive funding to develop a comprehensive data model, including incorporating cell phone data to understand travel patterns, to drive decision-making based on travel changes pre- and post-COVID-19. The analysis will help improve operational efficiencies and demonstrate how communities with multimodal transit networks can provide more efficient and reliable service with data-driven decision-making, especially during and after emergencies. $600,000

OR City of Portland The City of Portland, Oregon, will receive funding to improve confidence in public transportation by investing in clean, safe vehicles for its streetcars including replacing cloth seat coverings with easy-to-sanitize vinyl coverings; educating riders with new message boards at stops; and hiring public health-trained staff to ensure vehicles are properly sanitized and the system is adhering to public health guidelines to prevent the spread of COVID-19. $439,950

PA Southeastern Pennsylvania Transportation Authority (SEPTA) The Southeastern Pennsylvania Transportation Authority (SEPTA), in partnership with Drexel University, will receive funding to evaluate air ventiliation and surface cleaning in preventing the transmission of COVID-19. This project is designed to improve passenger safety and strengthen public confidence to return to mass transit during the COVID-19 public health emergency. $584,618

SC Berkeley-Charleston-Dorchester Council of Governments The Berkeley-Charleston-Dorchester Council of Governments in South Carolina will receive funding to partner with the Charleston Area Regional Transportation

Authority and TriCounty Link to develop a contactless mobile ticketing and trip planning app, which will provide the public a safe way to plan trips and pay fares on a single platform across all modes supported by multiple transportation agencies throughout the tri-county region. $575,000

TN Nashville Metropolitan Transit Authority (MTA) Nashville Metropolitan Transit Authority in Tennessee will receive funding to study how to transport large numbers of riders efficiently while ensuring safety with social distancing. The project will include strategies to minimize bus crowding through dynamic vehicle staging, dispatching and scheduling that will be integrated into a trip planning and crowding real-time feed, providing agencies and riders tools to make informed decisions that improve operations, safety, and the rider experience. $585,000

TX City of El Paso, Mass Transit Department (Sun Metro) The City of El Paso Mass Transit Department (Sun Metro) in Texas will receive funding to integrate a contactless payment system, allowing riders to purchase tickets and passes using mobile devices or credit cards. The accompanying mobile app will allow users to get real-time locations and schedules of buses. $225,000

UT Utah Transit Authority (UTA) The Utah Transit Authority will receive funding to expand its contactless payment software to include E-vouchers that will allow contactless payments with UTA mobile fares as well as transportation network companies. The project also will add a rider web portal and mobile app, providing more options for trip planning. $508,200

VA Virginia Department of Rail and Public Transportation (DRPT) The Virginia Department of Rail and Public Transportation will receive funding to develop a COVID-19 Transit Recovery Toolkit, including a comprehensive strategy handbook covering facility sanitation, exposure mitigation, contactless fare payments and policies for employee and passenger safety, long-term sanitation strategies, increasing service frequencies, reducing vehicle capacity, implementing multi-door boarding and adopting longer term zero fare policies to help transit agencies statewide, particularly those in rural areas. $247,500

VT Vermont Agency of Transportation (VTrans) The Vermont Agency of Transportation (VTrans) will receive funding to purchase and install UVC lighting units in transit vehicles and personal vehicles operated by volunteer drivers. VTrans will test the technology as a strategy to combat the spread of viruses, increase the safety of drivers and riders, and build confidence in the safety of public transportation. $581,201

WA King County Metro King County Metro in Washington will receive funding to test strategies to distribute subsidized, contactless mobile transit tickets to customers through local businesses, hospitals and community-based organizations in urban and rural areas. The project would test and document transit validation tools, fare incentive programs and best practices for including businesses in extending transit subsidies to riders to welcome them back during the COVID-19 recovery. $400,000