State Planning & Research Part II Work Program

Research, Development, & Technology Transfer Program

Program Year 2022

Original Submission, August 2021

In Cooperation with the US Department of Transportation and Federal Highway Administration

Please find attached the Program Year 2022 work program for the DDOT Research, Development, and Technology Transfer Program (SPR-B) for your review and (hopefully) approval.

As mentioned on our latest call, we are submitting the work plan initially without any new projects because we want the new university consortium up and running so they can participate in the call this year. In order to award that contract, however, we need the recurring, annual portion of the 2022 work program obligated so that we can make the required financial certifications. The scale of that financial certification was not known until quite late in the solicitation development process – we have changed the contract's structure slightly and the pricing component was among the last items settled with OCP. We have worked internally to assure that sufficient ob-lim will be available to obligate during FY2021 if we can secure your review and approval in the next month and a half.

Please let me know if you have any questions or comments. I will be on vacation the next two weeks so would ask that you copy Katie Crabb (as well as Lezlie) on any responses so she can help respond if needed

CONDITIONAL APPROVAL

For Division Administrator – FHWA DC Division

GOVERNMENT OF THE DISTRICT OF COLUMBIA
MURIEL BOWSER, MAYOR

SPR Part II Work Program

Research, Development, & Technology Transfer Program
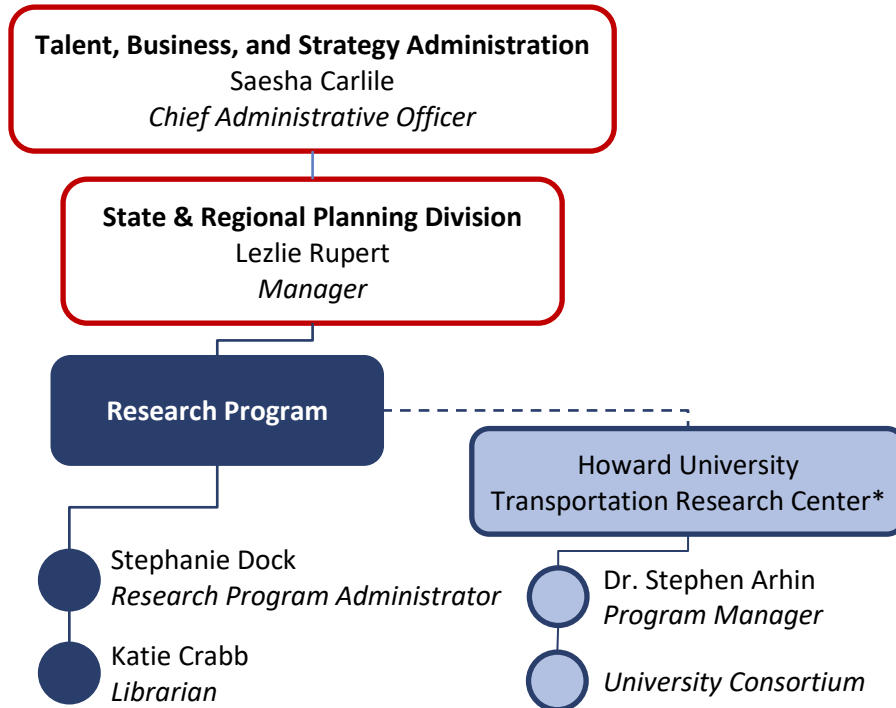
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Overview

Title 23 of the United States Code provides federal funding for state research programs by requiring that at least a minimum of ½ percent of certain federal funds apportioned to a state be used for research, development, and technology transfer (RD&T) programs. These activities involve research on new areas of knowledge, adapting findings to practical application by developing new technologies and the transfer of these technologies, including the process of dissemination, demonstration, training, and adoption of innovations by users.

This work program identifies the work to be accomplished and cost estimates by activity for the use of State Planning & Research (SPR) funds for research purposes during Program Year 2022.

Mission

The mission of the District Department of Transportation's (DDOT) Research Program is to facilitate and promote innovative transportation research, implementation, outreach, and technology transfer activities in order to improve the efficiency and effectiveness of DDOT's service delivery. To do this, the Research Program convenes and guides a structured approach to research, provides research material, and manages research projects.

Organization Chart

Talent, Business, and Strategy Administration
Saesha Carlile
Chief Administrative Officer

State & Regional Planning Division
Lezlie Rupert
Manager

Research Program

Howard University
Transportation Research Center*

Stephanie Dock
Research Program Administrator

Katie Crabb
Librarian

Dr. Stephen Arhin
Program Manager

University Consortium

*The university research management support contract is being resolicited and this lead university partner may change this year based on the outcomes of that solicitation process.

DDOT Statement of Compliance

I, Saesha Carlile, Chief Administrative Officer of the District Department of Transportation, do hereby certify that the District is in compliance with all requirements of 23 U.S.C. 505 and its implementing regulations with respect to the research, development, and technology transfer program, and contemplate no changes in statutes, regulations, or administrative procedures which would affect such compliance.

Saesha L Carlile

Saesha Carlile
Chief Administrative Officer
District Department of Transportation

Proposed Funding

Budget Overview

Work Item	Work Item Description	PY2022 Budget	Federal Portion	District Portion	Other & Prior Contributions	Expected Future Contributions	Total Cost
100	Research Program Administration and In-House Research	$267,062	$213,650	$53,412	Annual	Annual	$267,062
101	Academic and Administrative Support Services	$460,453	$368,363	$92,091	Annual	Annual	$460,453
102	Quick Response, Literature Reviews, & Pilot Support	$48,825	$39,060	$9,765	$97,650	Annual	$146,475
103	Pooled Fund Projects & Collaborative Research Efforts	$119,545	$102,836	$16,709	$289,500	$108,000	$517,045
104	Research Projects	$0	$0	$0	$1,908,995	$0	$1,908,995
	TOTAL	$895,885	$723,908	$171,977	$2,296,145	$108,000	$3,300,031

Proposed Work Item #100

I. Work Item & Division

SPR Program Year:	2022	SPR Work Item #:	100
Work Item Title:	Research Program Administration and In-House Research		
Administration/Division:	Administrative / State and Regional Planning Division		
Coordinator:	Stephanie Dock		

II. Work Item Budget

DDOT Staff Labor Expenditures:

Positions	SPR Hours	SPR Charges
Research Program Administrator	2080	$162,402
DDOT Librarian	2080	$104,660

Overall Budget

PY22 Budget[1]	Federal Portion	District Portion	Other & Prior Contributions	Expected Future Contributions	Total Cost
$267,062	$213,650	$53,412	Annual	Annual	$267,062

[1] Includes 8.5% IDCR

III. Work Item Information

Purpose and Objectives

The Research Program is responsible for developing, managing, coordinating, and implementing research activities within the agency. This work item covers program oversight activities, the conduct of in-house research, and the agency's core program contributions to the Transportation Research Board (TRB).

Description of Activities

The Research Program, with the support of the FHWA Division Office, has been working to improve programmatic fundamentals. Critical activities are:

- Finishing the close out on earlier work program federal aid projects (FAPs) as projects complete
- Continuing to revise and expand the standard operating procedures for program activities

Staff will support core program activities, namely:

- Monitoring all active research projects
- Administering the university support contract, including defining and initiating new processes per new support contract scope
- Managing the research internship program
- Managing the DDOT Library and library services, including digitizing the archives, disseminating DDOT research, and assisting external researchers seeking to use DDOT's collections

- Coordinating the TRB relationship
- Supporting agency innovation efforts through the State Transportation Innovation Council and Every Day Counts initiatives, pilot application review, and assistance with research funding applications as appropriate
- Conducting internal research, including literature reviews and market scans
- Supporting and engaging in agency data governance effort

PY2022 Deliverables
- Quarterly reports
- University support contract monitored and new processes initiated per contract scope
- Near term items from the Research Peer Exchange (Dec. 2020) Action Plan implemented or underway
- New research projects identified, obligated, and contracted
- Older federal aid projects (FAPs) closed out for program years 2015 (2015004), 2017 (2017014), 2020 (2020005), and 2021 (2021005).
- Develop policies and procedures for DDOT Library knowledge management efforts via tools such as the Wiki and the Policy Compendium
- DDOT archives digitization project continued progress with posting through the DDOT Back in Time website
- Library collection management – refine and identify funding for acquisitions plan and focus on digital publication management by collecting accessible PDF versions and refining AASHTO document access

Proposed Work Item #101

I. Work Item & Division

SPR Programl Year:	2022	SPR Work Item #:	101
Work Item Title:	Academic & Administrative Support Services		
Administration/Division:	Administrative / State and Regional Planning Division		
Coordinator:	Stephanie Dock		

II. Work Item Budget

Non-Labor Expenditures & Consultant Services

Description	Total
Administrative Support	$316,148
Peer Reviewers	$8,680
Research Internship Program	$135,625

Overall Budget

PY22 Budget[1]	Federal Portion	District Portion	Other & Prior Contributions	Expected Future Contributions	Total Cost
$460,453	$368,363	$92,091	Annual	Annual	**$460,453**

[1] Includes 8.5% IDCR

III. Work Item Information

Purpose and Objectives

The Research Program utilizes the resources of area universities to expand the program's capacity and to support transportation research at those universities.

Description of Activities

The activity for this work item is currently conducted by the Howard University Transportation Research Center (HUTRC), which leads a consortium of local universities. The contract to conduct this work was re-solicited during PY2021 and the lead university may change depending on the outcome of the competitive procurement process. The award is expected at the very beginning of PY2022 and the costs listed here are based on the government estimate prepared for that award.

Salaries for the lead university's program support staff are paid from this budget area. Where university staff members paid from this work item are engaged as Principal Investigators on research projects, those projects will be conducted at a reduced cost. University costs are assumed to include applicable overhead rates and fringe benefits for staff salaries.

Expert peer reviewers are engaged to support research projects and ensure quality products by reviewing methodology, interim deliverables, and the final report. Reviewers are offered a small stipend

in return for their time, based on the expected level of engagement. Estimate assumes 2 paid reviewers per project for 4 projects.

The internship program is administered by the lead university, which is responsible for recruitment, hiring, and payment. Intern research projects are identified throughout DDOT and intern work is overseen by agency staff. The cost estimate for the internship program is based on ten full-time interns during the summer and three part-time interns during the semester, though the exact numbers of interns will vary based on level (graduate/undergraduate), number of requests, and available budget.

PY2022 Deliverables:[1]
- Monthly meetings with DDOT Research Program staff
- Quarterly reports on performance and expenditures
- Assistance with Research Manual and standard operating procedures updates, particularly related to the new contract structure
- Annual performance and expenditure report, including Partner Academic Researcher Plan performance metrics
- Partner Academic Researcher Plan development and deployment, including identification and engagement of researchers to propose and conduct research projects
- Support for research problem statements and scopes of work development
- Management and oversight of research projects conducted under the support contract
- Technical editing of final reports
- Recruitment of and stipend payments to summer and semester interns
- Assistance with identification and engagement of peer reviewers for research projects as the projects get underway; payment of stipends as appropriate
- Annual report on implementation of research projects completed within the past 5 years.
- Evaluation design and evaluation process design support

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[1] These deliverables reflect the new contract structure; if the new contract award is substantially delayed these deliverables (and associated costs) will be delayed.

Proposed Work Item #102

I. Work Item & Division

SPR Program Year:	2022	SPR Work Item #:	102
Work Item Title:	Quick Response, Literature Reviews, & Pilot Support		
Administration/Division:	Administrative / State and Regional Planning Division		
Coordinator:	Stephanie Dock		
Position:	Research Program Administrator		

II. Work Item Budget

Non-Labor Expenditures & Consultant Services

Project #	Description	Estimated Cost PY22	Other & Prior Contributions	Expected Future Contributions	Total
TBD[1]	Quick Response Projects	$32,550	Annual	Annual	$32,550
20-QR01	Advisory Bicycle Lanes Evaluation (Phase 2)	$16,275	$10,850	$0	$27,125
21-QR01	Pilot Policy Framework	$0	$54,250	$0	$54,250
21-QR02	Bicyclists vs Right Turn Vehicles: Optimizing Design Based on Conflict Risk Data	$0	$32,550	$0	$32,550

[1] Project numbers will be assigned as quick response projects are identified to use these funds

Overall Budget

PY22 Budget[1]	Federal Portion	District Portion	Other & Prior Contributions	Expected Future Contributions	Total Cost
$48,825	$39,060	$9,765	$97,650	Annual	**$146,475**

[1] Includes 8.5% IDCR

III. Work Item Information

Purpose and Objectives

This work item funds literature review and market scan efforts that are too large to be conducted internally, supports pilot evaluation work, and sets funds aside for quick response projects to respond to requests from DDOT leadership.

Description of Activities

A portion of these funds are not programmed in advance because quick response and literature review projects are by their nature uncertain at the time of work plan development. The use of these funds requires approval from DDOT leadership (Chief Administrative Officer, DDOT Chief of Staff, or DDOT Director). Project details will be added when (and if) projects be identified and approved.

The cost estimate for this work item is based on the last several years of requests and known activities that may be in the works. On average, requests have averaged $30,000-$35,000 per year, but expenditures in years the funds are used are typically higher.

Year	# of Projects	Expenditures	Notes
2017	3	$49,600	
2018	0	$0	No work program this program year
2019	0	$0	$25,000 requested but not funded due to proximity to end of the program year and project timeline; $5,000 item discussed but not formally requested before year end
2020	1	$10,850	
2021	1	$0	$32,550 requested, not yet expended as of work plan submission

Project 20-QR01: Advisory Bicycle Lane Evaluation (Phase 2)

In October 2019, the FHWA granted DDOT permission for a trial of the advisory bike lane pattern on five corridors in the Capitol Hill area of the District of Columbia. This experiment is aimed at determining the effectiveness of the new advisory bike lanes that are to be installed on five corridors in the Capitol Hill area in the District of Columbia. The experiment will consist of an evaluation process to observe bicyclists' and motorists' behavior along the subject streets before and after the application of the experimental devices. A survey to assess bicyclists' sense of safety along with motorists' understanding of the purpose of the advisory bike lanes will also be included in this experiment.

Phase 1 collected before data during the fall of 2020 and an interim report was completed in Dec. 2020. This continuation funds Phase 2 of the study, including after data and the final report.

- **Manager**: Will Handsfield, Bicycle Specialist, Planning & Sustainability Division
- **Work Conducted By**: Howard University
- **Expected Date of Issuance**: November 2021
- **Planned Completion**: March 2022 (4-month project)

Project 21-QR01: Pilot Support

DDOT has initiated a new intake process for potential partners (academic, private sector, and others) seeking to pilot, demonstrate, or test emerging transportation technologies in the District of Columbia. The program is meant to bring a more structured process for identifying, selecting, and implementing pilots and demonstrations. There has been good interest from a variety of potential partners. DDOT is now at a stage where we would be ready to move forward with some pilots, but staff are finding that in several cases, the existing regulatory structure does not cover these specific activities or requires a modification to the existing regulations. This project will assist the agency in developing a pilot policy and a draft rulemaking to implement that policy.

- **Manager**: Dan Emerine, Manager, Policy & Legislative Affairs
- **Work Conducted By**: Consultant TBD
- **Expected Date of Issuance**: September 2021
- **Planned Completion**: January 2022 (5-month project)

Proposed Work Item #103

I. Work Item & Division

SPR Program Year:	2022	SPR Work Item #:	103
Work Item Title:	Pooled Funds & Collaborative Research		
Administration/Division:	Administrative / State and Regional Planning Division		
Coordinator:	Stephanie Dock		
Position:	Research Program Administrator		

II. Work Item Budget

Non-Labor Expenditures & Consultant Services

Project #	Description	Estimated Cost PY22	Other & Prior Contributions	Expected Future Contributions	Total
	Transportation Research Board Annual Dues	$83,545	Annual	Annual	$83,545
TPF-5(370)	Fostering Innovation in Pedestrian and Bicycle Transportation	$0	$100,000	$0	$100,000
TPF-5(431)	Applications of Enterprise GIS for Transportation, Guidance for a National Transportation Framework (AEGIST)[1]	$0	$100,000	$0	$100,000
TPF-5(440)	Support for Urban Mobility Analyses	$0	$50,000	$0	$50,000
TPF-5(455)	National Accessibility Evaluation Phase II Access Across America	$36,000	$36,000	$108,000	$180,000
TPF-5(467)	Research Project Tracking System	$0	$3,500	$0	$3,500

[1] These pooled fund projects are funded with SPR-A funds

Overall Budget

PY22 Budget	Federal Portion	District Portion	Other & Prior Contributions	Expected Future Contributions	Total Cost
$119,545	$102,836	$16,709	$289,500	$108,000	**$517,045**

III. Work Item Information

Purpose and Objectives

This work item covers DDOT's annual commitments to Transportation Pooled Fund (TPF) projects.

Description of Activities

Transportation Research Board Annual Dues

This item is for the District's dues to the Transportation Research Board (TRB). This amount is an estimate for the July 2021-June 2022 dues, assuming a small increase from prior years. These funds are paid to TRB directly, not via the pooled fund mechanism

- **Manager**: Stephanie Dock, Research Program Administrator, Planning & Sustainability Division

- **Work Conducted By**: Transportation Research Board

Project TPF-5(370): Fostering Innovation in Pedestrian and Bicycle Transportation

The overall goals for this Transportation Pooled Fund (TPF) study are to: 1. Provide answers to emerging questions about innovative facility design, planning, and implementation to improve safety and mobility for pedestrians and bicyclists. 2. Conduct effective and efficient research of innovative traffic control devices to accelerate their incorporation into the Manual on Uniform Traffic Control Devices (MUTCD). 3. Facilitate the collection and reporting of robust transportation facility data that will allow for updating Federal, State, local, and other design guidelines, such as the American Association of State Highway and Transportation Officials (AASHTO) design guides. 4. Support research on addressing rural multimodal transportation needs, regulatory streamlining, opportunities to improve cost effectiveness and efficiencies in the transportation system, and multimodal investment analysis.

DDOT has participated in this study since its inception in 2017 and has contributed to 4 of the 5 years. DDOT is determining whether to contribute in 2022; the program will be updated if this project has funding added. This project is approved for 100% SPR funds and therefore no District share is included for this project.

- **Manager**: Mike Goodno, Bicycle Program Specialist, Planning & Sustainability Division
- **Lead Agency**: Federal Highway Administration

Project TPF-5(431): Applications of Enterprise GIS for Transportation, Guidance for a National Transportation Framework (AEGIST)

This pooled-fund project will assist DOTs, MPOs, and local governments create enterprise GIS data management systems based on data governance best practices that support collaboration through shared business rules and standards that support the principle of "measure once, use many times," with the goal of a single roadway dataset that meets the needs of multiple groups. The first phase of the project will develop guidance to be named, a document that will guide the Nations DOT's to one geospatial transportation standard. Once the guidance is finalized, the Pooled Fund Study will provide assistance to the participating Sates to implement the guidance.

DDOT joined this project in 2022 and is evaluating its utility and the future work plans before committing further. This project is approved for 100% SPR-A funds.

- **Manager**: James Graham, GIS and Applications Manager, Information Technology Division
- **Lead Agency:** Federal Highway Administration

Project TPF-5(440): Support for Urban Mobility Analyses

The pooled fund study scope focuses on mobility and reliability performance measures, data and issues. New emphasis areas include emerging data sources, freight movement, arterial street mobility issues, reliability performance measures, and addressing the agency challenges for FAST Act requirements. For

over 30 years, TTI's urban mobility research efforts have developed and refined a comprehensive set of performance measures and the tools to measure and monitor mobility conditions in urban America. Since 1998, the study has been a pooled fund effort involving a combination of state departments of transportation (DOTs) (currently 15), FHWA and other sponsors from metropolitan planning organizations and Transport Canada. The analysis procedures and resulting performance measures have been used in multi modal performance measurement efforts by numerous state DOTs, metropolitan planning organizations (MPOs) and in other countries.

DDOT joined this project in 2020 for the previous 2-year work plan and is evaluating its utility and the future work plans before committing further. This project is approved for 100% SPR-A funds.

- **Manager**: Kelli Raboy, ITS Manager, Traffic Engineering & Safety Division; Ting Ma, Performance Manager, Performance Management Division
- **Lead Agency**: Texas DOT

Project TPF-5(455): National Accessibility Evaluation Phase II Access Across America

This project has two main objectives. First, it will create a new, national Census block-level accessibility dataset that can be used by partners in local transportation system evaluation, performance management, planning, and research efforts. Second, it will produce and publish a series of annual reports describing accessibility to jobs by auto, transit, and biking in metropolitan areas across America. Accessibility Dataset

This is the second iteration of this pooled fund, with a new TPF number for the next 5-year period. DDOT has participated in this study since its inception in 2015. This project is approved for 100% SPR funds and therefore no District share is included for this project.

- **Manager**: Stephanie Dock, Research Program Administrator, State & Regional Planning Division
- **Lead Agency**: Minnesota DOT

Project TPF-5(467): Research Project Tracking System

Each state in the U.S. has a transportation research program. While these programs vary substantially in size, complexity, staffing level, and resource availability, there are certain needs that are generally common to all programs. One of these needs is a tracking system for active and completed research projects. The tracking system can be used for numerous functions, including (but not necessarily limited to) tracking of active projects, research implementation, work plan submissions and approvals, key project-related documents and deliverables, and reports. This study will develop common functional requirements, a software solution and maintenance of the software solution for a Research Program Tracking System to be used by multiple DOTs.

DDOT is joining Phase 1 of this study in 2021. Contributions to Phase 2, which will build the tracking system, will depend on the utility of the tool to DDOT. As Phase 1 is just getting underway, it has not

been determined whether to contribute to Phase 2 at the time of the original work plan submission. This project is approved for 100% SPR funds and therefore no District share is included for this project.

- **Manager**: Stephanie Dock, Research Program Administrator, State & Regional Planning Division
- **Lead Agency**: Kentucky Transportation Cabinet

Proposed Work Item #104

I. Work Item & Division

SPR Program Year:	2022	SPR Work Item #:	104
Work Item Title:	Research Projects		
Administration/Division:	Administrative / State and Regional Planning Division		
Coordinator:	Stephanie Dock		
Position:	Research Program Administrator		

II. Work Item Budget

Non-Labor Expenditures & Consultant Services

FAP	Project #	Description	Estimated Cost PY22	Other & Prior Contributions	Expected Future Contributions	Total
2020 (011)	20-R01	Pedestrian and Cyclist Intersection Safety Sandbox	$0	$202,819	$0	$202,819
TBD	20-R02	Full Evaluation of a Low-Income Transit Fare Pilot Program in DC[1]	$0	$1,168,933[2]	$0	$1,168,933
TBD	21-R01	Building Up Agency-Wide Automated Image Processing Capability to Inform Safety and Mobility[1]	$0	$108,500	$0	$108,500
TBD	21-R03	Identifying and Intervening with High-Risk Drivers[1]	$0	$189,875	$0	$189,875
2021 (019)	21-R04	Tax Revenue and Telecommuting	$0	$238,868	$0	$238,868

[1] At the time of work plan submission, these projects were still in the process of obligation and their FAPs and final budgets will be updated once that is complete.

[2] This project includes both prior year contributions and other (non-FHWA) funds.

Overall Budget

PY22 Budget[1]	Federal Portion	District Portion	Other & Prior Contributions	Expected Future Contributions	Total Cost
$0	$0	$0	$1,908,995	$0	**$1,908,995**

[1] Includes 8.5% IDCR

III. Work Item Information

Purpose and Objectives

This work item covers new and continuing research projects selected during the annual call for research projects.

Description of Activities

Research projects are selected through the process described in the Research Manual. A call for projects is issued annually and projects are ranked by the Research Project Selection Committee (RPSC), a group

comprised of the agency's senior leadership. Due to the timing of the award of the new university research management support contract, the call for projects will be issued during the first quarter of PY2022 and this work program amended to include those.

There are several continuing projects from prior years that do not need additional funding but are still active and thus included in the work program until they have their final reports completed.

The complete project descriptions are included in Appendix B.

Project 20-R01: Pedestrian and Cyclist Intersection Safety Sandbox – FAP 2020(011)

Intersection crossing is increasingly a challenge for distracted pedestrians, seniors, and individuals with disabilities (e.g., low vision or mobility issues). DC's Vision Zero Initiative seeks to reach zero fatalities and serious injuries to travelers of DC's transportation system, through more effective use of data, education, enforcement, and engineering. Part of both Vision Zero and DDOT's long-range transportation plan, MoveDC, is a commitment to increase pedestrian and cyclist safety at intersections.

As the Nation's Capital, DDOT receives numerous vendor pitches for emerging technology solutions. However, because of the nascent nature of these solutions, their potential benefit to the agency is often difficult to assess and, if deemed suitable, often difficult to champion toward implementation.

Toward a more strategic approach for testing applications of innovative solutions for Vision Zero, DDOT intends to implement one or more pilot or demonstration projects that use emerging technology solutions to improve pedestrian and/or cyclist safety in intersections. In technology development, the term "sandbox" is used to refer to a testing environment that allows for safe testing of new software or code before implementation in a program or serivce. Borrowing from this idea, this project will designate a "sandbox" of a single intersection or corridor within the District to be used to safely pilot new technologies

This project will implement the sandbox with several emerging solutions and evaluate the outcomes. It is expected that many of the solutions will still be in research and development phases and that this project can help to shape those products while also providing valuable lessons learned for DDOT staff.

- **Manager**: Kelli Raboy, ITS Manager, Transportation Operations & Safety Division
- **Work Conducted By**: HTNB (A&E Schedule)
- **Planned Completion**: June 2022 (18-month project)

Project 20-R02: Full Evaluation of a Low-Income Transit Fare Pilot Program in DC

Low-income households are the most likely to be burdened by the costs of using public transit, the most likely to forego using transit due to cost, and the least likely to have alternative travel options. The cost burden of transit has a number of possible negative effects on low-income Washingtonians, including inhibiting their ability to get and maintain employment, use social services, obtain healthcare, and complete educational programs. Preliminary results from a low-income fare pilot in Boston showed a

30% boost in transit use by low-income households, including trips for health-care/social services visits. In addition, a 2011 experiment in DC found that even small transit subsidies offered to the unemployed increased job search activity by 19%, especially among those living far from employment opportunities.

To learn whether and to what extent cost is a key barrier to transit equity, the DC Department of Transportation (DDOT) is partnering with The Lab @ DC, WMATA, the Department of Human Services (DHS), and the World Bank to conduct a randomized evaluation of a fully and partially subsidized Metro transit program. WMATA will create a discounted fare product that could be added to a SmarTrip card for eligible low-income individuals. DHS has committed to enroll participants from public assistance programs that already verify income and distribute income-based benefits as part of their standard business process.

In the study, participants will be randomly assigned to one of three conditions: no transit subsidy, a partially subsidized fare, and a fully subsidized fare, i.e. free unlimited trips. The project will rely partly on administrative data, which will capture the high-level impacts on the number of trips taken, jobs applied to, job trainings completed, and employment status. The acquisition and analysis of this data will be done through The Lab @ DC, World Bank, WMATA, and the grant from World Bank Abdul Latif Jameel Poverty Action Lab (JPAL) North America without funds from DDOT.

- **Manager**: Catherine Teebay, Policy Specialist, Policy and Legislative Affairs Division
- **Work Conducted By**: The Lab @ DC (Executive Office of the Mayor)
- **Expected Date of Issuance**: September 2021
- **Planned Completion**: May 2023 (18 month project, assumes January 2022 enrollment initiation)

Project 21-R01: Building Up Agency-Wide Automated Image Processing Capability to Inform Safety and Mobility – FAP TBD

DDOT frequently uses camera footage to better understand traveler behavior (e.g., around parking, lane usage, turning movements, and collisions or near misses) and existing configuration and condition of the roadway and associated infrastructure. This footage provides insight into existing patterns or conditions for future planning or design changes, provides insight into real-time conditions for operational decision making, and drives before and after analyses for assessing the impacts of a change in condition.

To date, much of the processing of this footage has been done manually, which often proves costly and inefficient, thereby limiting the degree to which DDOT is able to use camera footage. Recent advances in artificial intelligence and machine learning have the potential to speed up and improve processes for analyzing camera footage, but a consistent, agency-wide approach is needed to ensure quality of analysis, maximize utility across divisions, and minimize any duplication of effort.

This project will provide comprehensive recommendations on how DDOT can expand its use of camera footage via automated image processing to ensure all agency information needs are met. Results will directly identify actions and changes that DDOT can make to existing technology, policy, and processes to ensure quality of analysis, maximize utility across divisions, and minimize any duplication of effort.

The project will benefit the District by enhancing DDOT's ability to understand traveler behavior and roadway conditions toward better planning, design, and operational decision-making.

- **Manager**: Kelli Raboy, ITS Manager, Transportation Operations & Safety Division; James Graham, GIS Manager, Information Technology Division
- **Work Conducted By**: Consultant (A&E Schedule)
- **Expected Date of Issuance**: October 2021
- **Planned Completion**: September 2022 (12-month project)

Project 21-R03: Identifying and Intervening with High-Risk Drivers – FAP TBD

Research suggests that many dangerous drivers are simply not aware of: (1) the fact that they are driving unsafely; (2) the risk associated with their dangerous driving; and (3) how far out of the norm their dangerous driving is. Automated notifications have also been shown to increase desirable behavior and reduce undesirable behavior across many contexts, including driving. For example, in a study of teenage drivers, alerting both the teenagers and the parents of teenage drivers of risky behavior occurring in their cars can reduce risky driving. The District does something similar, by using Automated Traffic Enforcement (ATE) systems to enforce traffic safety and regulations for red light and speeding violations. ATE systems do this by automatically taking photographs of the rear of the vehicle and its license plate if the driver violates regulations, then sends a citation and fine to the registered vehicle owner's address. However, these are *reactive* measures towards reducing risky driving behavior. Our study proposes to build upon this system further by targeting proactive measures to risky drivers to reduce crashes.

DDOT and The Lab will collaborate to design the modeling and intervention for this project. There are two key components to the intervention:

1. analysis of data from the District's ATE systems and MPD crash data, to predict a driver's likelihood of being involved in a crash
2. proactive intervention(s) to reduce risky behavior for drivers likely to be involved in a crash

The Lab @ DC will complete the analysis (#1) with existing staff time and resources. DDOT will fund the costs associated with proactive interventions (#2).

- **Manager**: Linda Bailey, Vision Zero Director, Vision Zero Division
- **Work Conducted By**: The Lab @ DC
- **Expected Date of Issuance**: September 2021
- **Planned Completion**: September 2023 (24-month project)

Project 21-R04: Tax Revenue and Telecommuting – FAP 2021(019)

According to the D.C. Tax Facts, the motor fuel tax in 2000 was reported to be $32.65 million dollars and was drastically decreased to $25.1 million dollars in 2017. Transportation infrastructure is costly to build and even costlier to maintain; in 2017, *The Condition of the District's Roadways* reported that the actual

expenditure on the District roadways was 4.5 times higher than the FY 2010-2014 average. Concurrently, the adoption of electric and hybrid vehicles and decreases in road trips due to the transition to telecommuting and eCommerce, especially with the onset of the COVID-19 pandemic, are significantly influencing transportation revenue generation from gasoline taxes. This will become a serious challenge for infrastructure asset management in the near future.

The main objective of this research is to investigate the most influential parameters and possible scenarios affecting the District's Highway Trust Fund revenues due to increased telecommuting and changes in commute mode in order to propose a multi-criteria decision-making model for transportation tax revenue generation.

- **Manager**: Lezlie Rupert, Manager, State and Regional Planning Division; Kyle Scott, Resource Allocation Manager, Resource Allocation Division ; Sam Brooks, Program Analyst, State and Regional Planning Division
- **Work Conducted By**: Morgan State University
- **Planned Completion**: December 2023 (18-month project)

Appendix A. Regulatory Compliance Checklist

REGULATION REQUIREMENT	23 CFR 420 Section	DDOT Compliance
The Program must be implemented in compliance with its approved work program.	117, 205	x
Annual approval of State DOT Research and Development Work Program.	111, 115, 209	x
Documentation that describes the State DOT's management process and the procedures for selecting and implementing RD&T activities must be developed by the State DOT and submitted to the FHWA Division office for approval. Significant changes in the management process must be submitted by the State DOT to the FHWA for approval.	115, 209	Updated and in review with FHWA
Periodic reviews of the State DOT's Management Process of the RD&T.	209	x
The State DOT's RD&T work program must, as a minimum, consist of a description of RD&T activities to be accomplished during the program period, estimated costs for each eligible activity, and a description of any cooperative activities including the State DOT's participation in any transportation pooled fund studies and the NCHRP. The State DOT's work program should include a list of the major items with a cost estimate for each item. The work program should also include any study funded under a previous work program until final report has been completed for the study.	207	x
The State DOT's RD&T work program must include financial summaries showing the funding levels and share (Federal, State, and other sources) for RD&T activities for the program year.	207	x
The State must use an interactive process for identification and prioritization of RD&T activities for inclusion in an RD&T work program.	209 (a)(1)	x
The State must use all FHWA planning and research funds set aside for RD&T activities to the maximum extent possible.	209 (a)(2)	x
The State must have procedures for tracking program activities, schedule, accomplishments, and fiscal commitments	209 (a)(3)	x
The State must use support and use of the TRID database for program development, reporting, and input of the final report information.	209 (a)(4)	x
The State must have procedures to determine the effectiveness of the State DOT's management process in implementing the RD&T program, to determine the utilization of the State DOT's RD&T outputs, and to facilitate peer exchanges of its RD&T Program on a periodic basis	209 (a)(5)	x
The State must have procedures for documenting RD&T activities through the preparation of final reports. As a minimum the documentation must include the data collected, analyses performed, conclusions, and recommendation. The State DOT must actively implement appropriate research findings and should document benefits.	209 (a)(6)	x
The State must participate in peer exchanges of its RD&T management process and other State DOTs' programs on a periodic basis. Note: FHWA has guidance defining "period" as at least once every 5 years for a minimum of 2-3 days.	209 (a)(7)	x

REGULATION REQUIREMENT	23 CFR 420 Section	DDOT Compliance
The State DOT must include a certification that it is in full compliance with the requirements of this subpart in each RD&T work program. Note: the language to be used for this certification is specified in the regulation.	209	x
Suitable reports that document the results of activities performed with FHWA planning and research funds must be prepared by the State DOT or subrecipient and submitted for approval by the FHWA Division Administrator prior to publication. The FHWA Division Administrator may waive this requirement for prior approval.	117 (e)	x
The FHWA's approval of reports constitutes acceptance of such reports as evidence of work performed but does not imply endorsement of a report's findings or recommendations. Reports prepared for FHWA-funded work must include appropriate credit references and disclaimer statements.	117 (e)	x
The State DOT must administer the RD&T program consistent with their overall efforts to implement section 1001(b) of The Transportation Equity Act for the 21st Century and 49 CFR part 26 regarding disadvantaged business enterprises.	121 (c)	x
The nondiscrimination provisions of 23 CFR 200 etc. with respect to Title VI of the Civil Rights Act of 1964 and the Civil Rights Restoration Act of 1987 apply to all programs and activities of recipients, subrecipients, and contractors receiving FHWA research funds, whether or not those programs or activities are federally funded.	121 (h)	x
Procedures for the procurement of property and services with FHWA research funds must be in accordance with 49 CFR and/or other applicable regulations.	121 (j)	x
(A) Costs are eligible for FHWA participation provided that the costs: 1) are for work performed for activities eligible under the Section of title 23 applicable to the class of funds, 2) are verifiable from the State DOT's or the subrecipient's records, 3) are necessary and reasonable for the proper and efficient to accomplish of project objectives and meet the other criteria for allowable costs in the applicable cost principles, 4) are included in the approved budget or amendments thereto, 5) were not incurred prior to FHWA authorization, and (B) indirect costs are allowable if supported by a cost allocation plan and indirect cost proposal prepared, submitted, and approved as required	113	x
The State DOT must submit performance and expenditure reports, including a report from each subrecipient that contain as a minimum: (i) Comparison of actual performance with established goals; (ii) Progress in meeting schedules; (iii) Status of expenditures in a format compatible with the work program, including a comparison of budgeted (approved) amounts and actual costs incurred; (iv) cost overruns or underfunds; (v) approved work program revisions; and (vi) other pertinent supporting data.	117 (b)	x

Appendix B: Project Descriptions

Pedestrian and Cyclist Intersection Safety Sandbox (20-R01, FAP2020011)

ISSUE

Intersection crossing is increasingly a challenge for distracted pedestrians, seniors, and individuals with disabilities (e.g., low vision or mobility issues). Nationally, 5,376 pedestrians died in crashes in 2015, a 9.4% increase from the previous year. DC's Vision Zero Initiative seeks to reach zero fatalities and serious injuries to travelers of DC's transportation system, through more effective use of data, education, enforcement, and engineering. Part of both Vision Zero and DDOT's long-range transportation plan, MoveDC, is a commitment to increase pedestrian and cyclist safety at intersections.

As the Nation's Capital, DDOT receives numerous vendor pitches for emerging technology solutions. However, because of the nascent nature of these solutions, their potential benefit to the agency is often difficult to assess and, if deemed suitable, often difficult to champion toward implementation.

Given these issues, a more strategic approach for testing applications of innovative solutions for Vision Zero is needed.

BACKGROUND AND EXISTING KNOWLEDGE

A preliminary version of this proposal was submitted and accepted during the 2017 Call for Research Projects process, but ultimately did not move forward due to lack of funding. At that time the technical team worked extensively with the research team to expand and refine the scope, review literature on existing technologies, and develop an RFI and RFQ for solicitation. These materials have been shared with members of the Sustainable Transportation Branch, the Associate Director for Transportation Operations and Safety, and the former lead on Vision Zero.

SCOPE OF WORK

The research is intended to implement a sandbox for one or more pilot or demonstration projects that use emerging technology solutions to improve pedestrian and/or cyclist safety in intersections. The sandbox would encompass a single intersection or corridor within the District. Envisioned solutions include:

- Technology that enhances DDOT's situational awareness of intersection activity to inform safety improvements
- Technology that provides auditory or visual alerts for pedestrians, cyclists, and/or drivers approaching crosswalks based on real-time activity in the intersection

The research would fund a consultant to facilitate the program management and evaluation of this sandbox project. The primary tasks for the consultant would be to assist DDOT in finding an appropriate mix of vendors, facilitate pilots and provide incentive funds to help cover vendor pilot costs (using funds from project budget), and evaluate the pilots.

More detailed scopes of work for both the 1) program management and evaluation support and 2) the RFI intended to identify vendors interested in participating in the sandbox have been provided as separate attachments to this submission.

POTENTIAL BENEFITS AND IMPLEMENTATION

The research would result in implementation and evaluation of one or more pilot or demonstrations of emerging technology for pedestrian and/or cyclist safety in intersections. The implementation and

evaluation would further provide insight into the feasibility and usability of these technologies, thereby enabling DDOT to make more informed decisions on whether to pursue a full-scale implementation. Ultimately, this research would improve safety outcomes for pedestrians and cyclists in the District.

Additionally, as this would be the first instance of DDOT's use of a sandbox approach for procurement and evaluation of emerging technology solutions, it could be used as a model for future sandbox projects to address a variety of DDOT needs.

Full Evaluation of a Low-Income Transit Fare Pilot Program In DC (20-R02)

ISSUE
Low-income households are the most likely to be burdened by the costs of using public transit, the most likely to forego using transit due to cost, and the least likely to have alternative travel options. WMATA's ridership data shows us that:
- Over 65% of highest income rail customers receive a transit subsidy through employer-sponsored programs, compared to only 10% of DC's lowest income rail customers (Nelson et al. 2007).
- Low-income riders are more likely to spend more per month by purchasing individual rides rather than paying upfront for a discounted monthly pass.
- Low-income riders comprise 52% percent of DC's bus ridership, compared with 13% of rail ridership, which is likely due to the higher cost of rail trips, among other factors.

BACKGROUND
The cost burden of transit has a number of possible negative effects on low-income Washingtonians, including inhibiting their ability to get and maintain employment, use social services, obtain healthcare, and complete educational programs. Preliminary results from a low-income fare pilot in Boston show that low-income households receiving a discounted fare take about 30% more trips, including more health care/social service trips (Rosenblum et al. 2019). In addition, a 2011 experiment in DC found that even small transit subsidies offered to the unemployed increased job search activity by 19%, especially among those living far from employment opportunities (Phillips 2014).

These examples show initial changes in transit trips and job search, but there exists little evidence on the broader effects of subsidized fares on other measures of welfare and the implications for poverty and inequality in the US generally or DC in particular. Nationally, many jurisdictions are adopting transit fare subsidies for low-income riders but are doing so without first piloting them for feasibility, impact, and cost-effectiveness. Though some government programs and nonprofits provide transit subsidies, there is no universally-available fare product for low-income residents in DC.

SCOPE OF WORK
Objective: To learn whether and to what extent cost is a key barrier to transit equity, the DC Department of Transportation (DDOT) is partnering with The Lab @ DC, WMATA, the Department of Human Services (DHS), and the World Bank to conduct a randomized evaluation of a fully and partially subsidized Metro transit program. Can a subsidized fare program for low-income residents increase (1) mobility through greater usage of public transit and (2) other measures of social and economic well-being?

Research approach: This grant will allow us to expand the scope and improve the quality of data collected in an evaluation that is already in the planning stages. In the study, participants will be randomly assigned to one of three conditions: no transit subsidy, a partially subsidized fare, and a fully subsidized fare, i.e. free unlimited trips.

WMATA will create a discounted fare product that could be added to a SmarTrip card for eligible low-income individuals. DHS has committed to enroll participants from public assistance programs that already verify income and distribute income-based benefits as part of their standard business process. The project will rely partly on administrative data, which will capture the high-level impacts on the number of trips taken, jobs applied to, and job trainings completed, and employment status. The acquisition and analysis of this data will be done through The Lab @ DC, World Bank, WMATA, and the grant from JPAL North America without funds from this grant.

This grant will support this rigorous evaluation through (1) primary data collection on mobility and well-being outcomes and (2) data quality assurance for SmarTrip administrative data.
1. The primary data collection will provide vital data on outcomes not captured accurately or entirely by administrative data, allowing us to examine the effect of additional trips have on the quality of life of participants.
2. The accuracy of our administrative data relies on participants using the SmarTrip card registered to them in the study. To incentivize participants to keep and continue using those cards, we plan to regularly deposit a small amount of value onto the cards.

POTENTIAL BENEFITS AND IMPLEMENTATION
Outcomes: Our primary outcome of interest is mobility, measured by number of trips. We will also look at changes in trip length, total travel time, average travel time per trip, number of transfers, and mode used to explore the kinds of tradeoffs people are making to cost, travel time, and trip efficiency. In addition to mobility, we want to understand what else is affected when transit trips become less expensive. Measures of social and economic well-being would include job search activity, number of hours worked, job retention, trip purpose, engagement with DHS, and fare compliance.

Benefits to the District: At scale, the subsidy would represent a multimillion dollar annual investment from the District. While the number of trips taken will be an important outcome captured in administrative data, the additional data collection will capture a full picture of how lives change (or do not) when barriers to transit are lessened. The accuracy and completeness of the data collected will be vital to determining if a free or subsidized fare is worthwhile for the District. Measuring a wider scope outcomes during a pilot will also allow us to respond to inquiries from Council and the community at large about the potential benefits of improved transit equity.

Building Up Agency-Wide Automated Image Processing Capability to Inform Safety and Mobility (21-R01)

ISSUE
DDOT frequently uses camera footage to better understand traveler behavior (e.g., around parking, lane usage, turning movements, and collisions or near misses) and existing configuration and condition of the roadway and associated infrastructure. This footage provides insight into existing patterns or conditions

for future planning or design changes, provides insight into real-time conditions for operational decision making, and drives before and after analyses for assessing the impacts of a change in condition.

To date, much of the processing of this footage has been done manually, which often proves costly and inefficient, thereby limiting the degree to which DDOT is able to use camera footage. Recent advances in artificial intelligence and machine learning have the potential to speed up and improve processes for analyzing camera footage, but a consistent, agency-wide approach is needed to ensure quality of analysis, maximize utility across divisions, and minimize any duplication of effort.

BACKGROUND AND EXISTING KNOWLEDGE

There have been a number of efforts to bring machine learning to image processing for transportation purposes at DDOT and in the industry more broadly.

- Sensity, now owned by Verizon, installed cameras in the PA2040 area and the parkDC Penn Quarter/Chinatown area that did image processing to detect when parking spaces are occupied. The processing was done "on the edge" (as part of a processors attached to the camera), rather than transmitting the images back. The technology requires its own cameras that are integrated into streetlights.
- George Washington University, as part of the GigabitDCx competition run by OCTO, developed a platform to which anyone could submit a timelapse or full motion video and have it processed to do vehicle, bike, and pedestrian counts. GWU has developed this technology further, but the crowdsourced platform has not advanced further.
- Conduent has used machine learning to process data from our time lapse cameras to better understanding parking patterns
- Microsoft and Esri engaged DDOT to use existing traffic cameras to track vehicular counts and near misses. Work with Esri is ongoing but did not continue with Microsoft due to constraints around camera movements.
- Several other vendors (e.g., Miovision) have reached out with possible applications, but these have not gone beyond initial pitches or exploration

Other areas are also in development. The Massachusetts Department of Transportation recently completed a research project that relied on mobile LiDAR and automated processing to detect pedestrian and ADA features along state highways.[2]

SCOPE OF WORK

The primary objective of this project is to build up DDOT's automated image processing capability. This will be achieved through a series of tasks:

- Assessment of use cases and needs via internal stakeholder outreach
- Market research on available tools and technologies, including use cases, implementations to date, required supportive technologies and processes, and validation and verification
- Identification of existing gaps in supportive technologies and processes (e.g., installation and data storage)
- Comprehensive recommendations on next steps for standing up a consolidated program that can effectively and efficiently support need for automated image processing agency wide.

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[2] Ai, Chengbo and Qing Hou, "Improving Pedestrian Infratructure Inventory in Massachusetts Using Mobile LiDAR" September 2019, https://www.mass.gov/doc/improving-pedestrian-infrastructure-inventory-in-massachusetts-using-mobile-lidar-1/download

Potential use cases include, but are not limited to: vehicle trajectories, object and count detection, near misses Near misses, trajectories, object and count detection parking occupancy detection; vehicle, freight, cyclist, pedestrian counts and turning movements; collision and near miss detection; pavement and sidewalk condition; lane and signal configuration; sign and pole inventory.

POTENTIAL BENEFITS AND IMPLEMENTATION

This project will provide comprehensive recommendations on how DDOT can expand its use of camera footage via automated image processing to ensure all agency information needs are met. Results will directly identify actions and changes that DDOT can make to existing technology, policy, and processes to ensure quality of analysis, maximize utility across divisions, and minimize any duplication of effort. The project will benefit the District by enhancing DDOT's ability to understand traveler behavior and roadway conditions toward better planning, design, and operational decision-making.

Identifying and Intervening with High-Risk Drivers (21-R03)

ISSUE

Every year there are dozens of recorded driving-related fatalities, thousands of traffic crashes, and hundreds of thousands of driving violations (speeding and dangerous driving) in the District. With 27 traffic fatalities in 2019 and 209 crashes resulting in injuries to date in 2020, we are far from the District's goals of achieving zero traffic fatalities by 2024.

DDOT, DMV, MPD, and The Lab @ DC in OCA are working together on this project to identify drivers at high risk of being involved in a serious crash and to test proactive interventions to these high-risk drivers.

BACKGROUND AND EXISTING KNOWLEDGE

A joint study (not yet published) conducted by the New York City Department of Transportation (NYC DOT) and the University of Chicago (UChicago) analyzing traffic violations and crash data found that those with repeat speeding and red-light violations were more likely to have subsequent crashes. Researchers from this study found that repeat offenders are 30% more likely to be involved in a serious traffic crash.[3] Another (internal and not publicly available) driver behavior study conducted by the University of Chicago for the Chicago Department of Transportation found that previous citations and crashes can predict subsequent crash risk. Their preliminary results found that drivers with at least two tickets in the past three months and at least three tickets in the past 2.5 years are 3 times more likely to be involved in a crash in the following year. A different study found that a small share of drivers (5%) were responsible for 35% of crashes in Louisiana (Das et al, 2015).

Research suggests that many dangerous drivers are simply not aware of: (1) the fact that they are driving unsafely; (2) the risk associated with their dangerous driving; and (3) how far out of the norm their dangerous driving is.[4] Automated notifications have also been shown to increase desirable behavior and reduce undesirable behavior across many contexts, including driving. For example, in a study of teenage drivers, alerting both the teenagers and the parents of teenage drivers of risky

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[3] NYC DOT study has not been made public yet.
[4] Leonard Evans, Traffic Safety (2004).

behavior occurring in their cars can reduce risky driving.[5] The District does something similar, by using Automated Traffic Enforcement (ATE) systems to enforce traffic safety and regulations for red light and speeding violations. ATE systems do this by automatically taking photographs of the rear of the vehicle and its license plate if the driver violates regulations, then sends a citation and fine to the registered vehicle owner's address. However, these are *reactive* measures towards reducing risky driving behavior. Our study proposes to build upon this system further by targeting proactive measures to risky drivers to reduce crashes.

SCOPE OF WORK

DDOT and The Lab will collaborate to design the modeling and intervention for this project. There are two key components to the intervention:

1. analysis of data from the District's ATE systems and MPD crash data, to predict a driver's likelihood of being involved in a crash

2. proactive intervention(s) to reduce risky behavior for drivers likely to be involved in a crash

The Lab @ DC will complete the analysis (#1) with existing staff time and resources. This proposal is intended to fund the costs associated with proactive interventions (#2).

Predictive Model

Our model will use regression and machine learning methods to predict the likelihood that a driver will be involved in a crash in the next year. The goals of our model are to use the model predictors (e.g., features describing the people involved in a crash and/or receive a citation, features of the vehicles involved, locations, weather conditions, time of day, season) to (1) develop risk levels of being involved in a crash and (2) to develop "profiles" of risky drivers to target our proactive interventions. We also plan to evaluate whether the impact of an intervention varies with a driver's predicted probabilities of being involved in a crash.

Interventions

In partnership with The Lab @ DC, DDOT will use the model's predictions to target proactive interventions to risky drivers. While we do not know yet what intervention will be the most effective in changing drivers' behaviors, we'll bring a behavioral and evidence lens to the messaging, for instance, some examples could be:

- **Loss-aversion.** "Your household is at risk of losing your vehicle -- and very possibly a life -- due to risky driving. The [make and model] has been cited __ times for dangerous driving, putting you at risk of losing your car insurance and your car, and placing the driver at high risk of an accident. Don't lose your family member or your car -- determine who is driving dangerously and remind them to drive safely."
- **Social norms & Pluralistic ignorance.** "The vast majority of drivers are safe, but someone in your household is driving very dangerously. Your vehicle is in the top __% for riskiest driving in the District. Save the lives of your family members and others on the road. " [some evidence-based advice]

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[5] Simons-Morton et al, *The Effect on Teenage Risky Driving of Feedback From a Safety Monitoring System: A Randomized Controlled Trial.* Journal of Adolescent Health 53 (2013).

- **Social Influence.** "You can reduce the risk of [losing your vehicle / being in an accident] by making sure that everyone in your household knows the rules of the road, including speed limits and how to change lanes safely."
- **Identity-affirmation.** "Your vehicle is in the top ___% for riskiest driving in the District. As the vehicle owner, you control what happens next. You are uniquely capable of reducing driving-related risks in your vehicle. Take action! ... "

We will prioritize at least one such intervention for rigorous testing based on feedback from experts, user-testing, and feasibility of random assignment.

Experimental Design

The evaluation design for this project will depend, in part, on the intervention(s) designed. Broadly, we intend to use a randomized controlled trial to evaluate the impact of an intervention on the number of speeding and red-light violations in the District.

POTENTIAL BENEFITS AND IMPLEMENTATION

Outcomes: Our primary outcome of interest is the level of traffic violation levels, measured by the number of drivers with repeat red-light and speeding violations. We expect to see fewer red-light and speeding infractions for drivers in the treatment group, i.e. those receiving the intervention (notification that they are a risky driver) compared to their baseline level compared to those who do not receive the intervention.

How Results could be Implemented: If we see statistically significant results after evaluating the effectiveness of the intervention, The Lab will work with DDOT to deploy the model so that DDOT can use the predictions and send notifications to all drivers who are predicted to be at high risk.

Benefits to the District: In addition to helping the District reduce the level of traffic injuries and fatalities by encouraging safer driving behaviors, this project would benefit the District by moving us closer to our Vision Zero goals of reaching zero traffic fatalities by 2024.

Tax Revenue and Telecommuting (21-R01, FAP 2021019)

ISSUE
The District of Columbia has 1,057 miles of federal and local roadways with 21.6% in poor and 25.3% in fair conditions, and 244 bridges of which 12% are reported as structurally deficient. Concurrently, the adoption of electric and hybrid vehicles and decreases in road trips due to the transition to telecommuting and eCommerce, especially with the onset of the COVID-19 pandemic, are significantly influencing transportation revenue generation from gasoline taxes. This will become a serious challenge for infrastructure asset management in the near future.

BACKGROUND AND EXISTING KNOWLEDGE
According to the D.C. Tax Facts, the motor fuel tax in 2000 was reported to be $32.65 million dollars and was drastically decreased to $25.1 million dollars in 2017. Transportation infrastructure is costly to build and even costlier to maintain; in 2010 the federal government spent approximately $4 billion was spent on the construction of new highways and bridges while $19 billion was spent on maintenance of existing highways and bridges. In 2017, *The Condition of the District's Roadways* reported that the actual expenditure on the District roadways was 4.5 times higher than the FY 2010-2014 average.

SCOPE OF WORK

The main objective of this research is to investigate the most influential parameters and possible scenarios affecting the District's Highway Trust Fund revenues due to increased telecommuting and changes in commute mode in order to propose a multi-criteria decision-making model for transportation tax revenue generation. Within the research plan, several activities are embedded into the six (6) proposed tasks, resulting in the development of a tax revenue generation model. The six proposed tasks are:

Task 1: Literature Review

In this task a comprehensive literature review will be conducted on the effects of transitioning to telecommuting and related factors such as fuel efficiency, electric and hybrid vehicles, fuel prices, and eCommerce on transportation tax revenue generation. District transportation expenditures in the last 20 years will also be studied.

Task 2: Analyze Current Transportation Tax Revenue Models

DC's transportation expenses include the costs required to operate and maintain the current transportation system, and to expand services and infrastructure as needed. Due to inflation, real revenue value has decreased. In addition, higher vehicle fuel efficiency has further worsened revenue generation (Puro, 2013). To address the deficiency of the current funding scheme, this task will analyze the current transportation tax revenue model and the variables affecting it in the District. See Figure 1.
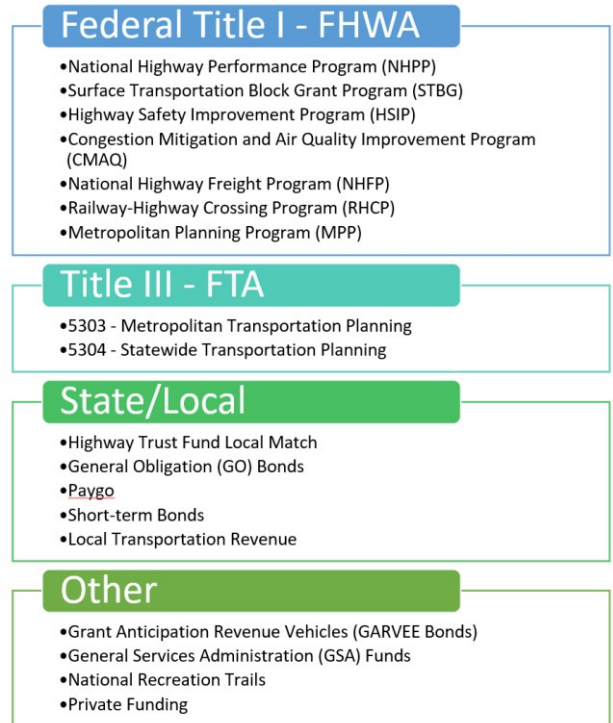
Federal Title I - FHWA
- National Highway Performance Program (NHPP)
- Surface Transportation Block Grant Program (STBG)
- Highway Safety Improvement Program (HSIP)
- Congestion Mitigation and Air Quality Improvement Program (CMAQ)
- National Highway Freight Program (NHFP)
- Railway-Highway Crossing Program (RHCP)
- Metropolitan Planning Program (MPP)

Title III - FTA
- 5303 - Metropolitan Transportation Planning
- 5304 - Statewide Transportation Planning

State/Local
- Highway Trust Fund Local Match
- General Obligation (GO) Bonds
- Paygo
- Short-term Bonds
- Local Transportation Revenue

Other
- Grant Anticipation Revenue Vehicles (GARVEE Bonds)
- General Services Administration (GSA) Funds
- National Recreation Trails
- Private Funding

Figure 1. DDOT Funding Sources

Task 3: Investigate the Impact of Telecommuting on Transportation Tax Revenue and Expenditures

The number of remote workers nationally has increased by 159% since 2005 (USDOT, 2017). Although previous reports estimated that only a third of jobs can be done entirely from home, up to half of American workers are now working from home due to the COVID-19 pandemic. This has more than doubled the portion of people who worked from home in 2017-2018 (Guyot & Sawhill, 2020). In this task, the impact of the rapid transition to telecommuting on daily travel patterns and consequently on District transportation tax revenue generation will be investigated.

Task 4: Perform a Comprehensive Survey Study on the Transition from Commuting to Telecommuting

According to an EV Adoption (2019) report, the US electric vehicle market share will increase from 3.04% in 2020 to 17.65% in 2028. Moreover, US ecommerce sales have increased by 136.7% since 2008 and are expected to grow by 30% by 2022. A comprehensive questionnaire will be designed and widely distributed to a large group of participants (+200) in order to collect data related to willingness to telecommute rather than travel for job and leisure purposes, purchasing a hybrid/electric vehicle, online shopping, as well as willingness to pay taxes for state and federal services provided.

Task 5: Conduct Sensitivity Analyses

In addition to recent rapid transitions to telecommuting, other factors influencing the transportation tax revenue generation, will be analyzed, see Figure 2, to develop projection models of future revenue. After identifying the main influential factors, a sensitivity analysis will be conducted for each variable to estimate its effects on revenues. Given the high uncertainty about most of these parameters, the sensitivity analysis will focus on realistically estimating transportation tax revenue generation. Subsequently, a parametric study will be conducted to analyze the correlations and interrelation between the most influential factors and transportation tax revenue generation.

Task 6: Analyze Data, Develop Model, and Evaluate Alternatives

Using the data generated from Task 3 through Task 5, along with the data extracted from current sources in Task 2, a model will be developed to predict future transportation tax revenue generation in the next 10 years and propose alternative strategies for the District to bridge the gap between the revenue lost and expenditures. These
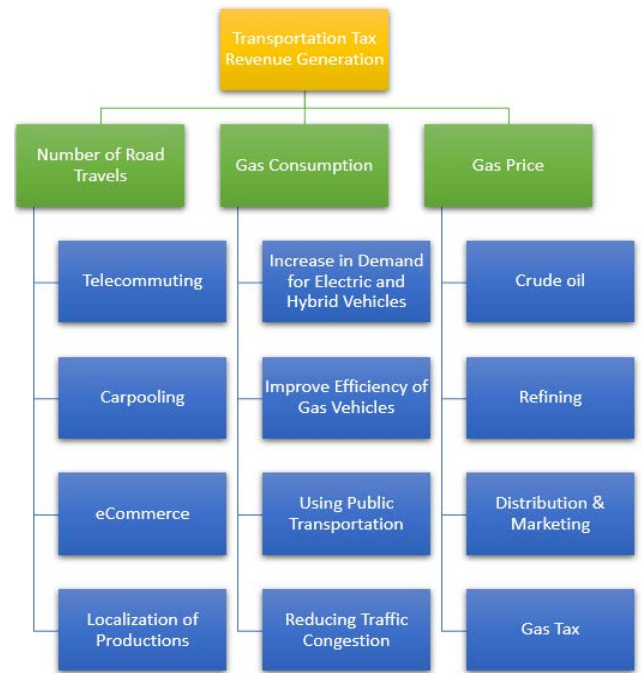

Figure 2. Main components of transportation tax revenue generation

strategies will be the result of the sensitivity analysis and a series of what-if analyses of possible future scenarios to draw conclusions regarding models and effective policies for funding future transportation needs.

Task 7: Prepare Reports Including Recommendations for Implementation

An interim report to DDOT will be prepared after nine (9) months of project work which will document progress on Tasks 1-4. The final report after 18 (18) months of project work will document the methods used and findings obtained in this project. It will include recommendations for implementing the products of this study, including specific alternatives for matching transportation revenues to the needs of transportation agencies.

POTENTIAL BENEFITS AND IMPLEMENTATION

It is expected that by identifying the main variables and analyzing the possible scenarios affecting the transportation tax revenue due to the transition to telecommuting, as well as conducting the sensitivity and parametric analyses, the proposed model will aid policy makers in predicting transportation tax revenues and making decisions on alternatives for bridging the revenue gap.