2022
State Planning and Research Program I

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SPR I Part A

Office of Transportation Planning

David Mohler, Executive Director	**Steve Woelfel**, Deputy Executive Director	**Bob Frey**, Director of Project-Oriented Planning	**Ethan Britland**, Manager of Multimodal Planning	Peter Sutton
				Makaela Niles
				Vacant (to be filled)
			Lionel Lucien, Manager of Public Private Development	Vacant (to be filled)
		Kevin Lopes, Director of GIS Services		David Dinocco
				Michael McGill
				Jose Simo
				Argenis Sosa
				Manny Zotos
				Sudip Paudel
				Charles Major
			Derek Krevat, Manager of MPO Activities	Derek Shooster
				Chris Klem
				Vacant (to be filled)
			Jules Williams, Manager of Sustainable Transportation	Shannon Greenwell
				Max Natanagara
				Vacant (to be filled)
			Hongyan (Lily) Oliver, Manager of Research	Nicholas Zavolas
				Patrick McMahon
				Michael Flanary
				Drew Pflaumer
			Caroline Vanasse, Manager of Transit Planning	Doug Johnson
				Vacant (to be filled)
		Liz Williams, Director of Data and Policy		
		Michelle Ho, Director of Capital Planning	**Maria Ramirez**, Manager of Administration	
				Susan Reppucci

Highway Division

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<tr><td rowspan="32">Jonathan Gulliver,
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Acting Deputy Administrator and Chief Engineer</td><td rowspan="8">Jack Moran,
Deputy Chief Engineer for Performance and Asset Management</td><td rowspan="8">Ed Naras,
Pavement Management Engineer</td><td>Patrick Lawlor</td></tr>
<tr><td>Cody Holemo</td></tr>
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<tr><td rowspan="10">John Bechard,
Deputy Chief Engineer for Project Delivery</td><td rowspan="10">John Anthony,
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<tr><td>Jeffrey Bruce</td></tr>
<tr><td>Mehdi Sadjady</td></tr>
<tr><td>Leo Scanlan</td></tr>
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<tr><td>Brian Knowles</td></tr>
<tr><td rowspan="14">Neil Boudreau,
Assistant Administrator for Traffic and Safety</td><td colspan="2" rowspan="14">Carrie McInerney,
Manager of Advanced Transportation Technology</td><td>Charles Young</td></tr>
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Administration

A.1 / Administration and SPR Coordination

Task lead: Maria Ramirez

Task purpose and need: To supervise and direct planning and research staff and projects to maximize State Planning and Research (SPR) funding. The administrative staff includes the Executive Director, Deputy Executive Director, Director of Project-Oriented Planning, Director of Strategic Planning (vacant), Director of Data and Policy, Director of Capital Planning and Manager of Administration, and one administrative support staff. The administrative staff oversees all fiscal and administrative activities of the following units:

- Capital Planning
- GIS Services
- MPO Activities
- Multimodal Planning
- Public-Private Development
- Sustainable Transportation
- Research
- Transit Planning

Guidance is also provided to the following units of the MassDOT Highway Division that are authorized for SPR reimbursement: Pavement Management, Statewide Traffic Data Collection, Traffic Crash Records and Safety Management, and Survey.

- Development and implementation of Standard Operating Procedure(s) for Billing and Project Closeout Review
  - This subtask will involve the development of one or more standard operating procedures (SOP) addressing billing and project closeouts with the intent of both avoiding improper payments and developing consistency with project and contract closeouts.
  - MassDOT's Office of Transportation Planning's administration staff will create an internal working group that will coordinate with FHWA on the development and implementation of draft SOP(s).

Consultant supported subtasks: None

Accomplishments in prior year:

Developed standard operating procedures for billing, project closeouts and new project/contract awards and funding to ensure proper billing and consistency with project and contract awards/closeouts.

Proposed activities for this year:

- SPR I and II administration, including required reporting, amendments, and scope and contract approvals by FHWA.
- Submit SPR I and II deliverables to FHWA.

- Continue onboarding several OTP staff to fill vacancies.
- Internal working group to continue coordination with FHWA on billing, project closeouts and new contracts/awards consistent with SOP.

Anticipated products:

- All activities, tasks, and deliverables identified for completion within FFY 2022.
- Finalization of project closeout documentation and Standard Operating Procedure(s) addressing billing and contract closeouts and new contract/project awards.

Estimated task completion: September 2022
Estimated task budget: $1,163,098.00

Staff salaries and benefits: $709,357.00

MassDOT staff members	% time to task
David Mohler	100%
Stephen Woelfel	100%
Bob Frey	50%
Michelle Ho	40%
Elizabeth Williams	50%
Kevin Lopes	50%
Maria Ramirez	100%
Susan Repucci	100%
Contracted Student Intern	100%
Contracted Student Intern	100%

Other costs: $453,741

American Association of State Highway and Transportation Officials (AASHTO) Annual Membership: $48,000
AASHTO Technical Services: $199,000
Transportation Research Board (TRB) (State Contribution to TRB Core Programs): $89,741
Miscellaneous administrative expenses: $10,000
Northeast Association of State Transportation Officials (NASTO): $2,000
Newspaper ads for public meetings/announcements: $8,000
The Eastern Transportation Coalition: $92,000
Office supplies: $5,000

Capital Planning

A.2 / Capital Planning Development and Coordination

Task lead: Michelle Ho

Task purpose and need: This task is necessary for the development and process improvements of the annual Capital Investment Plan (CIP) for MassDOT and the MBTA. Work under this task will involve the production of the state fiscal year (SFY) 2023-2027 CIP, a fiscally constrained document that includes all of MassDOT's capital investments across all Divisions as well as investments for MassDOT's Enterprise services. In building this plan, staff will work with each MassDOT Division and the MBTA to identify and prioritize projects for funding over this five-year period. Additionally, public input will be solicited following the procedures established in MassDOT's Public Participation Plan.

The SFY2023-2027 CIP will be a full reset plan for the next five years. It will incorporate trends and changing demands on our transportation system because of changes in travel patterns associated with COVID.

With input and guidance from the Secretary, Administrators, and the General Manager, the Divisions and the MBTA will revisit goals, strategic objectives, and priorities for the next five years in developing a new capital plan for MassDOT and the MBTA. The new CIP will be informed by the effort that is simultaneously being undertaken for the development of the long-range state transportation plan.
The 2023-2027 CIP will continue to incorporate process improvements for the planning cycle, including enhancements to the model used to track project information and costs; incorporation of objectives from asset management and strategic plans (e.g. the Transit and Transportation Asset Management Plans, Rail Plan, Focus 40, Rail Vision, Freight Plan); refinements to project scoring methodologies; incorporation of more detailed equity analyses; incorporation of sustainability and resiliency investment considerations in program sizing and project evaluations; and an increased focus on engaging traditionally underrepresented groups during public participation processes.

Accomplishments in prior year:

- Produced the SFY 2022 Capital Investment Plan entirely virtual given the ongoing challenges related to COVID. Because of the continued uncertainty at both MassDOT and the MBTA with revenues available (federal and state) a decision was made to develop a one-year CIP for SFY 2022. As with the SFY 2021 CIP, all public outreach activities were accomplished virtually.
- Utilized on-call consultant support from Cambridge Systematics (CS) under SPR Task A.16, "On-Call Contracts," to develop and maintain the project universe of all projects programmed in the CIP. All projects programmed in the 2022-2026 STIP were incorporated into the CIP. Worked with CS to add additional functionality to the project universe to align with new requests from the Executive Office for Administration and Finance (ANF) to allocate our projects and requested funding into Tier 1 (base case), Tier 2 (new programs/projects reflected in the Governor's original transportation bond bill

(TBB) of July 2019), and Tier 3 (new programs/projects proposed for funding by MassDOT/MBTA that were not in the TBB or base case).
- Continue to advocate and advance project scoring improvements in the areas of economic impact, resiliency, and sustainability.
- Refined reporting templates for the Massachusetts Executive Office of Administration and Finance (ANF) that pull from the project universe and are used to submit the MassDOT CIP by ANF Plan Item, CIP program and funding. Worked with CS to add additional functionality to the project universe to align with new requests from the Executive Office for Administration and Finance (ANF) to allocate our projects and requested funding into Tier 1 (base case), Tier 2 (new programs/projects reflected in the Governor's original transportation bond bill (TBB) of July 2019), and Tier 3 (new programs/projects proposed for funding by MassDOT/MBTA that were not in the TBB).
- Updated our crosswalk with CIP funding categories to reflect new sources (e.g., new grant anticipation notes - Next Gen GANs - for the Highway bridge program) that align with the Commonwealth's accounting system (MMARS) to facilitate reporting on capital spending.
- Refined the new online CIP story map and utilized the "Tableau" software tool to create graphics for the story map directly from the project universe to incorporate new funding sources and information.
- Continued to improve the functionality and usability of the CIP online comment tool to enhance its search capability and created an interface to the Public Involvement Management Application (PIMA) tool to enhance analytical capabilities.
- Developed a program that automated the equity analysis process to minimize the manual data analysis required and to align with the mapped investments in the project universe.

Proposed activities for this year:
- Coordinate the development of the SFY 2023-2027 Capital Investment Plan.
- Continue to implement improvements to streamline the CIP development process and minimize the amount of manual inputs and analyses. Initiate the development of the CIP sooner (commence in July 2021).
- Ensure alignment with the development of the STIP and the long-range state transportation plan

Anticipated products:
- SFY 2023-2027 Capital Investment Plan.
- Capital planning improvements to governance; milestone establishment; scoring and investment evaluation; alignment with multimodal planning and performance targets/metrics; and CIP/STIP alignment.

Estimated task completion: September 2022
Estimated task budget: $89,808.00

Staff salaries and benefits: $89,808.00

MassDOT staff members	% time to task
Michelle Ho	60%

Other costs: $0

Geospatial Technology

A.3 / GIS Coordination

Task lead: Kevin Lopes

Task purpose and need: To work closely with each MassDOT Division; other state agencies, including MassGIS; municipalities; and regional agencies, including Metropolitan Planning Organizations (MPOs), to continually improve the delivery of GIS data and applications for all GIS customers, ensuring better information and project delivery through a variety of systems and technologies. Work under this task will also involve participating in and contributing to the specialized coordination required to integrate OTP's GIS tools and platforms into agency-wide asset management inventories and processes. We will also represent MassDOT at various state, regional and national GIS user groups.

Accomplishments in prior year:

- Continued ongoing GIS coordination through a variety of correspondence and meetings.
- Completed the first draft of the MBTA MaPIT workflow.
- Began working with the Highway Division on an As-Built reporting mechanism to update the Road Inventory more efficiently.
- Continued outreach with municipalities to develop partnerships and help maintain road and asset data.

Proposed activities for this year:

- All coordination activities performed in FFY 2021 are intended to continue throughout FFY 2022. The level of coordination needed will vary throughout the year, based on particular issues or efforts to support all GIS tasks.
- Continue to work with the Rail & Transit Division on connecting with the Grants Plus database.
- Continue working with the MBTA to incorporate their projects into the MaPIT application.

Anticipated products:

- Various products may be initiated through coordination with MassDOT Divisions or municipal and regional governments.

Estimated task completion: Ongoing
Estimated task budget: $183,193.00

Staff salaries and benefits: $183,193.00

MassDOT staff members	% time to task
Kevin Lopes	100%
Jose Simo	70%

Other costs: $0

A.4 / GIS Platform Development

Task lead: Kevin Lopes

Task purpose and need: To support the use of geographic information systems (GIS) for all MassDOT, MBTA, Metropolitan Planning Organization (MPO) and municipal staff. Also, to ensure that there is continuous access to the GeoDOT platform, that users are able to work with all applications, and that GIS technology is kept current and operating efficiently with updated and reliable tools introduced throughout the year.

Consultant supported subtasks:

- PMG: eSTIP Enhancement
- ESRI MaPIT Development
- CDM Smith: Highway Route Log Enhancements
- Location Service Data Transit Modeling Tool: TBD

Accomplishments in prior year:

- Provided a variety of support services to the MassDOT Divisions and municipalities including relevant applications for various agency staff.
- Completed eSTIP design for the Transit Division with implementation coming in 2022.
- Completed another phase of the Highway Project Intake tool (MaPIT) for MassDOT staff, municipalities and MPOs to create projects and developed a new municipal dashboard.
- Developed the Massachusetts Mobility Dashboard.
- Developed the VMT Viewer for public use.
- Continued providing training and support to various business units throughout MassDOT, MBTA and various municipalities.

Proposed activities for this year:

- The MaPIT application will be updated to include other project types (including for Rail & Transit Division, Aeronautics Division, and MBTA projects).
- Enhancement of the eSTIP will continue this year to include transit projects and information.
- Enhancements to the Highway Route Log.
- Update the Road and Bicycle Inventory Report application.
- Development and maintenance of GeoDOT, our GIS portal, will continue.
- Websites will be created and updated as necessary.
- New applications will continue to be developed throughout the year.
- Existing applications will be updated and improved as necessary.
- Continued cloud hosting of our GIS platform.
- Scope and develop Location Service Data Transit Modeling tool

Anticipated products:

- Various applications, web sites and web maps are expected to be created.

Estimated task completion: Ongoing

Timeline for new consultant support: PMG: eSTIP Enhancement

- Consultant Name: PMG
- Scope development and FHWA review/approval: July 2021
- Consultant procurement and selection: N/A
- Contract negotiations and FHWA review/approval: August 2021
- Consultant notice to proceed: October 2021
- Total duration of task: 14 Months

Timeline for new consultant support: ESRI MaPIT Development

- Consultant Name: ESRI
- Scope development and FHWA review/approval: July 2021
- Consultant procurement and selection: N/A
- Contract negotiations and FHWA review/approval: August 2021
- Consultant notice to proceed: October 2021
- Total duration of task: 12 Months

Timeline for new consultant support: CDM Smith: Highway Route Log Enhancements

- Consultant Name: CDM Smith
- Scope development and FHWA review/approval: July 2021
- Consultant procurement and selection: N/A
- Contract negotiations and FHWA review/approval: August 2021
- Consultant notice to proceed: October 2021
- Total duration of task: 15 Months

Timeline for new consultant support: Location Service Data Transit Modeling Tool

- Consultant Name: TBD
- Scope development and FHWA review/approval: January 2022
- Consultant procurement and selection: TBD
- Contract negotiations and FHWA review/approval: TBD
- Consultant notice to proceed: TBD
- Total duration of task: February 2023
- Please note that spending on other SPR I projects and tasks will be tracked throughout the year and may be adjusted to accommodate funding for this tool. MassDOT does not anticipate increasing the overall SPR amount.

Estimated task budget: $3,215,891.00

Staff salaries and benefits: $274,518.00

MassDOT staff members	% time to task
Menelaos Zotos	100%
Michael McGill	90%
Sosa Argenis	90%
Charles Major	25%
Jose Simo	20%

Consultant costs: $1,234,073

Subtask / contract #	Total cost:	Spending Pre-FFY 2022:	FFY 2022 spending:	Post FFY 2022 spending:	Consultant/Post -Contractor Name	Consultant NTP	Contract End Date
PMG: eSTIP Enhancement / 110641	$824,073	$490,000	$134,073	$200,000	PMG	October 2021	September 30 2022
ESRI MaPIT Development / 110122	$2,836,134	$1,236,134	$800,000	$800,000	ESRI	October 2021	September 30 2022
CDM Smith: Highway Route Log Enhancements / 85243	$503,332	$103,332	$300,000	$100,000	CDM Smith	October 2021	September 30 2022
Location Service Data Transit Modeling Tool	TBD	$0	TBD	TBD	TBD	TBD	TBD

Other costs: $1,707,300

$700 for annual Intuilabs maintenance.
$1,600 for annual GeoJobe maintenance.
$4,500 for annual Intersection Manager maintenance.
$5,000 for annual search engine subscriptions for research program.
$8,000 for annual SalesForce maintenance.
$8,500 for annual Tableau maintenance.
$10,000 for annual GeoCortex maintenance
$18,000 for annual Wrike maintenance.
$20,000 for PMG Maintenance
$28,000 for annual TransCAD maintenance.
$30,000 for annual Pictometry maintenance.
$40,000 for 1Spatial Maintenance.
$50,000 for Hardware/software purchases.
$68,000 for Voyager Search software license.
$100,000 for Conveyal software licenses and support.
$330,000 for annual ROK Technologies for AWS Cloud Hosting.
$985,000 for annual ESRI Enterprise Agreement.

A.5 / GIS Services

Task lead: Kevin Lopes

Task purpose and need: To provide a wide variety of standard and customized maps in support of MassDOT's operations and customers, maintain annual reports and catalogs, as well as provide post-production support and miscellaneous graphic design.

Accomplishments in prior year:

- The GIS Services staff continued to provide a wide variety of standard and customized maps for many internal and external customers on an ongoing basis.
- Staff responded to over 300 map and data requests.
- Map and data catalogs were maintained and updated on schedule.
- Miscellaneous graphics support tasks performed frequently including new GeoDOT home page design.

Proposed activities for this year:

- All standard and recurring mapping and data provision activities performed in 2021 are intended to continue throughout 2022, as well as responding to specialized map and data requests as needed.
- We will continue to improve our map library and increase access to our data resources and improve provision of transportation information to a larger audience.

Anticipated products:

- GIS Maps.
- Map Catalog.
- Miscellaneous Reports.

Estimated task completion: Ongoing
Estimated task budget: $25,644.00

Staff salaries and benefits: $25,644.00

MassDOT staff members	% time to task
Michael McGill	10%
Sosa Argenis	10%
Jose Simo	10%

Other costs: $0

A.6 / Highway Performance Monitoring System (HPMS)

Task lead: Kevin Lopes

Task purpose and need: To update and maintain the Highway Performance Monitoring System (HPMS) data files in order to comply with Federal Highway Administration (FHWA) reporting requirements for the National Highway System (NHS) and the Surface Transportation Block Grant Program (STBG) route mileage, system condition and performance, vehicle-miles of travel, highway functional classification, and administrative jurisdiction.

Accomplishments in prior year:

- The Certified Public Road Mileage of 2020 was sent to FHWA on April 1, 2021, with an updated letter from Governor Charlie Baker authorizing the Secretary of Transportation to approve public roadway mileage.
- The 2020 Interstate submittal was uploaded to the FHWA web site on April 13th, 2021.
- 2020 HPMS full submittal was uploaded to the FHWA web site on June 15, 2021.

Proposed activities for this year:

- All activities performed in FFY 2021 are intended to continue throughout FFY 2022, with any additional FHWA requirements added to the process as needed.
- We are participating in the AEGIST Pooled Fund Study
- This year we intend to submit the complete HPMS Submittal by April 15th.

Anticipated products:

2021 Certification of Public Road Mileage - April 1, 2022.
2021 HPMS Submittal - April 15, 2022.

Estimated task completion: Ongoing
Estimated task budget: $65,548.00

Staff salaries and benefits: $65,548.00

MassDOT staff members	% time to task
David DiNocco	50%
Sudip Paudel	25%

Other costs: $0

A.7 / Inventory Data Management

Task lead: Kevin Lopes

Task purpose and need: To provide MassDOT Divisions, other state agencies, municipalities and our public customers with comprehensive data and database management, as well as ensure that all users can access needed data efficiently. We will also provide data and spatial analysis where needed.

Accomplishments in prior year:

- Performed a variety of data management tasks and projects that support MassDOT Divisions, including many spatial databases.
- Several analysis projects were completed including the CIP Equity Analysis.
- Made significant updates to our Bicycle Inventory dataset.
- Created automatic unique IDs for several Highway Assets datasets.
- Support Stormwater Asset Inventory collection and will incorporate into the GeoDOT platform.
- Several attributes were completely reviewed and updated including Pedestrian Facilities.

Proposed activities for this year:

- Data management tasks and projects performed in FFY 2021 are intended to continue throughout FFY 2022.
- MIRE Data Elements will be incorporated into the data model including Interchange type and several others.
- A Roads and Highways event layer with be auto generated from the Regional GTFS feeds.
- Develop a new Rail Inventory LRS.
- New data development tasks will increase as we enhance our data portfolio.
- Data Quality Control standards will continue to be developed and implemented.
- Metadata standards will continue to be implemented.

Anticipated products:

- New data products and analysis will be completed this year.

Estimated task completion: Ongoing
Estimated task budget: $155,683.00

Staff salaries and benefits: $155,683.00

MassDOT staff members	% time to task
Sudip Paudel	75%
Charles Major	75%
David DiNocco	50%

Other costs: $0

A.8 / Travel Forecasting, Data Collection and Transportation System Performance

Task lead: Bob Frey

Task purpose and need: To measure and forecast statewide travel and measure transportation system performance to meet federal and state planning requirements and provide decision-makers with information to help guide current and future transportation policies and investments. This task has two major components: Travel Data Analyses and Socioeconomic Projections.

- Travel Data Analyses: Daily and historical travel data are collected and analyzed to measure and monitor performance, conditions, changes and trends in travel patterns, mode use, person movement, behavior and preferences.
- Socioeconomic Projections: Changes in population, employment, housing, land use, and development patterns and trends are examined and projected for their effects on the transportation landscape. Periodic full-scale updates are performed to help inform development of state and regional transportation plans.

Both of these components are recurring, ongoing activities that help to provide the latest planning assumptions by incorporating updated data collection methods, surveys, and projections.

Consultant supported subtasks: Travel Data Analyses Socioeconomic Projections

Accomplishments in prior year:

- Implemented the second year of a three-year MassDOT-wide contract providing historical and real-time traffic data through the Eastern Transportation Coalition's Vehicle Probe Project (VPPII). The contractor is the University of Maryland's agent for the Coalition, CATT Lab, which provides automated data sharing and analyses through the Regional Integrated Transportation Information System (RITIS) platform. Combined with INRIX travel data, RITIS enables MassDOT to measure and monitor performance, communicate information, and support numerous planning, operations, and research activities.
- Performed various activities related to the statewide travel demand model including data requests and coordination of updates.

Proposed activities for this year:

- Continue analyses of real-time and historical travel data through the VPPII, including measuring and monitoring system performance and supporting planning, operations, and research activities.
- Continue work with MAPC, the Massachusetts Executive Office of Energy & Environmental Affairs (EOEEA), sub-consultants and regional planning agencies to produce Year 2050 socioeconomic projections consistent with multiple land-use scenarios and at a detailed level incorporating anticipated development to help inform future long range transportation planning efforts (on the state and regional levels).

- Continue data work and coordination of activities related to the statewide travel demand model.
- Funding participation and review of expanded RITIS products for State DOTs (a pooled fund effort coordinated through The Eastern Transportation Coalition (TETC).

Anticipated products:

- Travel patterns, travel time and movement, mobility data and performance reports (including detailed analysis components in transportation studies).
- Population, household, and employment projections for the Year 2050, for base, low, and high growth scenarios.
- Data provision to internal and external customers and coordination of travel demand modeling activities.
- Miscellaneous reports.
- Expanded and improved RITIS reports and applications for travel data analyses.

Estimated task completion: Ongoing

Timeline for new consultant support: Travel Data Analyses

- Consultant Name: UMD CATT Lab
- Scope development and FHWA review/approval: March 2019
- Consultant procurement and selection: March 2019
- Contract negotiations and FHWA review/approval: April 2019
- Consultant notice to proceed: June 2019
- Total duration of task: 36 months

Timeline for new consultant support: Travel Data Analyses

- Consultant Name: UMD CATT Lab
- Scope development and FHWA review/approval: August 2021
- Consultant procurement and selection: September 2021
- Contract negotiations and FHWA review/approval: September 2021
- Consultant notice to proceed: October 2021
- Total duration of task: 8 months

Timeline for new consultant support: Travel Data Analyses

- Consultant Name: UMD CATT Lab
- Scope development and FHWA review/approval: January 2022
- Consultant procurement and selection: February 2022
- Contract negotiations and FHWA review/approval: March 2022
- Consultant notice to proceed: June 2022
- Total duration of task: 36 months

Timeline for new consultant support: Socioeconomic Projections

- Consultant Name: MAPC
- Scope development and FHWA review/approval: September 2019
- Consultant procurement and selection: October 2019
- Contract negotiations and FHWA review/approval: November 2020*
- Consultant notice to proceed: October 2019
- Total duration of task: 36 Months

Timeline for new consultant support: Socioeconomic Projections

- Consultant Name: MAPC
- Scope development and FHWA review/approval: August 2021
- Consultant procurement and selection: August 2021
- Contract negotiations and FHWA review/approval: September 2021
- Consultant notice to proceed: October 2021
- Total duration of task: 24 months

Timeline for new consultant support: Socioeconomic Projections

- Consultant Name: UMDI
- Scope development and FHWA review/approval: August 2021
- Consultant procurement and selection: August 2021
- Contract negotiations and FHWA review/approval: September 2021
- Consultant notice to proceed: October 2021
- Total duration of task: 24 months

Estimated task budget: $1,795,896.00

Staff salaries and benefits: $54,939.00

MassDOT staff members	% time to task
Bob Frey	50%

Consultant costs: $1,735,957

Subtask / contract #	Total cost:	Pre-FFY 2022:	FFY 2022:	Post-FFY 2022:	Consultant/ Contractor Name:	Consultant NTP:	Contract end date:
Travel Data Analyses / 107885	$3,464,187	$2,562,230	$901,957	$0	UMD CATT Lab	June 2019	May 30 2022
Travel Data Analyses / 107885 Amendment	$375,000	$0	$375,000	$0	UMD CATT Lab	October 2021	May 30 2022
Travel Data Analyses / TBD	$3,700,000	$0	$200,000	$3,500,000	UMD CATT Lab	June 2022	May 30 2025
Socioeconomic Projections / 109453	$134,000	$105,000	$29,000	$0	MAPC	October 2019	Sept 30 2022
Socioeconomic Projections / TBD	$200,000	$0	$130,000	$70,000	MAPC	October 2021	Sept 30 2023
Socioeconomic Projections / TBD (ISA)	$230,000	$0	$100,000	$130,000	UMDI	October 2021	Sept 30 2023

Consultant notes:
*Note on contract 109453 with MAPC: Although FHWA did not participate in this contract in FFY 2020, MassDOT retroactively sought and gained FHWA approval for the inclusion of this contract in the FFY 2021 SPR Work Program. FHWA has participated in this contract since October 1, 2020.
*Est. $75,000 for expanded RITIS Products for State DOTs (a pooled fund effort coordinated through TETC, part of 107885 amendment)

Other costs: $5,000 (for CTPP products and surveys, a pooled fund effort through the U.S. Census Bureau)

MPO Activities

A.9 / Implementation of Federal Programs and Regulations

Task lead: Derek Krevat

Task purpose and need: Activities under this task will include the administration of the following discrete federal programs: Congestion Mitigation Air Quality Improvement Program (CMAQ), Federal Lands Access Program (FLAP), Scenic Byways, and Title VI strategies and compliance. This task will also include the administration of the Safe Routes to School (SRTS) education and infrastructure programs.

Accomplishments in prior year:

- CMAQ was administered successfully with three consultation committee meetings held and a full program of projects was identified for the State Transportation Improvement Program (STIP).
- FLAP was administered successfully with the obligation of federal funds for previously identified projects.
- The SRTS infrastructure program redesign was implemented and seven additional projects were awarded for programming in the 2022-2026 STIP. A process for a new project solicitation in FFY 2022 has been developed.
- Three Scenic Byways received national designation as part of the National Scenic Byway Program, and MPO Activities staff continued to support regional partners' efforts to acquire land, preserve historic sites, and promote byways.

Proposed activities for this year:

- Distribute CMAQ analysis spreadsheets to each metropolitan planning organization (MPO) for their use in determining proposed CMAQ-funded projects' emissions reductions.
- Hold CMAQ Consultation Committee meetings.
- Compile notes from the CMAQ Consultation Committee meeting(s) and record new CMAQ-eligible projects.
- Complete annual CMAQ report submission to FHWA through the UPACS system.
- Work with the Eastern Federal Lands Highway Division (EFLHD) to coordinate activities related to FLAP project solicitation and selection.
- Work with the Office of Diversity and Civil Rights (ODCR) on delivery of the Title VI reports from the MPOs.
- Continue to have a SRTS educational program focus on growing the number of participating schools, especially in underserved communities (staff and consultant).
- Continue to improve the SRTS infrastructure program and undertake a new project solicitation to fill the current FFY 2026 placeholder in the STIP.
- Host and/or lead SRTS pedestrian and bicycle events (e.g., walk/bike to school, safety trainings, etc.).

- Support MassDOT's Highway Division in the design and construction of SRTS infrastructure projects that have been initiated and approved through the MassDOT Highway Division's Project Review Committee (PRC).
- Oversee all activities that are part of contract 108522 (Statewide Safe Routes to School Program) with AECOM, which is funded using Transportation Alternatives Program (TAP) funding.
- Grant application assistance and coordination for any new Scenic Byway funding that becomes available.
- Coordinate all Ferry Boat Program (FBP) activities.

Anticipated products:
- The determination of CMAQ-eligible projects.
- The programming of new SRTS infrastructure projects.
- SRTS education and infrastructure program implementation.
- MPO Title VI Reports.
- Programming of awarded FLAP projects in coordination with the Eastern Federal Lands Highway Division (EFLHD).

Estimated task completion: September 2022
Estimated task budget: $48,984.00

Staff salaries and benefits: $48,984.00

MassDOT staff members	% time to task
Derek Krevat	20%
Vacant (to be filled)	5%
Derek Shooster	20%
Gus Norrbom	20%
Wesley Lickus	20%

Other costs: $0

A.10 / Metropolitan Planning Support and Oversight

Task lead: Derek Krevat (temporary)

Task purpose and need: Activities under this task include liaisons assisting in the development and oversight of MPO 3C certification documents such as Regional Transportation Plans (RTPs), Transportation Improvement Programs (TIPs), and Unified Planning Work Programs (UPWPs), and coordination and oversight of MPO planning deliverables through their respective UPWPs. Additionally, MPO liaisons will assist regional partners with target setting activities for required federal performance measures. MPO Activities staff will also assist with planning and corridor studies as needed. Regional planning co-ops will assist with this task as needed.

Accomplishments in prior year:

- All thirteen regions within the Commonwealth drafted and endorsed UPWPs and TIPs that were submitted to federal partners for approval.
- Multiple amendments to TIPs and UPWPs were drafted and endorsed across all the MPOs, requiring oversight and administration by the MPO Activities Group.
- All thirteen regions adopted statewide safety performance measures, as required by the Federal Highway Administration (FHWA) for Calendar Year (CY) 2021.
- The Cape Rail Study was completed.
- Various memoranda of understanding (MOUs) were developed and endorsed by applicable stakeholders.
- Managed contracts for regional programs and projects.
- Participated in federal certification reviews.

Proposed activities for this year:

- All thirteen regions within the Commonwealth will draft and endorse 3C documents, including UPWPs and TIPs.
- The MPO Activities group will coordinate the setting of Federal Highway Administration
- (FHWA) performance targets for Calendar Year (CY) 2022 safety measures (PM1); revisit
  Federal Fiscal Year (FFY) 2022 National Highway System (NHS) measures (PM2) and FFY 2022 Congestion, Emissions and Freight measures (PM3) with each of the thirteen regions.
- MPO liaisons will work with their respective MPO partners to ensure the development of these 3C documents according to schedule.
- MPO liaisons will also work with their respective MPO staffs to continue the delivery of planning activities programmed within UPWPs and look towards ways of improving the utility and quality of MPO staff-produced planning products.
- Participation in federal certification review process as needed.
- Participation in state and regional planning studies and working groups as needed.
- Manage contracts for regional programs and projects when necessary.

- Regional planning co-op participation in various tasks to assist other groups across OTP with a focus on sustainable transportation.

Anticipated products:

- Most activities are ongoing throughout the year; TIPs and UPWPs will be developed by summer 2022 with approval by reviewing partners before the start of FFY 2023.

Estimated task completion: September 2022
Estimated task budget: $103,756.00

Staff salaries and benefits: $103,756.00

MassDOT staff members	% time to task
Derek Krevat	35%
Vacant (to be filled)	55%
Derek Shooster	30%
Gus Norrbom	20%
Wesley Lickus	20%

Other costs: $0

A.11 / State Transportation Improvement Program Coordination and Capital Planning Support

Task lead: Derek Shooster

Task purpose and need: Work under this task involves supporting the development of the annual Capital Investment Plan (CIP) update (see "Capital Planning Coordination," for more details) and leading the development of the Federal Fiscal Year (FFY) 2023 - 2027 State Transportation Improvement Program (STIP) update. Work also includes the oversight and internal/external coordination of an electronic STIP (eSTIP) application (see "GIS Support Services" for more details). The STIP is a financially constrained document that contains a listing of all federally funded transportation projects in the Commonwealth of Massachusetts. It is a combined effort among MassDOT, Metropolitan Planning Organizations (MPOs, Regional Transit Authorities, and a number of state agencies that work to design and build highways and transit projects.

Accomplishments in prior year:

- Coordinated the maintenance of the FFY 2021-2025 STIP.
- Produced the FFY 2022-2026 STIP.
- Supported the production of the SFY 2022 CIP Update.
- Continued to implement the electronic STIP (eSTIP) application and initiated a work task with consultant, PMG, and the Rail and Transit Division to begin incorporating transit projects into eSTIP.
- Assisted with the coordination and programming of special federal-aid sources.

Proposed activities for this year:

- Support the State Fiscal Year (SFY) 2023-2027 CIP and associated mapping, analysis, and public engagement activities.
- Lead the development of the FFY 2023-2027 STIP.
- Coordinate the maintenance of the FFY 2022-2026 STIP.
- Coordinate the development and implementation of an eSTIP for the FFY 2023-2027 STIP (see "GIS Support Services" task for more details).
- Assist with the coordination and programming of special federal-aid sources.
- Continue incorporating transit projects into eSTIP.
- Serve as the Project Champion for the research project, "Measuring Accessibility to Improve Public Health" (see SPR II for more details) and assist with other CIP process improvements.

Anticipated products:

- FFY 2023-2027 STIP.
- eSTIP application process improvements.
- SFY 2023-2027 CIP.

Estimated task completion: September 2022
Estimated task budget: $73,707.00

Staff salaries and benefits: $73,707.00

MassDOT staff members	% time to task
Derek Shooster	40%
Vacant (to be filled)	20%
Derek Krevat	20%
Gus Norrbom	20%
Wesley Lickus	20%

Other costs: $0

A.12 / Statewide Long Range Transportation Plan

Task lead: Derek Krevat

Task purpose and need: The last statewide long range transportation plan, We Move Massachusetts was completed in 2014 with a planning horizon of 2040. Subsequently, the Commission on the Future of Transportation in the Commonwealth, created by Governor Baker's Executive Order No. 579, developed "Choices for Stewardship: Recommendations to Meet the Future of Transportation" (the Commission report) in 2019 to identify potential scenarios and strategies for MassDOT and the Commonwealth as a whole to undertake to better position the Commonwealth for those potential scenarios.

The Massachusetts Statewide Long-Range Transportation Plan (the Plan) will incorporate changes in strategy since We Move Massachusetts; lessons learned from the Commission report; and long-range visions from MassDOT's state, regional, and local partners. The Plan will provide recommendations for MassDOT to implement to meet the needs of the Commonwealth through the year 2050. The Plan is intended to be a "high-level" document that - in consultation with the public and MassDOT's partners - defines a long-term vision for transportation in the Commonwealth, lays out goals to meet that vision, and reviews existing commitments and performance-based capital investment strategies for their capacity to meet the defined vision. Specifically, strategies and recommendations from existing state and federally required plans (e.g., the Transportation Asset Management Plan, Freight Plan, and Bicycle and Pedestrian Plans, etc.) will be incorporated. The Plan will then review various scenarios for externalities that may impact achievement of the defined vision and make recommendations for immediate and future implementation.

Consultant supported subtasks:

- Statewide Long Range Transportation Plan

Accomplishments in prior year:

- Released request for proposals (RFP), reviewed all submissions, and selected consultant.
- Initiated contract and developed draft scope of work with selected consultant.

Proposed activities for this year:

- Oversight and administration of the consultant-supported Statewide Long Range Transportation Plan scope of work.
- Develop a Public Engagement Plan (PEP) that will emphasize reaching traditionally underserved communities.
- Work in coordination with the consultant team on all Plan tasks and deliverables.
- Meet with consultant team monthly (or more as needed) to monitor Plan progress.

Anticipated products:

- PEP to support the Plan.
- Statewide Long Range Transportation Plan Advisory Committee.

- Other draft deliverables for the Statewide Long Range Transportation Plan (e.g., vision and values statements; performance-based planning and programming targets; needs assessments; etc.)

Estimated task completion: May 2023

Timeline for new consultant support: Statewide Long Range Transportation Plan

- Consultant Name: Cambridge Systematics
- Scope development and FHWA review/approval: March 2021
- Consultant procurement and selection: June 2021
- Contract negotiations and FHWA review/approval: September 2021
- Consultant notice to proceed: September 2021
- Total duration of task: 20 months

Estimated task budget: $1,195,877.00

Staff salaries and benefits: $74,744.00

MassDOT staff members	% time to task
Derek Krevat	25%
Vacant (to be filled)	20%
Derek Shooster	10%
Gus Norrbom	40%
Wesley Lickus	40%

Consultant costs: $1,121,133

Subtask / contract #	Total cost:	Spending Pre-FFY 2022:	FFY 2022 spending:	Post FFY 2022 spending:	Consultant/Post -Contractor Name	Consultant NTP	Contract End Date
Statewide Long-Range Transportation Plan / 114869	$1,669,040	$100,000	$1,121,133	$447,907	Cambridge Systematics	September 2021	July 31 2023

Other costs: $0

Multimodal Planning

A.13 / Bicycle and Pedestrian Planning

Task lead: Peter Sutton

Task purpose and need: To provide continued support for bicycle and pedestrian planning activities in Massachusetts in order to promote healthy, safe, and accessible non-motorized transportation options. This task will serve to implement and advance the recommendations of the Statewide Pedestrian Plan and the Statewide Bicycle Plan. Additional work under this task will involve providing assistance to MassDOT Highway District offices, MPOs, local governments, community-based organizations, and advocacy efforts in order to encourage, educate, plan, and design pedestrian and bicycle facilities.

Accomplishments in prior year:

- Organized and participated in Moving Together 2020.
- Organized and attended the Massachusetts Bicycle and Pedestrian Advisory Board Meetings.
- Organized and attended MassTrails Team Meetings.
- Continued implementation of the Bike and Pedestrian Plan deliverables.
- Finalized the Mass Central Rail Trail Feasibility Study (on-call service contract assignment).
- Initiated the North Adams Adventure Trail Feasibility Study (on-call services contract assignment).

Proposed activities for this year:

- Organize and participate in Moving Together 2021 (in person).
- Organize and participate in Bay State Bike Week 2022 (staff).
- Organize and attend the Massachusetts Bicycle and Pedestrian Advisory Board Meetings
- (staff).
- Organize and attend the MassTrails Team Meetings (staff).
- Continue to oversee and participate in OTP-specific implementation activities of the Statewide Bicycle and Pedestrian Plans (staff).

Anticipated products:

- Moving Together Conference 2021.
- Bay State Bike Week 2022.
- Implementation of Bike and Pedestrian Plan Deliverables.
- North Adams Adventure Trail Feasibility Study

Estimated task completion: September 2022
Estimated task budget: $95,845.00

Staff salaries and benefits: $95,845.00

MassDOT staff members	% time to task
Ethan Britland	10%
Peter Sutton	100%

Other costs: $0

A.14 / Corridor Planning Studies

Task lead: Ethan Britland

Task purpose and need: To perform, participate in, and manage several types of transportation planning studies, conducted either internally or by other entities, such as regional planning agencies and other MassDOT Divisions. The level of involvement is project-specific and includes activities such as study development and analysis, public participation, coordination, technical assistance, and review. Often, these studies are part of the standard planning, design, and environmental processes required to advance a transportation project forward to implementation.

Consultant supported subtasks:

- Wellington Circle Study (non-SPR Funded for consultant costs).
- Route 128 Land Use and Transportation Study (split funding of SPR and non-SPR)
- Route 1A East Boston Corridor Study (SPR funded for consultant costs).
- Northern Tier Passenger Rail Study (SPR funded for consultant costs).
- Kosciuszko Circle/Morrissey Boulevard Study (non-SPR Funded for consultant costs).

Accomplishments in prior year:

- Completed East West Passenger Rail Study (non-SPR Funded for consultant costs).
- Continued to conduct the Wellington Circle Study (non-SPR Funded for consultant costs).
- Procured consultant services, contracted, and initiated the Route 128 Land Use and Transportation Study (split funding of SPR and non-SPR for consultant costs).
- Procured consultant services, contracted, and initiated the Route 1A East Boston Corridor Study (SPR funded for consultant costs).
- Procured consultant services, contracted, and initiated the Northern Tier Passenger Rail Study (SPR funded for consultant costs).
- Procured consultant services, contracted, and initiated the Kosciuszko Circle/Morrissey and Day Boulevard Study (non-SPR funded for consultant costs).

Proposed activities for this year:

- Continue to conduct and complete the Wellington Circle Study (non-SPR Funded for consultant costs).
- Conduct the Route 128 Land Use and Transportation Study (split funding of SPR and non-SPR for consultant costs).
- Conduct the Route 1A East Boston Corridor Study (SPR funded for consultant costs).
- Conduct the Northern Tier Passenger Rail Study (SPR funded for consultant costs).
- Conduct the Kosciuszko Circle/Morrissey and Day Boulevard Study (non-SPR funded for consultant costs).

Anticipated products:

- Wellington Circle Study, task deliverables, Draft Report, and Final Report (non-SPR funded for consultant costs).
- Route 128 Land Use and Transportation Study task deliverables (split funding of SPR and non-SPR for consultant costs).
- Route 1A East Boston Corridor Study task deliverables (SPR funded for consultant costs).
- Northern Tier Passenger Rail Study task deliverables (SPR funded for consultant costs).
- Kosciuszko Circle/Morrissey and Day Boulevard Study task deliverables (non-SPR funded for consultant costs).

Estimated task completion: September 2022

Timeline for new consultant support: Route 128 Land Use and Transportation Study (split funding of SPR and non-SPR)

- Consultant Name: VHB
- Scope development and FHWA review/approval: January, 2021
- Consultant procurement and selection: April, 2021
- Contract negotiations and FHWA review/approval: June, 2021
- Consultant notice to proceed: July, 2021
- Total duration of task: 24 months

Timeline for new consultant support: Route 1A East Boston Corridor Study (SPR funded for consultant costs).

- Consultant Name: WSP
- Scope development and FHWA review/approval: December,2020
- Consultant procurement and selection: April 2021
- Contract negotiations and FHWA review/approval: June,2021
- Consultant notice to proceed: July 2021
- Total duration of task: 18 months

Timeline for new consultant support: Northern Tier Passenger Rail Study (SPR funded for consultant costs).

- Consultant Name: HNTB
- Scope development and FHWA review/approval: February 2021
- Consultant procurement and selection: June 2021
- Contract negotiations and FHWA review/approval: August 2021
- Consultant notice to proceed: September 2021
- Total duration of task: 18 months

Estimated task budget: $1,166,413.00

Staff salaries and benefits: $216,711.00

MassDOT staff members	% time to task
Ethan Britland	80%
Makaela Niles	70%
Vacancy - Level 3	100%

Consultant costs: $949,702

Subtask / contract #	Total cost:	Spending Pre-FFY 2022:	FFY 2022 spending:	Post FFY 2022 spending:	Consultant/Post -Contractor Name	Consultant NTP	Contract End Date
Route 128 Land Use and Transportation Study (split funding of SPR and non-SPR) / 114652	$749,702	$0	$49,702	$400,000	VHB	July, 2021	June 30 2023
Route 1A East Boston Corridor Study (SPR funded for consultant costs) / 114356	$500,000	$20,000	$400,000	$80,000	WSP	July, 2021	December 31 2022

Consultant notes:
Route 128 Land Use and Transportation Study - $300,000 in developer mitigation funding will be used in addition to $449,702 of SPR funding (Total $749,702). This developer mitigation funding is intended to be used first.

Other costs: $0

A.15 / Freight Planning

Task lead: Makaela Niles

Task purpose and need: To continue to implement immediate infrastructure and policy strategies recommended in the 2017 Massachusetts Freight Plan. Other annual activities include 1) monitoring and responding as needed to multimodal freight trends, funding opportunities, legislation and rulemaking, and 2) participation in regional and national freight coordination efforts.

Consultant supported subtasks:

- Understanding the Impacts of COVID-19 on the Massachusetts Freight Network & Freight Planning Study

Accomplishments in prior year:

- Continued to explore implementation strategies from the 2017 Massachusetts Freight Plan as applicable.
- Completed further analysis of Statewide Truck Parking Locations (staff and on-call contract consultant).
- Continued to organize and coordinate FHWA Resource Center sponsored Freight/Truck Parking Workshop.
- Procured consultant services for Understanding the Impacts of COVID-19 on the Massachusetts Freight Network & Freight Planning Study. (Staff and consultant support)
- Monitored freight trends.
- Monitored notice of funding opportunities, legislation, and rulemaking.
- Participated in regional and national freight efforts, including coordination with the freight Advisory Committee.
- Supported the MassDOT Rail and Transit Division's freight planning activities.

Proposed activities for this year:

- Continue to explore implementation strategies from the 2017 Massachusetts Freight Plan as applicable.
- Conduct the Understanding the Impacts of COVID-19 on the Massachusetts Freight Network & Freight Planning study (staff and consultant support)
- Continue to monitor freight trends.
- Continue to monitor notice of funding opportunities, legislation, and rulemaking.
- Continue to participate in regional and national freight efforts, including coordination with the Freight Advisory Committee.
- Continue to support the MassDOT Rail and Transit Division's freight planning activities.
- Continued to organize and coordinate FHWA Resource Center sponsored Freight/Truck Parking Workshop.

Anticipated products:

- Statewide Truck Parking Improvements - Final Technical Memorandum (staff and on-call contract consultant).
- Freight Planning Workshop (staff and FHWA Resource Center support).

Estimated task completion: October 2022

Timeline for new consultant support: Understanding the Impacts of COVID-19 on the Massachusetts Freight Network & Freight Planning Study

- Consultant Name: Jacobs Engineering Group
- Scope development and FHWA review/approval: February 2021
- Consultant procurement and selection: June 2021
- Contract negotiations and FHWA review/approval: September 2021
- Consultant notice to proceed: October 2021
- Total duration of task: 12 months

Estimated task budget: $361,476.00

Staff salaries and benefits: $21,476.00

MassDOT staff members	% time to task
Makaela Niles	25%
Ethan Britland	5%

Consultant costs: $340,000

Subtask / contract #	Total cost:	Spending Pre-FFY 2022:	FFY 2022 spending:	Post FFY 2022 spending:	Consultant/Post -Contractor Name	Consultant NTP	Contract End Date
Understanding the Impacts of COVID-19 on the Massachusetts Freight Network & Freight Planning Study / 114842	$349,879	$0	$340,000	$9,879.00	Jacobs Engineering Group	October 2021	October 31 2022

Other costs:

A.16 / On-Call Contracts

Task lead: Makaela Niles

Task purpose and need: Three (3) consultant contracts for on-call services were procured in order to expeditiously initiate and conduct planning-level assignments. The time frames of these assignments vary, ranging from short-term assignments, such as technical analysis of transportation data, to long-term efforts, such as conceptual studies that may include a technical component along with coordination and interaction with other state agencies, advisory groups, stakeholders, and/or members of the public. An additional (recurring) on-call contract provides support for planning studies, travel modeling, and data management. These assignments are intended to support OTP's function as a shared/enterprise service for MassDOT, and also provide opportunities to examine and implement state of the art practices as part of our statewide transportation planning process.

Consultant supported subtasks:

Contract #109383 - Cambridge Systematics
Contract # 109384 - VHB
Contract #109385 - AECOM
Contract #116097 - Central Transportation Planning Staff

Accomplishments in prior year:

- Cambridge Systematics Assignment 1 - 2021-2025 CIP Support - Assignment Complete
- Cambridge Systematics Assignment 2 - CIP Public Engagement Support - Assignment Complete
- Cambridge Systematics Assignment 3 - 2022-2026 CIP Support - Assignment Complete
- Cambridge Systematics Assignment 4 - 2022 TAMP Update - Initiated
- Vanasse Hangen Brustlin Assignment 1 - Rapid Transit Station Density Analysis - Assignment Complete
- Vanasse Hangen Brustlin Assignment 2 - Mass Central Rail Trail Feasibility Study - Assignment Complete
- Vanasse Hangen Brustlin Assignment 3 - Statewide Truck Parking Improvements - Assignment Complete
- Vanasse Hangen Brustlin Assignment 4 - Cape Region Commuter Rail Study - Assignment Complete
- Vanasse Hangen Brustlin Assignment 5 - Baseline Equity Indicators - Assignment Complete
- Vanasse Hangen Brustlin Assignment 6 - North Adams Adventure Trail Feasibility Study - Assignment Complete
- Vanasse Hangen Brustlin Assignment 7 - Final Lynn Transit Action Plan and Commuter Rail Vision Study - Assignment Complete
- Vanasse Hangen Brustlin Assignment 8 - RAISE Grant Application: North Shore Bus Lanes - Assignment Complete
- AECOM Assignment 1 - Capital Planning SWOT Analysis - Assignment Complete
- AECOM Assignment 2 - Quantifying the Utility of Long-Distance Trip Refueling Infrastructure - Assignment Complete

- AECOM Assignment 3 - RAISE Grant Application: Mystic River Bicycle and Pedestrian Bridge - Assignment Complete
- Central Transportation Planning Staff - Road Inventory Support, Travel Model Assistance and Miscellaneous Study Support - Ongoing

Proposed activities for this year:
- Cambridge Systematics Assignment 4 - 2022 TAMP Update - Conduct Assignment
- Central Transportation Planning Staff - Road Inventory Support, Travel Model Assistance and Miscellaneous Study Support – Ongoing

Anticipated products:
- Cambridge Systematics Assignment 4 - 2022 TAMP Update
- CTPS miscellaneous studies and assistance TBD.
- CTPS - Statewide Road Inventory support and maintenance.
- CTPS - Statewide Travel Demand Model technical assistance.
- CTPS - State Transportation Maps Update.

Estimated task completion: September, 2022

Timeline for new consultant support: Contract #109383 - Cambridge Systematics
- Consultant Name: Cambridge Systematics
- Scope development and FHWA review/approval: April, 2019
- Consultant procurement and selection: June, 2019
- Contract negotiations and FHWA review/approval: August, 2019
- Consultant notice to proceed: October, 2019
- Total duration of task: 36 months

Timeline for new consultant support: Contract # 109384 - VHB
- Consultant Name: VHB
- Scope development and FHWA review/approval: April, 2019
- Consultant procurement and selection: June, 2019
- Contract negotiations and FHWA review/approval: August, 2019
- Consultant notice to proceed: October, 2019
- Total duration of task: 36 months

Timeline for new consultant support: Contract #109385 - AECOM
- Consultant Name: AECOM
- Scope development and FHWA review/approval: April, 2019
- Consultant procurement and selection: June, 2019
- Contract negotiations and FHWA review/approval: August, 2019
- Consultant notice to proceed: October, 2019
- Total duration of task: 36 months

Timeline for new consultant support: Contract #4 - Central Transportation Planning Staff
- Consultant Name: CTPS
- Scope development and FHWA review/approval: August, 2021
- Consultant procurement and selection: August, 2021

- Contract negotiations and FHWA review/approval: August, 2021
- Consultant notice to proceed: October, 2021
- Total duration of task: 12 months

Estimated task budget: $1,439,217.00

Staff salaries and benefits: $8,717.00

MassDOT staff members	% time to task
Makaela Niles	5%
Ethan Britland	5%

Consultant costs: $1,430,500

Subtask / contract #	Total cost:	Spending Pre-FFY 2022:	FFY 2022 spending:	Post FFY 2022 spending:	Consultant/Post -Contractor Name	Consultant NTP	Contract End Date
Contract #109383 - Cambridge Systematics / 109383	$500,000	$130,000	$370,000	$0	Cambridge Systematics	October, 2019	September 30 2022
Contract # 109384 - VHB / 109384	$500,000	$310,000	$190,000	$0	VHB	October, 2019	September 30 2022
Contract #109385 - AECOM / 109385	$500,000	$185,000	$315,000	$0	AECOM	October, 2019	September 30 2022
Contract #4 - Central Transportation Planning Staff / 116097	$555,500	$0	$555,500	$0	CTPS	October, 2021	September,30 2022

Other costs:

Public Private Development Unit

A.17 / Access Management Through Development Review and Land Disposition

Task lead: Jean Lucien

Task purpose and need: To implement access management through the review of private development proposals and the disposition of MassDOT land or railroad right-of-way (ROW). Work under this task will include the following specific items:

- Implement Access Management principles in the review of all private development projects in accordance with the Project Development and Design Guidebook.
- Conduct yearly pilot monitoring of built mitigation to ensure consistency with access management principles and safety analysis.
- Review all canvases related to the purchase or lease of MassDOT owned property.
- Review all requests for break-in access-controlled lines along state and interstate highways.
- Review all requests to use, acquire, or dispose of railroad right of way.
- Ensure that canvassing decisions are consistent with MassDOT policies on safety and mobility.

Additional staff time within the area of access management will also be spent on a research project entitled "Developing Massachusetts Specific Trip Generation Rates for Land Use Projects," funded through SPR II, to assist MassDOT in developing trip generation rates for high-priority land uses in Massachusetts. This research includes the development of an algorithm-based model for deriving accurate trip generation rates for development projects located in Massachusetts. This research will also identify and study available innovative technologies such as machine learning models and video analytics that can be used to assist MassDOT's efforts to collect vehicular and multi-modal trip generation data that can be used to further enhance the accuracy of its trip generation rate modeling program. The goals of this proposed research are to establish state-specific trip generation rates for development projects located in high-priority land use areas; propose mixed uses anticipated to generate multi-modal trips; and identify and evaluate new trip rate data sources and innovative collection technologies, including video analytics and artificial intelligence, to improve and expand trip generation models for land uses in Massachusetts.

Accomplishments in prior year:

- 12 ROW canvases were reviewed by the Public Private Development Unit (PPDU).
- Continued pilot program to assess the impacts of development proposals on safety and access management.

Proposed activities for this year:

- All coordination activities performed in FFY 2021 are intended to continue throughout 2021. Coordinate with the Secretary's Office to review current land-use review protocols under MEPA.
- Manage the research project to develop trip generation rates for high-priority land uses in Massachusetts.

Anticipated products:

- Review of canvases related to the purchase or lease of MassDOT owned property.
- Internal staff coordination with MassDOT Divisions.
- External staff coordination with other agencies.

Estimated task completion: Ongoing
Estimated task budget: $21,545.00

Staff salaries and benefits: $21,545.00

MassDOT staff members	% time to task
Jean Lucien	20%

Other costs: $0

A.18 / Coordination and Consultation with Developers and Project Stakeholders

Task lead: Jean Lucien

Task purpose and need: To conduct consultation meetings and provide technical guidance to developers and project stakeholders on transportation policies, planning, and design issues during the development of private projects. Work under this task will include the following specific items:

- Review all Transportation Scoping Letters (TSLs), confirm the assumptions, and provide feedback on the information included in transportation impact assessment studies.
- Conduct consultation meetings on all technical issues, transportation analyses, and conceptual plans for mitigation.
- Coordinate with all appropriate MassDOT Division units and the MBTA to seek inputs into the early development of transportation infrastructure that will help mitigate project impacts.
- Coordinate as necessary with other state agencies, cities, and towns.
- Respond to all questions and requests for information regarding the MassDOT permitting process from stakeholders on transportation policies, planning, and design issues during the development of private projects.

Accomplishments in prior year:

- Reviewed approximately 14 transportation-related grant applications for the Massachusetts Gaming Commission's grant mitigation program.
- Conducted meetings to provide technical support to developers and their consultants as part of their Massachusetts Environmental Policy Act (MEPA) submissions and review processes. Provided technical review and support on transportation issues for the environmental permitting of MassDOT/MBTA air rights projects.
- Worked with the Central Transportation Planning Staff (CTPS) to monitor transportation modeling work for the Suffolk Downs Redevelopment project.

Proposed activities for this year:

- All coordination activities performed in FFY 2021 are intended to continue throughout FFY 2022.
- PPDU will continue to work with MassDOT's Office of Real Estate and Asset Development (OREAD) and potential developers to provide assistance and guidance on development proposals.

Anticipated products:

- Internal staff coordination with MassDOT Divisions, the Massachusetts Port Authority (Massport), and the MBTA.
- External staff coordination with other agencies, including the Massachusetts Executive Office of Energy and Environmental Affairs and the Executive Office of Housing and Economic Development.

Estimated task completion: Ongoing

Estimated task budget: $16,158.00

Staff salaries and benefits: $16,158.00

MassDOT staff members	% time to task
Jean Lucien	15%

Other costs: $0

A.19 / Development Review through the MEPA and MassDOT Access Permit Processes

Task lead: Jean Lucien

Task purpose and need: To provide timely and thorough technical reviews and evaluations of the anticipated transportation impacts of development projects under the Massachusetts Environmental Policy Act (MEPA) and as part of the approval process for access permits issued by MassDOT.Work under this task will include the following specific items:

- Review and issue comments on behalf of MassDOT and the MBTA on all Environmental Notification Forms, Environmental Impact Reports, and Notices of Project Change to ensure consistency with MassDOT policies, regulations, and design standards.
- Adequately review all environmental documents attached to transportation studies for consistency with the latest transportation impact assessment guidelines.
- Ensure the coordination of transportation-related comments between all MassDOT Divisions and the MBTA, cities, towns, and stakeholders as appropriate.
- Coordinate with the MEPA Office to address outstanding issues on projects and timely submission of all MEPA comments.
- Review and submit comments on all Requests for Determination and Requests for Advisory Opinion when asked by the MEPA Office.
- Provide technical assistance to the MEPA Office and/or project stakeholders on all transportation-related issues.

Accomplishments in prior year:

- Coordinated throughout the year with all MassDOT Divisions, the MBTA, Massport, and cities and towns on technical reviews for development projects and responded to several public inquiries.
- All projects reviewed included commitments to provide pedestrian, bicycle, and/or transit accommodations.
- All conceptual plans or permitted projects were reviewed for Complete Streets accommodations.

Proposed activities for this year:

- All coordination activities performed in FFY 2021 are intended to continue throughout FFY 2022.
- Major projects currently under review include Dorchester Bay City Development in Boston, Seaport Square Redevelopment in Boston, Widett Circle, Woburn ARTC Redevelopment, and the South Exchange project in Boston.
- Work with the developer of the Dorchester Bay Development project to finalize the CTPS modeling for the study and develop the infrastructure needs to mitigate the impacts of the redevelopment of the site.

Anticipated products:

- Internal staff coordination with MassDOT Divisions, Rail and Transit, and the MBTA.
- External staff coordination with other agencies including MEPA, Massport, and the Massachusetts Department of Conservation and Recreation (DCR).
- Timely reviews and submissions of all MassDOT comments on environmental documents.

Estimated task completion: Ongoing
Estimated task budget: $32,317.00

Staff salaries and benefits: $32,317.00

MassDOT staff members	% time to task
Jean Lucien	30%

Other costs: $0

A.20 / MassDOT Policies Supported and Incorporated in Inter-Agency Objectives

Task lead: Jean Lucien

Task purpose and need: To support state-level initiatives with other agencies to encourage economic development. Work under this task will include the following specific items:

- Represent MassDOT on the Interagency Permitting Board. Attend all meetings and review submissions from cities and towns for Priority Development Site Designations; review and approval requests for 43D Expedited Permitting designations; and participate in all activities to expedite the permitting process at the state level.
- Work with MassDOT Divisions to review the overall permitting and approval process for developments with an emphasis on reviewing MassDOT/MBTA's approach to implementing transportation mitigation.
- Represent MassDOT on the Woburn Anderson Regional Transportation Center (RTC) Executive Committee. Participate in the management and oversight of the facility to promote multimodal objectives and fiscal solvency.

Accomplishments in prior year:

- Provided technical support on permitting and economic development issues to five cities and towns that have adopted 43D Expedited Permitting.
- Initiated work with the Office of Performance Management & Innovation (OPMI). To date, a methodology to address bus analysis has been developed and implemented.

Proposed activities for this year:

- All activities performed in FFY 2021 are intended to continue throughout FFY 2022. Conduct internal and external planning coordination for the 2023 TRB National/International Access Management Conference in Boston.
- Work with OPMI to develop an improved methodology for transit analysis and transit mitigation requests.
- Conduct a review of the need to update the current 2014 Transportation Impact Assessment Guidelines for consistency with MassDOT policies and regulations.

Anticipated products:

- Internal staff coordination with MassDOT Divisions and the MBTA.
- External staff coordination with Massport, the Massachusetts Department of Housing and Economic Development (HED), the Massachusetts Department of Conservation and Recreation (DCR) and other agencies.

Estimated task completion: Ongoing
Estimated task budget: $21,545.00

Staff salaries and benefits: $21,545.00

MassDOT staff members	% time to task
Jean Lucien	20%

Other costs: $0

A.21 / Mitigation, Transportation Demand Management, and Monitoring Programs for Development Projects

Task lead: Jean Lucien

Task purpose and need: To secure appropriate multimodal mitigation benefits consistent with MassDOT policies and to ensure that developers implement and follow up on their mitigation commitments. Work under this task will include the following specific items:

- Negotiate appropriate multimodal mitigation measures with private developers in the form of both capital and operational improvements.
- Prepare and issue Section 61 Findings on behalf of MassDOT to formalize mitigation measures.
- Ensure the timely issuance of needed MassDOT permits in accordance with State Highway Access Regulations.
- Ensure that project proponents meet all commitments to implement mitigation required as part of their Section 61 Findings.
- Review all submitted Transportation Monitoring Reports.

Additionally, consultant support will be procured to assist MassDOT identify the requisite methodology and regulatory legal and components for the design and implementation of a transit mitigation program in Massachusetts. The objectives of this study are to identify the legal and regulatory framework currently used throughout the country to require mitigation to offset the increased demand on existing transit services generated by new development; evaluate MassDOT's current transit mitigation practices in this area; review legal and regulatory administration, framework, and methodology of MassDOT's existing transit mitigation practices; and design and implement streamlined transit mitigation for all transit modes.

Consultant supported subtasks:

- Design and Implementation of a Massachusetts Transit Mitigation Program

Accomplishments in prior year:

- Issued seven Section 61 Findings for projects previously reviewed.
- Provided support to developers in designing and implementing transportation demand management (TDM) programs.
- Monitored recently built projects that received a Section 61 Finding from MassDOT using the Transportation Impact Assessment Monitoring Report (TIAMR) tool.
- Reviewed and commented on five Transportation Monitoring Reports.

Proposed activities for this year:

- Coordinate activities performed in FFY 2021 throughout FFY 2022.
- Assist with the oversight of the Land Use and Transportation Study along the Route 128 Corridor to serve as a prototype for multimodal program and project mitigation requests for development projects. This study is funded

under SPR Task A.14, "Corridor Planning Studies." Procure consultant support for the Transit Mitigation Program project.
- Collect developers' commitments to mitigation funds and monitor implementation of targeted study/improvements.

Anticipated products:
- Internal staff coordination with MassDOT Divisions and the MBTA.
- External staff coordination with Massport, HED, DCR and other agencies.
- Approved research proposal and contracts for Transit Mitigation Study.

Estimated task completion: Ongoing
Estimated task budget: $16,158.00

Staff salaries and benefits: $16,158.00

MassDOT staff members	% time to task
Jean Lucien	15%

Other costs: $0

Sustainable Transportation

A.22 / GHG Mitigation Analysis, Research, Guidance & Regulatory Requirements.

Task lead: Jules Williams

Task purpose and need: To support the Commonwealth's efforts to meet ambitious greenhouse gas (GHG) reduction goals. The scope of OTP's work under this task includes undertaking studies of GHG mitigation opportunities in Massachusetts; providing transportation planning input into state government efforts to develop, monitor and update the Commonwealth's Climate Policies; offering feedback on MassDOT's role in reducing statewide emissions; supporting Metropolitan Planning Organizations' (MPO) GHG impact estimation and reporting; identifying on-road GHG emissions as well as MassDOT and MBTA emissions under 310 CMR 60.05;providing analysis and advice needed to support the development of the Transportation and Climate Initiative (TCI) cap and trade program; and other initiatives.

Importantly for SPR 2022 new legislation has committed the state to net zero emissions by 2050 and will impose a declining GHG emissions cap on the transportation sector. The new law requires 2025 and 2030 transportation sector GHG emissions sublimit and a 2030 emissions reduction roadmap plan, all to be developed by Jan 1, 2022. As the largest source of GHG emissions, there will likely be significant implications for our sector.

Accomplishments in prior year:

- Continued to development of the TCI-P this included participation in inter-state meetings, review of modeling of TCI-P emissions public health and economic impacts, review of draft model rules and proposed legislation governing expenditure of TCI-P revenue, review of external reports on TCI-P impacts, development of a range of metrics proposed for use identifying overburdened and underserved populations, and coordination with state agencies.
- Reviewed the MPO TIP GHG impact estimates and provided comment where necessary, as required under 310 CMR 60.05.
- Supported the development of priorities for climate coordination among a group of State DOTs and briefed the Commonwealth incoming Undersecretary for Climate Change on opportunities for reducing transportation GHG emissions.
- Completed a report detailing statewide GHG emissions in CY2020 and submitted this report to MassDEP, as required under 310 CMR 60.05. The CY 2020 Aggregate MassDOT GHG emissions report, required under 310 CMR 60.05, was also submitted.
- Reviewed a range of proposals for policies under the states Clean Energy and Climate Plan and provided feedback to partner agencies.

Proposed activities for this year:

- Review of MPOs' GHG impact analyses for the State Transportation Improvement Program (STIP).
- Develop estimate of on-road GHG emissions in the Commonwealth.
- Develop estimate of MassDOT and MBTA GHG emissions.
- Review and provide feedback on any proposals regulations and legislation to implement the TCI-P program in Massachusetts.
- Review and provide feedback on proposals for the 2025 and 2030 transportation sector GHG emissions sublimit and the 2030 emissions reduction roadmap plan.
- Participate in public meetings seeking feedback on proposals for implementation of the TCI-P in Massachusetts.
- Develop draft scope for a study on empirical evaluation of GHG impacts of active transportation and transit projects

Anticipated products:

- Draft and final on-road emissions estimate.
- Draft and final MassDOT/MBTA emissions estimate.
- Advice and analysis on TCI cap and trade program design and implementation issues.
- Advice and analysis on transportation sector modeling and policy issues posed by the Clean Energy and Climate Plan.
- Advice and analysis on any proposed regulatory initiatives needed to implement the TCI-P in Massachusetts.
- Advice and analysis on proposals for a 2025 and 2030 transportation sector GHG emissions sublimit and 2030 emissions reduction roadmap plan
- Draft scope for a study on empirical evaluation of GHG impacts of active transportation and transit projects

Estimated task completion: Ongoing
Estimated task budget: $98,702.00

Staff salaries and benefits: $98,702.00

MassDOT staff members	% time to task
Jules Williams	70%
Shannon Greenwell	25%

Other costs: $0

A.23 / Climate Adaptation Vulnerability Assessment

Task lead: Shannon Greenwell

Task purpose and need: To identify a prioritized set of high-risk climate hazards and associated high-risk transportation assets throughout the state using a rigorous methodology that integrates GIS tools, climate projections, and hydrologic and hydraulic models. In a second phase, the project will provide recommendations about how project results could be integrated into planning, asset management, operations, and maintenance activities. This task also includes coordination with adaptation initiatives by MassDOT Divisions, other state agencies, and Metropolitan Planning Organizations (MPOs). This task complies with Executive Order 569, which requires state agencies to assess vulnerability to climate change and extreme weather events and identify adaptation options for assets.

Consultant supported subtasks:

- Climate Adaptation Vulnerability Assessment
-

Accomplishments in prior year:

- Began the exposure analysis implementation
- Developed draft methodologies for estimating user-related impacts for all asset categories
- Developed the risk assessment methodology
- Began development of methodologies for creating depth damage relationships for each asset category
- Continued to perform administrative functions
- Continued to engage relevant MassDOT stakeholders and external stakeholders
- Continued to coordinate with internal stakeholders and other agency staff on resiliency issues as appropriate

Proposed activities for this year:

- Methodology development will be completed
- The WRF-Hydro model will be run for all of Massachusetts
- Stream event data will be transformed into flood plains using hydraulic tools
- Exposure analysis will be conducted for in-scope assets
- Depth-damage functions for asset categories will be finalized
- Continue to identify the appropriate MassDOT and MBTA processes for integrating the project results
- Continue to perform administrative functions and engage internal and external stakeholders on both this project and resiliency as appropriate.

Anticipated products:

- Completed methodologies
- Completed depth-damage functions
- Floodplains

Estimated task completion: February 2023

Timeline for new consultant support: Climate Adaptation Vulnerability Assessment

- Consultant Name: WSP
- Scope development and FHWA review/approval: May 2019
- Consultant procurement and selection: August 2019
- Contract negotiations and FHWA review/approval: March 2020
- Consultant notice to proceed: January 2020
- Total duration of task: 36 months

Estimated task budget: $1,885,367.00

Staff salaries and benefits: $75,034.00

MassDOT staff members	% time to task
Shannon Greenwell	75%
Jules Williams	10%

Consultant costs: $1,810,333

Subtask / contract #	Total cost:	Spending Pre-FFY 2022:	FFY 2022 spending:	Post FFY 2022 spending:	Consultant/Post -Contractor Name	Consultant NTP	Contract end date
Climate Adaptation Vulnerability Assessment / 106882	$3,885,002	$1,374,000	$1,810,333	$700,669	WSP	January 2020	February 01 2023

Consultant notes:

Other costs:

A.24 / Low Emissions Vehicles, Fuels, and Infrastructure

Task lead: Jules Williams

Task purpose and need: To provide planning studies and other analysis on issues related to low-emission vehicles and infrastructure. Increased adoption of low emissions vehicles and fuels is targeted as part of Massachusetts' efforts to reduce emissions. A range of policies are in place that seek to increase adoption of these technologies. This impacts MassDOT and the transportation system in a number of ways: changes in motor fuel excise revenues; demand for new kinds of refueling in new locations; changes in the kinds of signage needed on highways; changes in vehicle operating costs and associated incentives to drive and changes in the amount, types and locations of pollutants emitted; and requests for how the transportation network can support increased uptake of these technologies.

Accomplishments in prior year:

- Scope of work developed for a survey-based analysis of traveler preferences for refueling infrastructure and a consultant chosen to implement this work.
- Survey instrument was developed and administered to a sample of Massachusetts drivers.
- Reviewed final documentation from the clean vehicles program from the Department of Energy Resources.
- A final copy of the study on the Feasibility and Advisability of Zero Emission Vehicle Fees report was provided to FHWA.
- A dashboard was developed that will allow the number of registered zero emission vehicles in Massachusetts to be identified by geography.
- Completed a literature review assessing the state of knowledge on tailpipe pollutant emissions related to renewable drop-in hydrocarbon transportation fuels.

Proposed activities for this year:

- Draft scope of work for study on MassDOT public parking areas with possible reconstruction schedules detailing costs of electric vehicle charging equipment installation to meet projected EV demand.
- Develop and issue RFP for consultant support for study on EV charging at MassDOT public parking areas
- Select consultant for study on EV charging at MassDOT public parking areas - Respond to proposals for alternative fuel corridor designations as needed.
- Perform analysis of alternative fuel and vehicle Clean Energy and Climate Plan proposals as needed

Anticipated products:

- Inventory of MassDOT parking asset attributes
- Analysis of MassDOT parking area user behavior and implications for EV demand

Estimated task completion: Ongoing
Estimated task budget: $27,003.00

Staff salaries and benefits: $27,003.00

MassDOT staff members	% time to task
Max Natanagara	25%
Jules Williams	10%

Other costs: $0

A.25 / Post-COVID-19 Teleworking Study

Task lead: Max Natanagara

Task purpose and need: This study will assess the impact of teleworking on the Commonwealth's transportation system post-COVID-19. The different teleworking scenarios to be modeled and the resulting estimations of how future trips will change will have important implications for the public services that MassDOT provides in the future. Employer-resident surveys and a thorough literature review are shaping the inputs for both transportation modeling and economic modeling. A strategy will also be developed for continuing to monitor shifts in teleworking.

Consultant supported subtasks:
- Post-COVID-19 Teleworking Study

Accomplishments in prior year:
- Completed project literature review
- Developed and used evaluation criteria to select transportation and economic model
- Began establishing scenarios to be modeled
- Began developing surveys

Proposed activities for this year:
- Survey residents and employers within Massachusetts
- Conduct transportation and economic modeling to assess impact of teleworking scenarios
- Review MassDOT planning processes and investments

Anticipated products:
- Survey instrument and presentation detailing survey results.
- Presentation, map interface, and all data from trip/economic modeling of different scenarios.
- Strategy for continuing to monitor changes in telework.
- Final report and summary incorporating all prior deliverables.

Estimated task completion: August 2022

Timeline for new consultant support: Post-COVID-19 Teleworking Study
- Consultant Name: RSG, Inc.
- Scope development and FHWA review/approval:
- Consultant procurement and selection:
- Contract negotiations and FHWA review/approval:
- Consultant notice to proceed: February, 2021
- Total duration of task: 18 months

Estimated task budget: $722,863.00

Staff salaries and benefits: $58,902.00

MassDOT staff members	% time to task
Max Natanagara	75%
Jules Williams	10%

Consultant costs: $663,961

Subtask / contract #	Total cost:	Spending Pre-FFY 2022:	FFY 2022 spending:	Post FFY 2022 spending:	Consultant/Post -Contractor Name	Consultant NTP	Contract End Date
Post-COVID-19 Teleworking Study / 113996	$896,504	$232,543	$663,961	$0	RSG, Inc.	February 2021	August 15 2022

Consultant notes:

Other costs: $0

Transit Planning

A.26 / Bus Network Redesign

Task lead: Caroline Vanasse

Task purpose and need: The Bus Network Redesign is a complete re-imagining of the MBTA's bus network to reflect the travel needs of the Greater Boston region and create a more competitive bus service for current and future bus riders. Greater Boston has changed significantly in recent years, with shifting demographics, emerging employment districts, increasing traffic congestion, and changing travel patterns.

As MassDOT collectively continues to adapt to the uncertainty of COVID-19, so will the bus network. Throughout the pandemic, buses have played a role in connecting people with their jobs and essential businesses like hospitals and grocery stores. For these reasons, among others, a bus system that meets the needs of the region is an important issue. A central initiative of the Better Bus Project, the Bus Network Redesign builds on work that MassDOT and the MBTA have already completed and guides our recommendations for an improved bus network - a network that better serves existing riders, attracts new riders, and better meets regional needs. These changes will be comprehensive, including items such as route design, frequency of service, span of service, stop spacing, and coverage area.

Consultant supported subtasks:

- Bus Network Redesign

Accomplishments in prior year:

- Developed innovative survey and outreach tools to get input on project metrics
- Held first public meeting
- Held ten workshops with MBTA Service Planning, Operations, and other MBTA staff to develop route for network alternatives
- Identified High Frequency Corridors and began discussions with municipalities on opportunities to partner to implement bus infrastructure
- Convened twenty internal task force meetings to inform the development of network-level goals and metrics. The task force consists primarily of MBTA stakeholders from the following offices: Operations, Customer Experience, Systemwide Accessibility, Service Planning, Fleet and Facilities, Revenue, and Customer Technology, as well as representatives from MassDOT's OPMI and the Office of Diversity and Civil Rights (ODCR).
- Convened twelve external task force meetings consisting of business leaders, elected officials, municipal leaders, and social service providers to inform the project
- Created network evaluation tool.

Proposed activities for this year:

- Conduct extensive public engagement to get input on draft new bus network. Outreach strategies include hosting street teams at stations and large-scale

public events (if appropriate due to circumstances) and smaller workshops to gather input.
- Create network alternatives for internal discussion
- Create draft recommended new bus network for external engagement
- Hold internal workshops on policy decisions with internal stakeholders.
- Hold external task force meetings to get feedback on project outputs.

Anticipated products:
- Draft new bus network
- Network evaluation tool to assess new bus network against existing bus network
- Proposed final recommended network.

Estimated task completion: March 2022

Timeline for new consultant support: Bus Network Redesign
- Consultant Name: Cambridge Systematics
- Scope development and FHWA review/approval:
- Consultant procurement and selection:
- Contract negotiations and FHWA review/approval:
- Consultant notice to proceed: June 2019
- Total duration of task: 37 months

Estimated task budget: $676,776.00

Staff salaries and benefits: $66,421.00

MassDOT staff members	% time to task
Caroline Vanasse	85%

Consultant costs: $610,355

Subtask / contract #	Total cost:	Spending Pre-FFY 2022:	FFY 2022 spending:	Post FFY 2022 spending:	Consultant/Post -Contractor Name	Consultant NTP	Contract End Date
Bus Network Redesign / 107591	$3,330,901	$2,720,545	$610,355	$0	Cambridge Systematics	June 2019	July 31 2022

Consultant notes:
Other costs: $0

A.27 / Exploring the Connection Between Bus Trips and Other Modes

Task lead: Caroline Vanasse (temporary contact)

Task purpose and need: This study will build off of the lessons learned from the MBTA Systemwide Station Access Study, and the MBTA's recent bus stop inventory analysis to identify potential connections between bus trips and other modes from the perspective of bus passengers. The following are the three critical questions that will be considered as part of this study:

1.) Based on existing research and best practices from other transit systems, what does the most effective bus to bus, or bus to other mode, connection look like?
2.) How is the MBTA system performing against that standard?
3.) Depending on the findings to the two questions above, what are the most effective improvements the MBTA could implement to enhance bus connections to other modes?

Accomplishments in prior year: N/A (new task).

Proposed activities for this year:

- GIS and field mapping activities will contribute toward achieving the study's goals and answer the questions outlined above.
- Identify and recommend prioritized long term areas of improvement, particularly for future capital investments in major busway facilities
- Identify and recommend prioritized tactical improvements for connections, particularly in the short term for bus stops.

Anticipated products:

- Standard rubric and evaluation tool that defines not only the locations of bus shelters, but if transferring, where cross streets are needed.
- Inventory of existing connections, focusing on high volume connections (bus to bus, bus to other mode, etc.)

Estimated task completion: January 2023 [to be confirmed]
Estimated task budget: $221,415.00

Staff salaries and benefits: $36,812.00

MassDOT staff members	% time to task
Vacancy - Level 2	50%

Consultant costs: $184,603

Subtask / contract #	Total cost:	Spending Pre-FFY 2022:	FFY 2022 spending:	Post FFY 2022 spending:	Consultant/Post -Contractor Name	Consultant NTP	Contract End Date
N/A / TBD	$184,603	$0	$184,603	$0	TBD	TBD	TBD

Other costs: $0

A.28 / Green Line Corridor Capacity Study

Task lead: Douglas Johnson

Task purpose and need: The goal of this task is to support medium and long-term planning of the Green Line Transformation (GLT) Program in line with Focus40 recommendations.

Consultant supported subtasks:
- B Branch Station Consolidation
- Huntington Avenue - Riverway to Brigham Circle
- Green Line Corridor Transformation - CTPS Modeling

Accomplishments in prior year:
- Continued to work with the GLT Office to support additional Green Line Transformation planning activities on an on-demand basis.
- Completed additional analysis of station consolidation between the Packards Corner and Warren Street stations to support a design submission by the GLT Office.
- Completed the assessment of existing conditions and peer review of combined bus and light rail or streetcar/tram transitways. Assessed stop consolidation and transitway configuration concepts. Met with staff from the City of Boston to receive input on transitway configurations.

Proposed activities for this year:
- Complete analysis of a Huntington Ave Transitway based on conceptual design being developed by GLT Office.

Anticipated products:
- Transit Travel Time and Transit Level of Service Analysis for the MBTA Green Line E Branch and bus routes 39 and 66 using a shared transitway between Riverway and Brigham Circle.

Estimated task completion: December 2021

Timeline for new consultant support: Huntington Avenue - Riverway to Brigham Circle
- Consultant Name: IBI
- Scope development and FHWA review/approval:
- Consultant procurement and selection:
- Contract negotiations and FHWA review/approval:
- Consultant notice to proceed: April 2019
- Total duration of task: 33 months

Timeline for new consultant support: B Branch Station Consolidation
- Consultant Name: IBI
- Scope development and FHWA review/approval:
- Consultant procurement and selection:
- Contract negotiations and FHWA review/approval:
- Consultant notice to proceed: April 2019

- Total duration of task: 33 months

Timeline for new consultant support: Green Line Corridor Transformation - CTPS Modeling

- Consultant Name: CTPS
- Scope development and FHWA review/approval:
- Consultant procurement and selection:
- Contract negotiations and FHWA review/approval:
- Consultant notice to proceed: January 2021
- Total duration of task: 12 months

Estimated task budget: $96,287.00

Staff salaries and benefits: $6,918.00

MassDOT staff members	% time to task
Douglas Johnson	10%

Consultant costs: $89,369

Subtask / contract #	Total cost:	Spending Pre-FFY 2022:	FFY 2022 spending:	Post FFY 2022 spending:	Consultant/Post -Contractor Name	Consultant NTP	Contract End Date
Huntington Avenue - Riverway to Brigham Circle / 103485	$100,693	$93,178	$7,461	$0	IBI	April 2019	September 30 2022
B Branch Station Consolidation / 103485	$90,081	$86,672	$3,408	$0	IBI	April 2019	September 30 2022
Green Line Corridor Transformation - CTPS Modeling / 112660	$157,000	$78,500	$78,500	$0	CTPS	January 2021	December 30 2021

Consultant notes:

- The estimated completion date of December 2021 reflects a contract extension that took place to accommodate the addition of new tasks and allow for additional time to complete the deliverables for existing tasks.
- The RFP for the original contract was issued on June 5, 2017 and the contract was awarded on April 20, 2018. The contract was changed to a task-order basis on March 29, 2019.

Other costs: $0

A.29 / Development Mitigation Methodology

Task lead: Caroline Vanasse (temporary contact)

Task purpose and need: Currently, there are no defined guidelines for how much developers are to pay for transportation mitigation due to the impacts of developments on MBTA services, or how that amount should be determined. That is, the methodology and/or amount varies by agency and/or project. This project would come up with a draft methodology for determining mitigation dollars for the MBTA.

Accomplishments in prior year: N/A (new task).

Proposed activities for this year:

- Case study research and literature review regarding how other transit agencies calculate system impacts due to commercial, residential, and other developments/land use impacts
- Development of a guidance document that reviews potential strategies for quantifying service impacts on MBTA services
- Development of a potential methodology that could be used to estimate the impacts of commercial, retail, residential, and other types of land and property development activities on the throughput and delay of public transportation services

Anticipated products:

- Memorandum/report that summarizes research and literature review findings
- Quantitative models (and guidance on associated thresholds and metrics) that can be used to estimate service delivery impacts
- Detailed methodology and guidance regarding the estimation of impacts on public transportation and strategies for mitigation

Estimated task completion: March 2023 [to be confirmed]
Estimated task budget: $168,406

Staff salaries and benefits: $18,406

MassDOT staff members	% time to task
Vacancy - Level 2	25%

Consultant costs: $150,000

Subtask / contract #	Total cost:	Spending Pre-FFY 2022:	FFY 2022 spending:	Post FFY 2022 spending:	Consultant/Post -Contractor Name	Consultant NTP	Contract End Date
Development mitigation methodology	$500,000	$0	$150,000	$350,000	TBD	TBD	TBD

A.30 / MBTA Fare Review

Task lead: Caroline Vanasse (temporary contact)

Task purpose and need: The MBTA has over 100 different price points for a transit ride depending on mode, zone/distance, transfers, product type, and eligibility for reduced fares. This project would provide a comprehensive review of MBTA fare policy and pricing -- how pricing currently works, alternative pricing options, public/stakeholder input and impact analysis of alternative pricing options, recommendations for changes to MBTA fares, and potential barriers and strategies for implementing the recommendations.

Accomplishments in prior year: N/A (new task).

Proposed activities for this year:

- Case study research and literature review regarding how the MBTA fare tariff compares to other transit agencies, inclusive of contextual factors such as service area, coverage, revenue service hours, etc.
- Data collection (qualitative, quantitative, spatial) regarding MBTA fare policy, including studies conducted by non-state agencies such as advocacy groups and the MBTA Advisory Board
- Model and 'tariff alternatives' development

Anticipated products:

- Background report and presentation describing how MBTA fares compare to alternative pricing approaches used at other transit agencies around the world.
- Review/synthesis of previous public outreach on MBTA fare policy, a supplemental public survey and stakeholder interviews, and a summary report describing findings
- Modeling analysis of the potential ridership, revenue, and equity implications of alternative pricing options, using existing MBTA modeling tools where applicable
- Qualitative analysis of the technological, operational, and regulatory implications of alternative pricing options
- A report and presentation of findings, recommendations, potential barriers, and strategies for implementation

Estimated task completion: March 2024
Estimated task budget: $268,406

Staff salaries and benefits: $18,406

MassDOT staff members	% time to task
Vacancy - Level 2	25%

Consultant costs: $250,000

Subtask / contract #	Total cost:	Spending Pre-FFY 2022:	FFY 2022 spending:	Post FFY 2022 spending:	Consultant/Post -Contractor Name	Consultant NTP	Contract End Date
MBTA Fare Review	$850,000	$0	$250,000	$600,000	TBD	TBD	TBD

Other costs:

SPR I Part B

Pavement Management

B.1 / Statewide Pavement Management Activities

Task lead: Edmund Naras

Task purpose and need: The objective of the pavement management program is to responsibly manage the pavement portion of the highway transportation network. The program provides a rational and uniform system for evaluating roadway conditions in order to improve the effectiveness of pavement preservation and rehabilitation strategies. Additionally, it provides analytical and evaluation tools that assist administrators and project managers with improving the consistency of decision-making and formulate strategies to optimize pavement network performance and the allocation of resources.

Consultant supported subtasks:

- ISA for a balanced mixture design procedure, profilers certification and related pavement materials testing activities. (extension pending)
- Pavement management modeling, forecasting & optimized project selection for the Capital Investment Plan (CIP)
- ISA for Pavement Management Services including Data Collection Equipment
- Certification/Correlation, HMA Mixture Performance Testing, Support for Balanced Mix Design Implementation and Related Activities.

Accomplishments in prior year:

- Collected, processed and analyzed 4,000+ miles of pavement condition data.
- Successfully submitted Interstate and Non-Interstate NHS pavement data for HPMS
- Developed an optimized multi-year program for the Interstate and NHS. Integrated optimized program into the STIP.
- Utilized the MassDOT Pavement Management modeling, forecasting & optimized project selection tool to identify $250 Million dollars of future NHS pavement projects.
- Coordinated with District, Environmental and Highway Design staff to screen the $250M NHS project locations to establish non-pavement scope, identify preservation candidates, and prioritize future programming.
- Developed a statewide list of municipal numbered highways in fair and poor condition. Prioritized these sections by condition, NHS status, scope and other factors for rehabilitation over a five-year period.
- Performed correlation and certification for ride quality testing equipment utilized by contractors\other Northeast states and MassDOT for QC and acceptance testing.
- Performed acceptance testing for ride quality on approximately 500+ lane miles
- Continued monitoring performance of EDC-2 High Friction Surfacing Projects statewide

- Continued monitoring SHRP2 (R-26) pavement preservation sections on US-Rt 3. The control (do-nothing) section was deteriorated and resurfaced in June 2021.
- Reviewed over 370 projects at various stages of design.
- Advancing EDC-6 Targeted Overlay Pavement Solutions Initiative for Asphalt Rubber Mixtures, Highly Modified Polymer Mixtures and Stone Matrix Asphalt (SMA) mixtures. Pilot project under design and scheduled for advertising in the 2022 fiscal year.
- Piloting Higher RAP demonstration projects based on prior SPR Research Activities.

Proposed activities for this year:

- Collect pavement distress, rutting, geometric, GPS and video data for the Interstate System and continue the bi-annual data collection cycle for the remaining NHS, numbered routes and other highways under MassDOT jurisdiction.
- Perform ride quality acceptance testing for all new construction, resurfacing and preservation projects.
- Upgrade the hardware and software for the SurPro rolling dipstick utilized for calibration and certification of the Quality Assurance (QA) roughness testing equipment.
- Procure new Automated Pavement Data Collection Vehicle/Equipment to replace the outdated 2012 Pathrunner.
- Provide support for the interdepartmental service agreement (ISA) with UMass Dartmouth for performance-related Balanced Mix Design and Pavement Profiler Certification.
- Perform annual maintenance and upgrades on the Pavement Friction Tester and Bumper Mounted Profilers.
- Issue a new Interdepartmental Service Agreement (ISA) with UMass Dartmouth for continued support Pavement Management activities including correlation of data collection equipment, performance testing of mixtures, EDC-6 TOPS technologies and implementation of HMA balanced mix design.
- Pilot EDC-6 Targeted Overlay Pavement Solutions in projects statewide.

Anticipated products:

- Reporting of pavement condition data for Interstate, State-Maintained and NHS roadways and data required for the Highway Performance Monitoring System (HPMS).
- Continued improvements to PMS predictive modeling and project selection tools.
- Continued support of MassDOT's Municipal pavement program for State Numbered Routes
- Upgrade of the SurPro rolling dipstick profiler utilized for certification of the QA roughness testing equipment.
- Finalize the purchase of new automated pavement data collection equipment.
- Perform calibration and certification on all equipment used for MassDOT ride quality project acceptance testing.
- Performance testing of High-Performance mixtures and piloting balanced mix design

- Produce an optimized multi-year program for the Interstate and NHS pavement construction and preservation programs.
- Acquire new maintenance and software upgrades for the Pavement Management sections pavement management database.
- Continue development of the web-based pavement management database software and regression analysis for different types of pavements.

Estimated task completion: Ongoing

Timeline for new consultant support: Pavement management modeling, forecasting & optimized project selection for the Capital Investment Plan (CIP)

- Consultant Name: Deighton Associates
- Scope development and FHWA review/approval: October 2021
- Consultant procurement and selection: November 2021
- Contract negotiations and FHWA review/approval: December 2021
- Consultant notice to proceed: January 2022
- Total duration of task: 12 months

Timeline for new consultant support: ISA for a balanced mixture design procedure, profilers certification, and related pavement materials testing activities. (extension pending)

- Consultant Name: UMass Dartmouth
- Scope development and FHWA review/approval: September 2017
- Consultant procurement and selection: September 2017
- Contract negotiations and FHWA review/approval: September 2017
- Consultant notice to proceed: April 2018
- Total duration of task: 40 months

Timeline for new consultant support: ISA for Pavement Management Services including Data Collection Equipment Certification/Correlation, HMA Mixture Performance Testing, Support for Balanced Mix Design Implementation and Related Activities.

- Consultant Name: UMass Dartmouth
- Scope development and FHWA review/approval: December 2021
- Consultant procurement and selection: January 2022
- Contract negotiations and FHWA review/approval: February 2022
- Consultant notice to proceed: April 2022
- Total duration of task: 40 Months

Estimated task budget: $2,992,416.00

Staff salaries and benefits: $773,651.00

MassDOT staff members	% time to task
Edmund Naras	100%
Mike Ecmecian	100%
Jonathan Smith	100%
William Guttierrez	100%
Cody Halemo	100%
Stefan Kargakis	100%
Patrick Lawlor	100%
Liz Cruz-Falero	100%
Steven Morin	100%

Consultant costs: $557,765

Subtask / contract #	Total cost:	Spending Pre-FFY 2022:	FFY 2022 spending:	Post FFY 2022 spending:	Consultant/Post -Contractor Name	Consultant NTP	Contract End Date
Pavement management modeling, forecasting & optimized project selection for the Capital Investment Plan (CIP) / TBD	$68,900	$0	$68,900	$68,900	Deighton Associates	January 2022	TBD
ISA for a balanced mixture design procedure, profilers certification and related pavement materials testing activities. (Extension pending) / 103589	$993,178	$604,313	$388,865	$0	UMass Dartmouth	April 2018	July 31 2021
ISA for Pavement Management Services including Data Collection Equipment Certification/Correlation, HMA Mixture Performance Testing, Support for Balanced Mix Design Implementation and Related Activities. / TBD	$900,000	$0	$100,000	$800,000	UMass Dartmouth	April 2022	TBD

Consultant notes:

Other costs: $1,661,000

Pavement Friction Tester annual maintenance and software upgrades ($21,000)
Bumper Mounted Profilers annual maintenance and software upgrades ($43,000)
Upgrade hardware & software for SurPro Rolling roughness equipment ($37,000)
Purchase new Automated Pavement Data condition collection system ($1,500,000)
Pavement Preservation TSP2 membership ($20,000)
Miscellaneous mechanical & electronic supplies and training ($40,000)

Statewide Traffic Data Collection

B.2 / Statewide Traffic Data Collection

Task lead: Carrie McInerney

Task purpose and need: The MassDOT Highway Division's Statewide Traffic Data Collection Section (STDC) is responsible for the development and maintenance of the Annual Traffic Data Collection Program. The program is designed in accordance with FHWA's Traffic Monitoring Guide (TMG), the AASHTO Guide for Statewide Traffic Data Collection Programs, and the Highway Performance Monitoring System (HPMS) guidelines. Traffic-derived travel data from the HPMS are used in the federal-aid highway fund apportionment formulae. Traffic data are critical to the analyses that support the Condition and Performance Reports to Congress, which are subsequently used for national highway budgeting purposes. HPMS-derived travel data are required to meet Clean Air Act requirements, and travel data are central to estimating several of MassDOT's performance indicators such as vehicle crash and fatality rates and delay.

In addition, the Statewide Traffic Data Collection (TDC) section provides traffic data for MassDOT's pavement, highway, and bridge design efforts. This includes pavement rehabilitation, construction, maintenance, construction staging and traffic management. Data gathered in support of the Department's program varies from single road tube automatic traffic recorder counts to intersection turning movements for traffic signal design and vehicle type classification for pavement design and environmental analyses (air quality and noise levels).

The Statewide Traffic Data Collection Group conducts an Annual Counting program. The program is modeled after FHWA's Traffic Monitoring Guide, AASHTO's Guidelines for Traffic Data Programs and, most importantly, the HPMS Field Manual. The annual program involves the systematic collection of traffic data utilizing automatic traffic recorders located on various roadways throughout the state. The Traffic Count Program consists primarily of four main components:

- Continuous Count Program
- Short Duration Count Program
- Special Count Program
- Bicycle/Micromobility/Pedestrian Count Program

Continuous Count Program
MassDOT owns and maintains a large network of in pavement permanent count stations across the state. The permanent count location data is uploaded either automatically through an ongoing telemetry upgrade project or through a manually retrieved and post processing operation. MassDOT is continually checking stations through regular maintenance activities, upgrading communications and equipment through our consultant contract and mainstreaming repair and new locations through capital construction projects. MassDOT is currently evaluating in-house resources who may be able to assist the TDC Group with repair activities in the future (will be a component of the requested Strategic Program Plan Upgrade described below).

Short Duration Count Program
A short duration traffic counting program is conducted each year by the Statewide Traffic Data Collection section of the MassDOT Highway Division in conjunction with local regional planning agencies. The TDC Group works closely with Regional Planning Authorities (RPAs) to upload their vehicular count data into the Traffic Count Database System.

Special Count Program
Upon request, MassDOT TDC Group installs and/or coordinates installation of short duration count technology to support various design projects and special projects and provides post processed data to both requestor and/or MassDOT Office of Transportation Planning.

Bicycle/Micro mobility/Pedestrian Count Program
MassDOT is committed to accommodating all road users and various modes of transportation. In 2021, MassDOT purchased and installed twelve bicycle and pedestrian counters at eight locations across the state, including intersections, roadways, and shared-use trails. MassDOT will build upon the success of the bicycle and pedestrian pilot program initiated in FFY21 SPR cycle and intends to install at least ten new bicycle and pedestrian count stations across the state. The goal is to standardize the collection of bicyclist and pedestrian count data, expand the scope of data collection to other parts of the state, and to continue populating our statewide traffic portal to create a more comprehensive network of counting sites. MassDOT will also work with Regional Planning Authorities (RPAs) to upload their bicycle and pedestrian count data into the newly purchased Non-Motorized Database System.

Current consultant supported subtasks:
- MS2 - Process, store, analyze and calculate all traffic data to deliver HPMS reports and PM3 metrics.
- TrafInfo - Statewide Telemetry Program and Bike/Ped Support Services.
- Miovision/PDI turning movement counts for special count program.

New consultant supported subtask:
- Statewide FREEVAL Model for Interstates and Other Expressways.

Accomplishments in prior year:
- The STDC program supported and monitored continuous count activities on a monthly basis, capturing class, volume and speed data to support FHWA requirements.
- Special counts were performed by request in which data is used by MassDOT staff on various levels (e.g., Design, Project, Pavement, Traffic Engineering, etc.) for planning and evaluation of highway conditions.
- All operational continuous count sites (432 out of 551) were monitored on a monthly basis. Monthly volume and classification data were uploaded to FHWA's web-based QC software, "Travel Monitoring Analysis System (TMAS) 2.8 for TVT, VMT and vehicle type reports. 24 special request studies were completed, which included 94 volume, 57 classification and 58 speed studies.
- 113 turning movement count (TMC) studies were completed.

- Additional continuous count sites were configured and are using telemetry for a total of 385 out of the 551 sites.
- Counted 291 out of 715 2020 Coverage Program count locations. The overall combined total counted in FFY21 Q1, Q2 and Q3 is 348.
- Counted a total of 366 ramps in FFY21 Q1, Q2 and Q3. There are a total of 459 locations in the Ramp Count Program per calendar year.
- Regional Planning Agencies (RPA) counted 132 of 223 assigned 2020 Coverage Program counts. In addition, they have completed 332 additional (special) counts to date and 25 turning movement counts (TMC).
- MassDOT completed evaluation of bicycle and pedestrian counter technologies.
- MassDOT installed twelve bicycle and pedestrian counters at eight locations across the state, including intersections, roadways, and shared-use trails and integrated them into the MS2 Traffic Data Portal NMDS Module.
- Developed and adopted a MassDOT standard specifications for bicycle and pedestrian portable and permanent count stations to be used in capital construction contracts to expand the bicycle and pedestrian count program.
- Initiated creation of a Master Service Agreement with pre-approved bicycle and pedestrian count vendors so all statewide agencies and partners can purchase equipment with negotiated prices.

In support of HPMS requirements:

- Submitted short term coverage program counts.
- Submitted continuous count station data.
- Submitted the updated FAADT per MS2 average daily traffic (ADT) calculations.
- Submitted updated 2021 percentage peak single units (SU) and combination units (CU) data for all samples per MS2 calculations.
- Submitted corrected K factor data for those samples where they are less than 4.5 and improved the K factors reported for future years and reviewed with MS2.
- Submitted data for all ramps for 2020 and completed 2020 ramp data submittal.
- Submitted travel summary table, including rural interstates in the SU and CU.

Proposed activities for this year:

- Vehicular Count Program: The focus of the STDC department is to continue telemetry upgrades to all the continuous permanent count stations, in which daily data studies of class, volume, and speed will be uploaded and processed through MS2, the application used to process all traffic studies by month. This approach will significantly reduce the delay in delivering the data to TMAS and the annual HPMS reports. Staff will include proper class portable counts on all functionally classified roadways including rural interstate roadways, which is a requirement of FHWA.
- Short Duration Count Program: The STDC Group will continue to collect short duration counts as required by federal and state requirements and continue to coordinate with Regional Planning Agencies (RPAs) on their required count programs.

- Special Count Program: The STDC Group will continue to complete special counts in support of MassDOT design contracts and other congestion and planning studies and initiatives.
- Bicycle/Micromobility/Pedestrian Count Program: MassDOT will build upon the success of the bicycle and pedestrian pilot program initiated in FFY21 SPR cycle and intends to install at least ten new bicycle and pedestrian count stations across the state. The goal is to standardize the collection of bicyclist and pedestrian count data, expand the scope of data collection to other parts of the state, and to continue populating our statewide traffic portal to create a more comprehensive network of counting sites. MassDOT will also work with Regional Planning Authorities (RPAs) to upload their bicycle and pedestrian count data into the newly purchased Non-Motorized Database System.
- Comprehensive Travel Monitoring Program Evaluation Update: The FHWA Traffic Monitoring Guide (TMG) recommends a comprehensive program evaluation of the comprehensive travel monitoring program every five years. MassDOT last completed a program evaluation in 2010. Due to upcoming revisions to the TMG scheduled in late 2021, the advancement of technology applications for permanent count stations, the initiation of the bicycle and pedestrian count program and recent and upcoming MassDOT personnel changes (retirements, attrition, etc.), MassDOT is requesting to complete an update to Strategic Plan for Massachusetts Statewide Traffic Data Collection and ITS Traffic Monitoring, March 2010.
- Support HPMS Reporting:
    - Submit the 2021 FAADT data.
    - Submit the 2021 percentage peak SU and CU data for all samples.
    - Submit data for collected ramp counts for 2021.
    - Vehicle miles traveled (VMT) weight HPMS summary data for future year's submittal.
    - Class factor portable class counts to properly annualize them.
    - Class factor from year to year for any non-current year data so the HPMS data for SU and CU AADT is properly part of the current year with each year's submittal.
    - Run all data through MS2 and quality control it before sending the data into TMAS.
- Weigh-in-Motion Program: MassDOT identified a need to focus on improving Weigh-In-Motion (WIM) stations, data and technology to further assist the Commercial Vehicle Enforcement Section and improve safety. Additional WIM data will assist with pavement management, bridge evaluations and bridge design. MassDOT needs to improve upon commercial motor vehicle inspection and weight data and will work towards meeting the goal of obtaining WIM data and providing FHWA and the Federal Motor Carrier Safety Administration (FMCSA) with necessary information. The intent of a new WIM Program would be to install additional WIM sensors in pavement where identified by internal MassDOT freight coordinator, MassDOT Permits Department and possibly Mass State Police Commercial Vehicle Enforcement Section.
- Statewide FREEVAL Model for Interstates and Other Expressways: MassDOT has identified a need to develop a statewide FREEVAL model for all Interstates and expressways. The FREEVAL software builds traffic flow profiles, which can be updated annually with permanent count station data,

to do a variety of analyses based on the Highway Capacity Manual. A statewide FREEVAL model would provide MassDOT with freeway planning-level capacity analyses for all major highway corridors for undersaturated and oversaturated conditions, assess conditions under managed lane scenarios (HOV, HOT, restricted/special use), and provide critical work zone impact assessments, including calculating travel time and queuing impacts related to lane closures, as well as other evaluations under various levels of traffic diversion.

Anticipated products:

- Clustering Analysis - Seasonal, axle and growth factor grouping.
- Short Count Assignment - Factor group assignment for all short count stations.
- HPMS Traffic Data Reporting:
  - HPMS Segment Traffic Table
  - HPMS Ramp Count Table
  - HPMS Traffic Meta Data
  - HPMS State Summary - Vehicle Type TableTravel Time Database System (TTDS):
  - HPMS 2021 Travel Time Metric Data
- Updated Strategic Plan for Massachusetts Statewide Traffic Data Collection and ITS Traffic Monitoring.
- Statewide FREEVAL model covering Interstate system and other expressways under MassDOT jurisdiction.

Estimated task completion: Ongoing - 75% complete

Timeline for new consultant support: TrafInfo - Statewide Telemetry Program and Bike/Ped Support Services.

- Consultant Name: TrafInfo Communications, Inc.
- Scope development and FHWA review/approval:
- Consultant procurement and selection:
- Contract negotiations and FHWA review/approval:
- Consultant notice to proceed: March 7, 2017
- Total duration of task: 60 months

Timeline for new consultant support: Statewide FREEVAL Model for Interstates and Other Expressways.

- Consultant Name: TBD
- Scope development and FHWA review/approval: October 2021
- Consultant procurement and selection: November 2021
- Contract negotiations and FHWA review/approval: December 2021
- Consultant notice to proceed: January 2022
- Total duration of task: 24 months

Estimated task budget: $3,220,614.00

Staff salaries and benefits: $778,114.00

MassDOT staff members	% time to task
Charles Young	100%
David Manktelow	100%
Lori Suss	100%
Robert Belcastro	100%
Stanley Lamb	100%
Tracy DeYoung	100%
Wayne Schofield Jr	100%
Corey OConner	20%
Ian Adams	100%
Neil Boudreau	5%
Carrie McInerney	50%
John Amato	100%
Steve ONeil	100%

Consultant costs: $950,000

Subtask / contract #	Total cost:	Spending Pre-FFY 2022:	FFY 2022 spending:	Post FFY 2022 spending:	Consultant/Post -Contractor Name	Consultant NTP	Contract End Date
Midwestern Software Solutions	$400,000	$0	$400,000	$0	Midwestern Software Solutions		TBD
Miovision (through PDI)	$130,000	$0	$130,000	$0	Miovision/Precision Data Industries		TBD
TrafInfo – Statewide Telemetry Program and Bike/Ped Support Services / 95857	$2,421,822	$1,231,822	$320,000	$870,000	TrafInfo Communications, Inc.	March 2017	March 06 2025
Statewide FREEVAL Model for Interstates and Other Expressways / TBD	$250,000	$0	$100,000	$150,000	TBD	January 2022	TBD

Consultant notes:

- Total FFY 22 Consultant Costs of $950,000
- MS2 Contract (Midwestern Software Solutions) and Miovision (through PDI) contracts are stand alone contracts that are renewed each year
- Current TrafInfo Contract end date is March 6, 2022. MassDOT is pursuing a streamlined contract through the A&E Board for a new 3 year contract with TrafInfo with an estimated contract amount of $1,057,000 (March 6, 2022 – March 5, 2025)
- Freeval Model Project not yet awarded

Other costs: $1,492,500

State Police details needed for traffic control and safety ($75,000).
Road tube clamps ($10,000).
Road Tube ($100,000).
Road Tube Tape ($10,000).
Miscellaneous supplies from Home Depot ($2,500).
Proposed purchase of Automatic Traffic Recorders (ATR) (Telemetry Project) ($200,000).
Verizon Wireless service for Wavetronix Smart Sensors, Co-located Stations and Telemetry Stations ($75,000).
Ameresco Solar Panels 60 Watt, 12V Solar Panel ($40,000).

15 AMP MPPT Charge Controller Prewired Assembly with Surge Option ($75,000).
Batteries for Telemetry Stations (Boston Battery) ($30,000).
Posts for solar panels (RoadSafe Traffic Systems) ($5,000).
Utilities ($15,000).
Modems and Antennas ($70,000)
Proposed purchase of TIRTL Light Based Non-Invasive Sensor for counting, vehicle classification and speed ($15,000 ea.) ($60,000)
Hilti Automatic Powder-Actuated Fastening Nail Gun Package, supply of shot and nails ($15,000)
Portable Sensor Trailer (PTS sensor trailers with modem, oversize solar panels and batteries $20,000 ea.) ($100,000)
(2) Ford F150 4X4 SuperCrew XLT (G) (White) ($45,000 each) (90,000)
Proposed Purchase of Bicycle and Pedestrian Counting Equipment ($125,000)
Licensing and Data Fees for New and Existing Bicycle and Pedestrian Counters ($15,000) (10) Wavetronix Smart Sensor HD ($8,000 ea.) ($80,000)
(10) repair of existing permanent count stations ($5,000 ea.) ($50,000)
(5) new WIM permanent count stations ($50,000 ea.) ($250,000)

Survey

B.3 / CORS Network Operation and Expansion

Task lead: John Anthony

Task purpose and need: Work under this task will involve managing the Continuously Operating Reference Station (CORS) Network and accompanying website as well as supporting MassDOT departments, other state agencies, municipalities, planners, GIS users, and the architectural and engineering community on the use of the CORS Network. The Survey Section endeavors to expand the MaCORS Network by identifying suitable locations for the construction of additional CORS stations to expand and enhance the network.

Accomplishments in prior year:

- Registered approximately 150 new subscribers for the CORS network in Q3 of FFY2021. We have so far registered approximately 425 new subscribers for FFY2021.
- With the design and permitting phases completed, we are on track to build the Martha's Vineyard CORS in Q4 of FFY2021.

Proposed activities for this year:

- Continue to register new subscribers to the CORS Network.
- Conduct a network adjustment to bring the Martha's Vineyard CORS into the MaCORS Network and eventually the NOAA CORS Network (NCN).
- Enter a new three-year CORS Network support contract that covers software and firmware upgrades, as well as extended warranties through CCPs (Customer Care Packages).

Anticipated products:

- An expansion to the CORS Network that now consists of 21 sites with the addition of the Martha's Vineyard CORS.
- With software upgrades occurring in Q4FFY2021, the CORS Network will be poised to reliably offer a full multi-constellation product containing signals from the US, Russian, European, and Chinese satellite systems.

Estimated task completion: September 2022

Timeline for new consultant support:

- Consultant Name: TBD
- Scope development and FHWA review/approval: December 2021
- Consultant procurement and selection: December 2021
- Contract negotiations and FHWA review/approval: December 2021
- Consultant notice to proceed: March 2022
- Total duration of task: three years

Estimated task budget: $512,453.00

Staff salaries and benefits: $111,953.00

MassDOT staff members	% time to task
John Anthony	13%
John Barnes	15%
Evanson Browne	60%
Jeff Bruce	10%
Mehdi Sadjady	10%

Consultant costs: $300,000

Subtask / contract #	Total cost:	Spending Pre-FFY 2022:	FFY 2022 spending:	Post FFY 2022 spending:	Consultant/Post -Contractor Name	Consultant NTP	Contract End Date
N/A / TBD	$300,000	$0	$300,000	$0	TBD	March 2022	TBD

Consultant notes:
The CORS Network software support will be procured through the existing ITS58 contract that MassDOT IT has.

Other costs: $100,500
Cable/Internet bills $25,500
Construction costs $75,000 (Construction will be performed through an existing MassDOT construction contract)

B.4 / Development and Training

Task lead: John Anthony

Task purpose and need: To participate in national, regional, and statewide boards and conferences that promote continued professional development and training relative to GPS and the use of MassDOT's CORS Network. Attendance at these meetings will promote and develop the statewide geodetic control network for statewide spatial data.

Accomplishments in prior year:

- The MassDOT Survey section did not attend any conferences or seminars relating to geospatial or location functions that required SPR funding.

Proposed activities for this year:

- Seek out and attend conferences and seminars relative to geospatial and location technologies that would be beneficial to MassDOT staff.

Anticipated products:

- N/A

Estimated task completion: September 2022
Estimated task budget: $9,809.00

Staff salaries and benefits: $4,809.00

MassDOT staff members	% time to task
John Anthony	4%

Other costs: $5,000 (Other costs include travel expenses to attend development and training events)

B.5 / Geodetic Surveys for Statewide Project Control

Task lead: John Anthony

Task purpose and need: The MassDOT Survey Section maintains a statewide network of permanent geodetic control markers that provide public and private surveyors access to the NAD 83/NAVD 88 horizontal and vertical geodetic survey control datums. The Survey Section utilizes these markers, in conjunction with the MassDOT CORS Network, to establish semi-permanent survey control stations on MassDOT bridge and roadway projects throughout the Commonwealth. NAD 83 and NAVD 88 are common and widely recognized geodetic datums. Their use for project control is essential to maintain consistency throughout the various phases of project planning, design, and construction. The network is also used by MassDOT's Office of Transportation Planning, MassGIS, private surveyors, and numerous municipal and state agencies for various engineering, surveying, and GIS application.

Accomplishments in prior year:

- Performed GPS observations and electronic bar-code leveling to establish NAD 83 and NAVD 88 project survey control for thirty-seven (37) bridge rehabilitation/reconstruction and highway reconstruction/improvement projects.
- Performed 2nd order electronic bar-coded leveling to establish ten (10) new NAVD 88 benchmarks. Additional leveling needs to be performed before adjustment; no new NAVD 88 benchmarks were published in FFY21.
- Performed one hundred and twenty-two (122) GNSS observations as part of NGS' GPS on Priority NGS Benchmarks program.
- Performed RTK GNSS observations on one hundred and sixty-six (166) aerial photo identifiable check points throughout Massachusetts as QA/QC for statewide orthoimagery recently acquired by MassGIS. The resulting positions were provided to MassGIS for analysis.

Proposed activities for this year:

- Continue ongoing surveys to maintain and densify the statewide network of horizontal and vertical control stations.
- Continue to set project controls for various bridge rehabilitation/reconstruction, highway reconstruction/improvement, and photogrammetric mapping projects.
- Continue GNSS observations on the Priority NGS Benchmarks program to facilitate the National Geodetic Survey's (NGS) development of new horizontal and vertical survey control datums.

Anticipated products:

- Updated control point database and data card file enabling the MassDOT survey control point website to publish newly established control to the public.
- Individual control reports for each MassDOT project to be distributed to end users.

Estimated task completion: September 2022
Estimated task budget: $417,322.00

Staff salaries and benefits: $417,322.00

MassDOT staff members	% time to task
John Anthony	24%
Michael Chouinard	20%
John Barnes	24%
Jeff Bruce	40%
Arben Zhuri	60%
Brian Knowles	60%
Leo Scanlon	60%
Michael Roberts	60%
Eugene Tivnan	60%
Mehdi Sadjady	40%

Other costs: $0

B.6 / GPS and Conventional Survey Equipment

Task lead: John Anthony

Task purpose and need: To maintain and service MassDOT's GPS and conventional survey equipment to ensure accurate data collection and efficient data transmission to users.

Accomplishments in prior year:

- Purchased mark setting equipment and incidental survey supplies for the MassDOT Survey field crew through our current three-year service/equipment contract.

Proposed activities for this year:

- This is an ongoing task that will allow the Survey Section to purchase field equipment and supplies, and service equipment as necessary.

Anticipated products:

- Incidental survey supplies such as batteries, cables, prisms, nails, markers, and other survey instruments as needed.

Estimated task completion: September 2022
Estimated task budget: $118,503.00

Staff salaries and benefits: $18,503.00

MassDOT staff members	% time to task
John Anthony	8%
John Barnes	8%

Other costs: $100,000. (This is an allocated amount for the purchase field equipment (batteries, cables, prisms, etc.) and supplies (stakes, nails, markers, paint, etc.), and service equipment as necessary)

Traffic Crash Records and Safety Management

B.7 / Improved Crash Data and Safety on Massachusetts Roadways

Task lead: Bonnie Polin

Task purpose and need: This work consists of improving data collection and dissemination through working with police, the Registry of Motor Vehicles (RMV), MassDOT's Office of Transportation Planning, and others to improve distribution efforts. MassDOT will work with consultants and MassDOT Information Technology (IT) to upgrade and improve data dissemination and assist with the development of an updated crash system so that an enhanced data-driven approach to safety can be utilized. Data-driven safety analysis will be required to reach the goal areas related to zero deaths and serious injuries. We then apply highway safety methodologies to define and refine projects and programs to reduce fatalities and serious injuries.

Consultant supported subtasks:

- Data Quality Assurance

Accomplishments in prior year:

- Completed the 4 new Safety Analysis Modules for IMPACT system (https://apps.impact.dot.state.ma.us/cdp/home). Two (Crash based and risk-based network screening) were added in March 2021 and two (Crash tree and Test of Proportions) in August 2021. Much of last year's work centered on development of the Safety Analysis Modules, publicizing materials, and providing training on it (including one with nearly 300 people from MassDOT, MPOs, locals, State and local police, advocates, researchers, and others.
- Used the IMPACT geocoding tool for crash location validation, editing, automated and operator-assisted geocoding, and roadway inventory matching (From October 1, 2020 through July 9, 2021 when this report was prepared - 84,692 were automatically geocoded and 16,992 were manually geocoded by MassDOT Highway Safety staff).
- Provided data quality information to the RMV, including monthly rejection reports, police agency reporting levels, etc., in an effort to improve the data quality of the crash system.
- Provided input for the preparation of an RFQ for the RMV's new Crash Data System
- Continued collecting and overseeing intersection data collection for Model Inventory of Roadway Elements (MIRE) Fundamental Data Elements (FDE) and collected nearly 98% of the eligible intersections. The remaining intersections waiting to be inventoried are those that have issues with the road file and are awaiting corrections before the intersection data can be entered.
- Working on Updating the 2018 Top Crash Locations Report. (Awaiting approval to post the report but the crash clusters are available)
- Participated in meetings and activities of the Traffic Records Coordinating Committee (TRCC), Executive TRCC and subcommittees.

- Updated Safety Performance Functions (SPFs) for 3 legged and 4 legged signalized and unsignalized intersections with the help of UMASS Lowell.
- Conducted road safety audits (RSAs) throughout the Commonwealth to identify issues and proposed recommendations so that data driven safety improvements can be made. Due to COVID-19, conducted virtual RSAs in an effort to continue the process. To date, we have conducted 28 RSAs (all virtual) and have begun in-person RSAs in July.
- Developed the alternative analysis guide and spreadsheet tool using Highway Safety manual predictive analysis and integrated this into the MassDOT ICE Policy.
- Rolled out the 2022 Highway Safety Improvement Program (HSIP), infrastructure projects were advertised, and data and other non-infrastructure projects were contracted.
- Prepared HSIP annual report.
- Promoted awareness on safety matters (developed social media, enhanced Scan the Street for Wheels and Feet campaign, and assisted Communications Group on safety messaging) including the Engineering Thursday tweets which generate a lot of engagements.
- Assisted with Every Day Counts (EDC) Crowdsourcing Initiative.
- Assisting with the validation of StreetLight microscopic level data in the hope that the information can be used in projects and analyses.
- Worked with FHWA to test out the Safe System for Intersection methodology. It was tested at two locations where there were no SPFs available for these irregular intersections.
- Collaboratively work internally with others in MassDOT to develop a Speed Management Policy (hoping to finalize at the end of this FFY).
- Develop HSIP Implementation Plan (well in progress as of July 7, 2021 but anticipate completion in September).
- Completed Road Safety Audits.

Proposed activities for this year:

- Additional trainings on IMPACT and begin collecting feedback on additional needs to further enhance the MA Safety Management System.
- Continue geocoding crashes and bringing them up to real time geocoding so that we can follow up with the police who prepared the crash report. This should also help to improve data quality.
- Continue providing data quality information to the RMV, including monthly rejection reports, police agency reporting levels, etc., in an effort to improve the data quality of the crash system. Finalize input on RMV's RFQ for a new Crash data System so that a new contractor is procured.
- Complete the collection of the intersection data collection for Model Inventory of Roadway Elements (MIRE) Fundamental Data Elements (FDE) after Planning corrects the road inventory line work and data.
- Prepare and disseminate the 2019 Top Crash Locations Report (and possibly 2020 report) and provide GIS crash clusters and updated top crash location segments.
- Continue participating in meetings and activities of the Traffic Records Coordinating Committee (TRCC), Executive TRCC and subcommittees.
- Continue developing SPFs so that HSM methodologies can be utilized.

- Conduct road safety audits (RSAs) throughout the Commonwealth to identify issues and propose recommendations so that data driven safety improvements can be made, whether in person or remote. We anticipate conducting over 40 RSAs.
- Put in place and publicize guidance on various aspects of the HSM (e.g., state-preferred CMS) and methodology to use HSM alternatives analyses to evaluate cost-benefits of preferred analyses from a safety standpoint.
- Roll out the 2022 HSIP program to include infrastructure projects and non-infrastructure projects and focus on systemic approaches (like the EDC initiatives for FoRRRwD and STEP) based on the results of the soon-to-be-completed HSIP Implementation Plan
- Prepare the HSIP annual report.
- Continue to assist with raising awareness of safety messaging.
- Assisted with Every Day Counts (EDC) Crowdsourcing Initiative.
- Continue assisting with the validation of StreetLight microscopic level data in the hope that the information can be used in projects and analyses.
- Continue working with Safe System Intersection analyses.
- Begin work on the update of the Strategic Highway Safety Plan based on a Safe System approach.

Anticipated products:
- Listing/plan to further enhance IMPACT Data quality reports for the RMV.
- Top crash locations reports and GIS layers of clusters and segments.
- Additional SPFs coordinating and linking road attributes for automatically- and manually- geocoded crashes.
- Framework for an updated SHSP 2023-2027 HSIP Program.

Estimated task completion: ongoing

Timeline for new consultant support: Data Quality Assurance
- Consultant Name: Trillium
- Scope development and FHWA review/approval: September 2021
- Consultant procurement and selection: September 2021
- Contract negotiations and FHWA review/approval: September 2021
- Consultant notice to proceed: October 2021
- Total duration of task: ongoing renewed every year

Timeline for new consultant support: Select
- Consultant Name: TBD
- Scope development and FHWA review/approval: September 2021
- Consultant procurement and selection: October 2021
- Contract negotiations and FHWA review/approval: November 2021
- Consultant notice to proceed: December 2021
- Total duration of task: 21 months

Estimated task budget: $1,306,488.00

Staff salaries and benefits: $935,798.00

MassDOT staff members	% time to task
Bonnie Polin	90%
Contracted Student Intern	90%
Contracted Student Intern	90%
Ana Fill	90%
Dakota DelSignore	90%
Jennifer Inzana	90%
Kevin Fitzgerald	90%
Jonathan Brown	90%
Kirsten Johnson	90%
Michelle Deng	90%
Richard Conard	90%
Stacey Schwartz	90%
Rosalynd Scott	90%
Contracted Student Intern	90%
Contracted Student Intern	90%

Consultant costs: $370,690

Subtask / contract #	Total cost:	Spending Pre-FFY 2022:	FFY 2022 spending:	Post FFY 2022 spending:	Consultant/Post -Contractor Name	Consultant NTP	Contract End Date
Data Quality Assurance / 100725	$614,606	$455,916	$120,690	$38,000	Trillium	October 2021	December 31 2021
N/A / TBD	$500,000	$0	$250,000	$250,000	TBD	December 2021	TBD

Consultant notes:
Two contracts. One is renewed every year (100725). The second contract is new and will be used to develop MA specific SPFs or to calibrate to the Highway Safety Manual. We are in the process of prioritizing our needs so we can decide which SPFs to develop this coming year with the help of a consultant. Once I have that priority list complete, I will work on developing a scope of work and procuring a contract (using our streamlined process).

Other costs: $0

B.8 / Prevent and Minimize Risks to MassDOT Staff and Workers on the Roadways

Task lead: Bonnie Polin

Task purpose and need: Work is required to manage known and preventable risks to MassDOT employees and those working on the roadways by setting, communicating, and following safety standards to achieve our goal of zero fatalities and injuries.

Accomplishments in prior year:

- As of the date of this preparation (July 9th), work was just beginning on the assessment preparation. The bulk of the work will take place in the end of July, August and early September. Work Zone safety Assessments will be done in each district.

Proposed activities for this year:

- Continue to research and support work zone safety initiatives through participation in the Work Zone Technical Committee as part of the AASHTO Subcommittee on Traffic Engineering (SCOTE) and National Committee on Uniform Traffic Control Devices (NCUTCD).
- Perform Work Zone Safety Assessments (two per MassDOT District). This is anticipated to take place in end of July, August and September 2021 pending restrictions related to COVID-19.
- Continue involvement in the Strategic Highway Safety Plan (SHSP) emphasis area of Safety of Workers on the Roadways.
- Work with Highway Operations Center and FHWA on the Every Day Counts (EDC) crowdsourcing initiative. This will help with incident response and minimize exposure to workers on the roadways.

Anticipated products:

- 12 Work Zone Safety Assessments.

Estimated task completion: September 2022
Estimated task budget: $25,827.00

Staff salaries and benefits: $25,827.00

MassDOT staff members	% time to task
Corey OConner	5%
Fangyun Xi	5%
Ian Adams	5%
Kevin Chiang	5%
Noah Thompson	5%
Buu Tran	5%
Chris Falcos	5%

Other costs: $0

B.9 / Training of MassDOT Staff to Keep Current and Cutting Edge

Task lead: Bonnie Polin

Task purpose and need: This task includes training for MassDOT staff with the intention of keeping up with the latest practices in highway safety to effectively reduce fatalities and injuries on Massachusetts' roadways.

Accomplishments in prior year:

- Attended the Transportation Research Board (TRB) Annual Meeting, FHWA Peer Exchanges, and the AASHTO Committee on Safety and other AASHTO related meetings
- Served as panel members for National Cooperative Highway Research Program (NCHRP) studies.
- Trained other staff members on HSM methodologies and data driven safety analyses and other trainings to further the efforts to reduce fatalities and injuries

Proposed activities for this year:

- Attend the TRB Annual Meeting, FHWA Peer Exchanges, and the AASHTO Committee on Safety and other meetings
- Participate in NCHRP panels on safety research.
- MassDOT staff will avail themselves of training, as needed and as provided given restrictions related to COVID-19. (May be virtual or in person)

Anticipated products:

Better trained employees who can push new methodologies to reduce fatalities and injuries

Estimated task completion: ongoing
Estimated task budget: $60,489.00

Staff salaries and benefits: $48,489.00

MassDOT staff members	% time to task
Bonnie Polin	5%
Ana Fill	5%
Jennifer Inzana	5%
Richard Conard	5%
Michelle Deng	5%
Kevin Fitzgerald	5%
Dakota DelSignore	5%
Jonathan Brown	5%
Stacey Schwartz	5%
Kirsten Johnson	5%
Neil Boudreau	5%

Other costs: $12,000 (This is for travel cost of TRB and potentially AASHTO or National Committee Meeting, assuming they will meet in person).

Financial Tables

SPR I Part A

Task	PARS #	Staff cost	Consultant cost	Other cost	Total task cost
A.1 / Administration and SPR Coordination	TBD	$709,357	$0	$453,741	$1,163,098
A.2 / Capital Planning Development and Coordination	TBD	$89,808	$0	$0	$89,808
A.3 / GIS Coordination	TBD	$183,193	$0	$0	$183,193
A.4 / GIS Platform Development	TBD	$274,518	$1,234,073	$1,707,300	$3,215,891
A.5 / GIS Services	TBD	$25,644	$0	$0	$25,644
A.6 / Highway Performance Monitoring System (HPMS)	TBD	$65,548	$0	$0	$65,548
A.7 / Inventory Data Management	TBD	$155,683	$0	$0	$155,683
A.8 / Travel Forecasting, Data Collection & Transportation System Performance	TBD	$54,939	$1,715,957	$5,000	$1,775,896
A.9 / Implementation of Federal Programs and Regulations	TBD	$48,984	$0	$0	$48,984
A.10 / Metropolitan Planning Support and Oversight	TBD	$103,756	$0	$0	$103,756
A.11 / State Transportation Improvement Program Coordination and Capital Planning Support	TBD	$73,707	$0	$0	$73,707
A.12 / Statewide Long Range Transportation Plan	TBD	$74,744	$1,121,133	$0	$1,195,877
A.13 / Bicycle and Pedestrian Planning	TBD	$95,845	$0	$0	$95,845
A.14 / Corridor Planning Studies	TBD	$216,711	$949,702	$0	$1,166,413
A.15 / Freight Planning	TBD	$21,476	$340,000	$0	$361,476
A.16 / On-Call Contracts	TBD	$8,717	$1,430,500	$0	$1,439,217
A.17 / Access Management Through Development Review and Land Disposition	TBD	$21,545	$0	$0	$21,545
A.18 / Coordination and Consultation with Developers and Project Stakeholders	TBD	$16,158	$0	$0	$16,158
A.19 / Development Review through the MEPA and MassDOT Access Permit Processes	TBD	$32,317	$0	$0	$32,317
A.20 / MassDOT Policies Supported and Incorporated in Inter-Agency Objectives	TBD	$21,545	$0	$0	$21,545
A.21 / Mitigation, Transportation Demand Management, and Monitoring Programs for Development Projects	TBD	$16,158	$0	$0	$16,158
A.22 / GHG Mitigation Analysis, Research, Guidance & Regulatory Requirements	TBD	$98,702	$0	$0	$98,702
A.23 / Climate Adaptation Vulnerability Assessment	TBD	$75,034	$1,810,333	$0	$1,885,367
A.24 / Low Emissions Vehicles, Fuels and Infrastructure	TBD	$27,003	$0	$0	$27,003
A.25 / Post-COVID-19 Teleworking Study	TBD	$58,902	$663,961	$0	$722,863
A.26 / Bus Network Redesign	TBD	$66,421	$610,355	$0	$676,776
A.27 / Exploring the Connection Between Bus Trips and Other Modes	TBD	$36,812	$184,603	$0	$221,415
A.28 / Green Line Corridor Capacity Study	TBD	$6,918	$89,369	$0	$96,287
A.29 / Development Mitigation Methodology	TBD	$18,406	$150,000	$0	$168,406
A.30 / MBTA Fare Review	TBD	$18,406	$250,000	$0	$268,406

SPR I Part B

Task	PARS #	Staff cost	Consultant cost	Other cost	Total task cost
B.1 / Statewide Pavement Management Activities	TBD	$773,651	$557,765	$1,661,000	$2,992,416
B.2 / Statewide Traffic Data Collection	TBD	$778,114	$950,000	$1,492,500	$3,220,614
B.3 / CORS Network Operation and Expansion	TBD	$111,953	$300,000	$100,500	$512,453
B.4 / Development and Training	TBD	$4,809	$0	$5,000	$9,809
B.5 / Geodetic Surveys for Statewide Project Control	TBD	$417,322	$0	$0	$417,322
B.6 / GPS and Conventional Survey Equipment	TBD	$18,503	$0	$100,000	$118,503
B.7 / Improved Crash Data and Safety on Massachusetts Roadways	TBD	$935,798	$370,690	$0	$1,306,488
B.8 / Prevent and Minimize Risks to MassDOT Staff and Workers on the Roadways	TBD	$25,827	$0	$0	$25,827
B.9 / Training of MassDOT Staff to Keep Current and Cutting Edge	TBD	$48,489	$0	$12,000	$60,489

Totals

Task	Staff cost	Consultant cost	Other cost	Total task cost
SPR I Part A Total	$2,716,957	$10,569,986	$2,166,041	$15,452,984
SPR I Part B Total	$3,114,466	$2,178,455	$3,371,000	$8,663,921
SPR I Parts A and B totals	$5,831,423	$12,748,441	$5,537,041	$24,116,905

The SPR will be monitored throughout the year to determine if an amendment to the STIP is necessary to ensure adequate funding. The SPR I is 75% of the overall program, meeting the 75% maximum threshold.

2022
State Planning and Research Program II

Table of Contents

Office of Transportation Planning

David Mohler, Executive Director	**Steve Woelfel**, Deputy Executive Director	**Bob Frey**, Director of Project-Oriented Planning	**Ethan Britland**, Manager of Multimodal Planning	Peter Sutton
				Makaela Niles
				Vacant (to be filled)
			Lionel Lucien, Manager of Public Private Development	Vacant (to be filled)
		Kevin Lopes, Director of GIS Services		David Dinocco
				Michael McGill
				Jose Simo
				Argenis Sosa
				Manny Zotos
				Sudip Paudel
				Charles Major
			Derek Krevat, Manager of MPO Activities	Derek Shooster
				Chris Klem
				Vacant (to be filled)
			Jules Williams, Manager of Sustainable Transportation	Max Natanagara
				Vacant (to be filled)
			Hongyan (Lily) Oliver, Manager of Research	Nicholas Zavolas
				Patrick McMahon
				Michael Flanary
				Drew Pflaumer
			Caroline Vanasse, Manager of Transit Planning	Doug Johnson
				Vacant (to be filled)
		Liz Williams, Director of Data and Policy		
		Michelle Ho, Director of Capital Planning	**Maria Ramirez**, Manager of Administration	
				Susan Reppucci

Research

A. Research Program Development, Administration, and Implementation

Task lead: Hongyan Oliver

Task purpose and need: To provide oversight and administration of the research program, conduct internal and external outreach activities, and manage associated contracts. The Research Section's work includes conducting research problem statement (RPS) solicitations; organizing RPS evaluation and selection; procuring and administering research contracts; and tracking project performance and implementation efforts and impacts. Please see Appendix A for the FFY21 Problem Statement Solicitation Form, where implementation is emphasized.

Accomplishments in prior year:

- Engaged in multiple pre-Interdepartmental Service Agreement (ISA) coordination efforts between principal investigators (PI) and project champions (PC).
- Procured and/or administered 30 service agreements (and contracts) with research entities.
- Performed project development and management for 35 research projects.
- Conducted four research roundtables to connect MassDOT personnel with researchers and two internal information sessions during the 2021 solicitation period.
- Received 33 new problem statements (the FFY22 Problem Statement Solicitation Form shown as Attachment A).
- Coordinated the review and prioritization of statements for new FFY22 projects.
- Coordinated initial scoping and PI identification for the FFY22 research projects.
- Produced FFY20 Research Annual Report.
- Produced MassDOT Research Quarterly Newsletters.
- Updated MassDOT research website with new contents regularly.
- Conducted semi-structured interviews with project champions for three projects completed in 2020 to understand how research results have been utilized and implemented.
- Prepared quarterly reports on the status of research and training programs.
- Compiled materials for updating the Research Manual.

Proposed activities for this year:

- Continue providing the management of research contracts and agreements.
- Continue research project management.
- Prepare quarterly reports on the status of research and training programs.
- Update MassDOT Research Section website regularly.
- Produce FFY21 Research Annual Report.
- Produce MassDOT Research Quarterly Newsletters.
- Continue tracking research project performance, implementation and impacts.

- Track equipment purchased with research funds.
- Consult with relevant MassDOT Sections and FHWA on the MassDOT Research Manual updates.

Anticipated products:

- Executed ISAs and contracts.
- Quarterly reports.
- Final draft of the updated Research Manual.
- Regular updating of the Research & Technology Transfer website.
- Research Annual Report.
- Research Quarterly Newsletters
- Improved research processes for increased effectiveness and better communication of research value.

Estimated task completion: Ongoing
Estimated task budget: $82,213.00

Staff salaries and benefits: $82,213.00

MassDOT staff members	% time to task
Hongyan Oliver	20%
Nicholas Zavolas	20%
Patrick McMahon	20%
Michael Flanary	20%
Drew Pflaumer	20%

Other costs: $0

B. Massachusetts Cooperative Research Program (MCRP)

Task lead: Hongyan Oliver

Task purpose and need: MassDOT contracted with the University of Massachusetts Transportation Center (UMTC) at UMass Amherst to provide research, training, and technology transfer services through one integrated Interdepartmental Service Agreement (ISA) for FFY20-22. There are three components to the 3-year ISA: MCRP (Task B), LTAP (Task C), and MTS (Task D). Through the MCRP component, the Research Section directs, coordinates, and oversees UMTC to provide research support and conducting tasks as requested.

MCRP's services fall into five categories:

a) **Literature searches and reviews**: Perform literature and information searches and syntheses at the Research Section's request.

b) **Research subtasks**: Perform quick-turnaround subtasks to address MassDOT's imminent research needs. These subtasks can typically be completed in under 12 months (including a 3-month final product review and acceptance period) with a cost less than $100,000, and carried out by researchers with matching expertise (principal investigators) within the UMass system, but not by UMTC staff directly funded under the ISA.

c) **Research project support**: Assist MassDOT during the annual problem statement solicitation process; identify potential principal investigators (PI) with expertise matching specific research needs; help with scope of work development; ensure quality control (final copy-editing and 508 compliance of all research final reports); and submit final reports to Transportation Research International Documentation (TRID), National Transportation Library and other national transportation research record repositories.

d) **Research collaboration and outreach support**: Assist MassDOT with the National Cooperative Highway Research Program (NCHRP) problem statement review process, the New England Transportation Consortium research problem statement solicitation, the research annual report, the AASHTO Research RAC 2022 summer meeting logistics, and other activities as needed.

e) **Research project administration**: Provide fiscal and procedural administration for all research projects managed through UMTC including invoicing, template developments/updating, accounting, orientation/training, and on-demand activities. Provide advice to other state universities on how to administrate ISAs with MassDOT.

Under Category B, MassDOT intends to conduct 6-8 research subtasks during FFY22 through the UMTC ISA to address research problems and needs. Some of the subtasks are generated from the annual research problem statement solicitation process and some may be selected outside of that process. The second type of research subtasks will depend on the emerging agency needs and may include technical assistance in implementing completed research. The Research Section works with MassDOT project champions to identify the suitable principal investigators for each of the subtasks based on researcher expertise and anticipated completion dates, and assists with the development of scopes, budgets and schedules for these projects. MassDOT will coordinate with and request FHWA's approval of the scopes and budgets prior to the issuance of any research subtasks.

Subtasks:

MCRP
Currently planned MCRP research subtasks for FFY22 include:

B.4. Synthesis study: Best Practices for Designer Cost Recoveries (Continuing Research Subtask): Final report is to be accepted by FHWA and the 508 compliant report will be published on MassDOT Research website. Anticipated duration: 9 months. Anticipated costs in FFY22: $6,767.

B.6. Automated Guardrail Inventory and Condition Evaluation (Continuing Research Subtask): The final report will be completed and submitted to FHWA for review and acceptance. The 508 compliant report will be published on MassDOT Research website. Anticipated duration: 12 months. Anticipated costs for FFY22: $55,458. Project total costs: $100,000.

B.7. Construction & Materials Best Practice for Concrete Sidewalks Phase II (Continuing Research Subtask): Phase II investigate concrete placed in hot weather and continue to monitor the performance of the concreted placed in Phase I. that were not included in Phase I but may also be also critical in triggering concrete scaling. Anticipated duration: 15 months. Anticipated costs for FFY22: $204,766. Project total costs: $250,000.

B.8. Evaluating the Safety Impacts of Flashing Yellow Permissive Left-Turn Indications in Massachusetts: Approach Level Analysis (FFY22 New Subtask): Approach Level Analysis (FFY22 new research task): Despite the safety contributions from the previous MassDOT FYA study, there were noticeable difficulties in assigning approach-level crashes to each of the signalized intersections. This extension will utilize the previously developed FYA crash database to focus on understanding the intersection infrastructure elements and their respective impacts on driver behavior. It will aim at evaluating the before/after crashes of these FYA intersections from the approach-level to better understand the safety impacts of the LT permissive FYA signal. The advancement of these crash data analytics, methodologies, and applications will continue to remain

important in years to come and will increase safety by providing an increased understanding of conflict risk at signalized intersections involving this novel traffic control device. Anticipated duration: 15 months. Anticipated costs in FFY22: $100,000.

Additional subtasks will be developed based on emerging needs and be issued with FHWA's approval; such subtasks may include technical assistance in implementing completed research.

Accomplishments in prior year:

- Initiated and administrated four research subtasks:

  B.1. Construction & Materials Best Practice for Concrete Sidewalks Phase I:
  The final report was accepted by FHWA. The 508 compliant final report and Research Summary was posted on MassDOT Research website and submitted to the National Transportation Library and the Transportation Research Index Database (TRID). This subtask is 100% completed.

  B.2. Evaluating the Safety Impacts of Flashing Yellow Permissive Left-Turn Indications in Massachusetts: The final report was accepted by FHWA. The 508 compliant final report and Research Summary was posted on MassDOT Research website and submitted to the National Transportation Library and the Transportation Research Index Database (TRID). This subtask is 100% completed.

  B.3. Moved to Task E as E.8.

  B.4. Synthesis study: Best Practices for Designer Cost Recoveries. The SOW was approved by FHWA and the NTP was issued in FY2021 Q2. Project draft final report is anticipated to be submitted to FHWA for review in FY2021 Q4. This subtask is 85% completed.

  B.5. Removed per the MassDOT's champion's request.

  B.6. Automated Guardrail Inventory and Condition Evaluation. The SOW was approved by FHWA and the NTP was issued in FY2021 Q2. The research team collected field data, developed and validated algorithm, created geo-referenced guardrail inventory and condition database for the selected road sections. The project final report will be submitted to FHWA in FY22 Q1. This subtask is 50% completed.

  B.7. Construction & Materials Best Practice for Concrete Sidewalks Phase II. The NTP was issued, and the kickoff meeting took place in FY2021 Q4. Concrete sidewalk sections were placed for hot weather

concrete curing and durability experiment component. The project is 20% complete.

Conducted literature review per MassDOT's requests on two topics:
- Alternative modeling approach for project-level planning.
- Impacts of managed lanes on adjacent/parallel non-tolled or general-purpose lanes (GPLs), in terms of travel times and congestion.

- Assisted with 2021 MassDOT Research Problem Statement solicitation (for FFY22).
- Assisted with research solicitation outreach materials and hosted the outreach sessions.
- Conducted literature searches for 33 received problem statements.
- Drafted brief project statements for the final list of FFY21 projects to initiate PI identification process.
- Assisted with PI Interest Statement solicitation.
- Facilitated dialogues between the Affiliate network/academic researchers and MassDOT practitioners.
- Maintained the network of the transportation affiliated researchers.
- Conducted literature search on carbon-neutral fuels, transportation equity and innovation at MassDOT staff's request.

Proposed activities for this year:
- Continue to provide research services in the categories listed above.
- Complete the three existing research subtasks listed above.
- Initiate and perform up to 5 new research subtasks under MCRP's Services (Category B above).
- Assist Research Section in preparing FY21 Research Annual Report.
- Assist Research Section in preparing FY22 quarterly updates.
- Assist Research Section in hosting 2022 AASHTO RAC Summer Meeting.

Anticipated products:
- Delivery of research subtask interim and final reports.
- Delivery of monthly and quarterly reports
- Delivery of 2021 Research Annual Report
- Delivery of other research services as requested by the MassDOT Research Section.
- Coordination and logistical support for the AASHTO RAC next in-person (2022) summer meeting, which MassDOT committed to host in 2019. The in-person meeting was rescheduled for the summer of 2022 due to COVID-19 impact.

Estimated task completion: September, 2022

Timeline for consultant support: MCRP
- Consultant Name: UMass Amherst

- Scope development and FHWA review/approval: Previously completed
- Consultant procurement and selection: Previously completed
- Contract negotiations and FHWA review/approval: Previously completed
- Consultant notice to proceed: Previously completed
- Total duration of task: 36 months

Estimated task budget: $1,303,109.00

Staff salaries and benefits: $37,204.00

MassDOT staff members	% time to task
Nicholas Zavolas	10%
Hongyan Oliver	15%
Michael Flanary	10%
Drew Pflaumer	10%

Consultant costs: $1,265,905

Subtask / contract #	Total cost:	Spending Pre-FFY 2022:	FFY 2022 spending:	Post FFY 2022 spending:	Consultant/Post-Contractor Name	Consultant NTP	Contract End Date
MCRP / 109600	$3,717,617	$1,795,333	$1,265,905	$656,379	UMass Amherst	Previously completed	September, 30 2022

Consultant notes:
Note: MassDOT may consider requesting a NCTE for the UMTC ISA to allow UMass to continue providing services as stipulated in the ISA for another 12 months.

Other costs: $0

C. Local Technical Assistance Program (LTAP)

Task lead: Hongyan Oliver

Task purpose and need: MassDOT contracted with the University of Massachusetts Transportation Center (UMTC) at UMass Amherst to provide research, training, and technology transfer services through one integrated Interdepartmental Service Agreement for FFY20-22. There are three components to the 3-year ISA: MCRP (Task B), LTAP (Task C), and MTS (Task D). Baystate Roads is the longstanding program name for Massachusetts LTAP, and it serves as a conduit for information transfer on technologies, best practices, and methodologies for operating, maintaining, and managing municipal departments of public works and highway departments throughout the Commonwealth. The program also serves as an efficient communications network, by which MassDOT transfers policy information, engineering directives, program funding, and other updates to the 351 municipalities in Massachusetts. Please see Appendix B for FFY22 LTAP Training Plan.

Subtasks:

- LTAP

Accomplishments in prior year:

- The Local Technical Assistance Program (LTAP) expanded its COVID training response with a variety of additional fully remote options. Major accomplishments to date, with estimated Quarter 4 trainings scheduled, provided 115 classes attended by about 2,890 participants in total. The participants represented 86% (302) of Commonwealth communities. These trainings are summarized below (including scheduled sessions for Q4):

  Stump the Instructor Webinars:
  - A Sign of the Times
  - Backhoe and Equipment Maintenance
  - Better Mouse Traps
  - Chainsaw 101
  - Chainsaw 102
  - CMV/CDL new requirements are coming!
  - Don't Go in the Hole
  - From Dust to Ditches, Crowns to Cobble Stones and Everything in Between
  - Got Mud?
  - How is the weather in Sudbury?
  - How to Deal with Difficult People
  - How to Hire Qualified People
  - Lexington Pavement Management Excellence
  - Live Chainsaw Demo
  - MA Hoisting Engineer Regulations and Questions

- New England Road Talk: A Different Approach to Virtual Education and Training
- Pavement Markings
- Porous Pavement Do's & Don'ts
- Road Resources
- Roadway Slope Stabilization Innovative Solutions
- Social Media as Easy as 1, 2, 3
- Spotted Lanternfly and Other Invasive Insects in Massachusetts
- To Pre-treat or Not to Pre-treat?
- Trench Safety Stand Down
- What's Dripping from that Truck?
- What Is That White Stuff?
- Work Zone Safety

Virtual Instructor-led Classes:

- All About Liquids
- Asphalt Inspection Best Practices
- Asphalt Project Estimating
- Best Practices for Beaver Management
- Complete Streets 201: Designing Your Streets for People (3)
- Complete Streets 303: Bicycle/pedestrian Network Planning
- Complete Streets 304: Traffic Calming Design
- Complete Streets 305: Workshop Design
- Complete Streets 306: Public Engagement
- Drainage Roadway Maintenance and Reconstruction
- Elements and Maintenance of Back Road Drainage
- Invasive Species
- MaPIT 3.0
- Municipal Operating Budget
- NHI 133121V Traffic Signal Design and Operation
- NHI 131139V Constructing and Inspecting Asphalt Paving Projects
- OSHA 10
- Pavement Markings: Use, Application, Compliance and Materials
- Roundabout Series
- Snow and Ice Operations for Front Line Employees
- Snow and Ice Operations for Supervisors
- Street Tree Essentials
- Stormwater System Maintenance and Green Infrastructure Retrofitting in MA
- Succession Planning
- Using MaPIT for Chapter 90
- Woodchipper Safety
- Work Zone Safety

Blended Learning (Self-paced + virtual instructor-led class)

- Confined Space
- Flagger/1st Aid
- Grader Operator
- Pavement Preservation: Right Treatment, Right Time, Right Road
- Sign Installation & Maintenance
- Spreader Calibration

Online Self-paced Classes

- Class A CDL Program
- Class B CDL Program
- Online Traffic Signal Warrants: How to Perform, Assess, and Satisfy the Requirements of Each

On-Demand Videos

- Auto Stop-Start Engine Function
- Developing a Traffic Management Plan
- Leadership Series
- Tailgate Training Lock Out/Tag Out
- Transportation Applications of LiDAR
- Transportation Take-Away
- Traffic Safety Impacts of COVID-19

- Developed, planned, and delivered the virtual 2020 Moving Together Conference with 1,286 people registered for the conference, featuring 30 breakout sessions highlighting current pedestrian, bicyclist, and public transportation topics.
- Developed, planned, and delivered the virtual 2021 MassDOT Transportation Innovation Conference featuring 30 breakout sessions, covering topics related to the five program tracks: Practices in Municipal and Regional Transportation; Mobility, Accessibility, and Transportation Equity; Techniques in Design, Materials, & Construction; Promoting a Culture of Safe Transportation; Shaping Transportation in a Post Covid World. A total of 1,051 individuals registered, including staff from 17 state departments of transportations and multiple federal agencies.
- Conducted training impact evaluations on selected classes.
- Hosted two LTAP Advisory Board meetings.
- Developed four job-aids on selected topics for municipal DPWs.
- Provided monthly and quarterly reports.
- Published quarterly LTAP M3 newsletters.
- Updated LTAP website frequently to disseminate information.
- Conducted and evaluated FFY22 LTAP training needs survey.
- Developed Draft FFY22 LTAP Training Plan.

Proposed activities for this year:

- Continue to prepare, coordinate, and deliver training classes to municipalities per the FFY22 training plan (Attachment B), and yet be flexible to accommodate evolving, critical municipal needs and to follow MassDOT's guidance.
- Continue to expand and deliver online training and information sharing videos.
- Develop, plan, and deliver the 2021 Moving Together Conference in fall 2021.
- Develop, plan, and deliver the 2022 Transportation Innovation Conference in spring 2022.
- Continue to develop and implement suitable approaches to evaluate training effectiveness.

Anticipated products:

- Delivery of at least 100 virtual or in-person training sessions throughout the state.
- Delivery of the 2021 Moving Together Conference.
- Delivery of the 2022 Transportation Innovation Conference.
- Advisory Board meetings.
- Quarterly M3 newsletters.
- Updates to and maintenance of LTAP website.
- Training and conference feedback surveys and summaries.
- Monthly and quarterly reports on LTAP training activities.
- Draft FFY23 LTAP Training Plan.

Estimated task completion: September, 2022

Timeline for consultant support: LTAP

- Consultant Name: UMass Amherst
- Scope development and FHWA review/approval: Previously completed
- Consultant procurement and selection: Previously completed
- Contract negotiations and FHWA review/approval: Previously completed
- Consultant notice to proceed: September, 2019
- Total duration of task: 36 months

Estimated task budget: $1,665,495.00

Staff salaries and benefits: $15,364.00

MassDOT staff members	% time to task
Michael Flanary	5%
Drew Pflaumer	5%
Hongyan Oliver	10%

Consultant costs: $1,650,131

Subtask / contract #	Total cost:	Spending Pre-FFY 2022:	FFY 2022 spending:	Post FFY 2022 spending:	Consultant/Post-Contractor Name	Consultant NTP	Contract End Date
LTAP / 109600	$4,748,525	$2,375,464	$1,650,131	$722,930	UMass Amherst	September 2019	September, 30 2022

Consultant notes:
Note: MassDOT may consider requesting a NCTE for the UMTC ISA to allow UMass to continue providing services as stipulated in the ISA for another 12 months.
Other costs: $0

D. MassDOT Training Services (MTS)

Task lead: Hongyan Oliver

Task purpose and need: MassDOT contracted with the University of Massachusetts Transportation Center (UMTC) at UMass Amherst to provide research, training, and technology transfer services through one integrated Interdepartmental Service Agreement for FFY20-22. There are three components to the 3-year ISA: MCRP (Task B), LTAP (Task C), and MTS (Task D). Training Services (MTS) assist MassDOT in developing and implementing an annual plan to provide essential and high-quality technical training to MassDOT employees with a focus on the Highway Division. Through this component, MassDOT coordinates, directs, and oversees the UMTC training team as it provides training classes requested by MassDOT's Highway Division to its staff throughout the state. Please see Appendix C for FFY22 MTS Training Plan.

Subtasks:

- MTS

Accomplishments in prior year:

- MassDOT Training Services continued a COVID 19 transition, successfully presenting a variety of training topics via a variety of remote training environments. Trainings were offered through a virtual format (live-streamed through a variety of platforms), a blended learning approach, combining self-paced online modules and live streamed sessions, webinars, and on-demand video options. Information on training provided by other sources, but relevant to the MTS annual training plan were also provided.
- MTS provided 23 individual classes including 82 sessions and over 1,900 attendees. Individual classes are listed below (including scheduled sessions for Q4):

    - BridgeSight PG Super Software Training
    - Bucket Truck Operation & Safety
    - Chainsaw Maintenance
    - Chainsaw Safety & Storm Damage Awareness
    - Confined Space Training
    - FHWA NHI 130053 Bridge Inspection Refresher
    - FHWA NHI 133121V Traffic Signal Design & Operation
    - FHWA NHI 133139V Constructing and Inspecting Asphalt Paving Projects
    - FHWA NHI 134006V Utility Coordination
    - FHWA NHI 134001V Principles and Applications of Highway Construction Specifications
    - FHWA NHI 380032A Roadside Safety Design
    - FHWA NHI 380078 Signalized Intersection Guidebook
    - FHWA NHI 380091V Planning and Designing for Pedestrian Safety

- FHWA Performance Based Intersection Design
- Larger Mower Operation & Safety
- NRMCA Concrete Exterior Finishers Certification
- OSHA-10 for Construction
- OSHA Safety Awareness Training
- Sign Installation & Maintenance
- Trenching & Excavation Safety
- Woodchipper Operation and Safety
- Work Zone Safety for Construction Supervisors
- Work Zone Safety for Field Personnel

- Worked on streamlining MTS processes to improve training effectiveness and quality including needed coordination, registration, evaluation, and customized contents to reflect MassDOT's technical requirements.
- Coordinated with the Highway Division to develop FFY22 training plan.
    - Submitted monthly and quarterly reports.

Proposed activities for this year:

- Prepare, coordinate, and deliver MTS training classes per the FFY22 Training Plan (Attachment C), and yet be ready to update the training plans based on availability and schedule of external training classes and to accommodate critical, emerging Highway training needs.
- Coordinate with the Highway Division and the Planning Office to accommodate on-demand training needs.
- Record training attendance to inform future plans.
- Conduct training needs and effectiveness surveys.
- Develop FFY23 annual training plan.
- Prepare and submit monthly and quarterly reports.

Anticipated products:

- Delivery of high priority training workshops.
- Prioritized training list developed for FFY23.
- Training attendance records.
- Training feedback surveys and summaries.
- Monthly and quarterly reports on MTS training activities.

Estimated task completion: September, 2022
Timeline for consultant support: MTS

- Consultant Name: UMass Amherst
- Scope development and FHWA review/approval: Previously completed
- Consultant procurement and selection: Previously completed
- Contract negotiations and FHWA review/approval: Previously completed
- Consultant notice to proceed: September, 2019
- Total duration of task: 36 months

Estimated task budget: $1,010,484.00

Staff salaries and benefits: $4,577.00

MassDOT staff members	% time to task
Hongyan Oliver	5%

Consultant costs: $1,005,907

Subtask / contract #	Total cost:	Spending Pre-FFY 2022:	FFY 2022 spending:	Post FFY 2022 spending:	Consultant/Post-Contractor Name	Consultant NTP	Contract End Date
MTS / 109600	$2,963,244	$1,404,082	$1,005,907	$553,255	UMass Amherst	September 2019	September, 30 2022

Consultant notes:
Note: MassDOT may consider requesting a NCTE for the UMTC ISA to allow UMass to continue providing services as stipulated in the ISA for another 12 months.
Other costs: $0

E. Short-term Research Projects

Task lead: Hongyan Oliver

Task purpose and need: To perform the studies contained within this task, MassDOT contracts directly with universities, research institutes and/or private companies. The respective anticipated duration of active investigation and report writing efforts for short-term, medium-term and long-term projects are, respectively: less than 15 months, 15-21 months, and longer than 21 months (including 3 months of final report review, approval and 508 compliance process) There may be occasion when a project actual duration doesn't align with the anticipated duration due to challenges arising during research investigation and beyond the project team's control. Under such circumstances, additional time may be granted pending FHWA's approval, and the project shall remain within the original category for fiscal tracking purpose. The Research Section conducts annual research problem statement (RPS) solicitations to collect research needs from agency staff. The submitted problem statements are then prioritized based on MassDOT Division/Shared-Service Office Senior Leaders' rankings, MassDOT overall priorities, and research funding eligibility and availability.

The Research Section assists MassDOT project champions with literature searches; the drafting of scopes of work; identification and selection of principal investigators, and the administration of project agreements/contracts, deliverables, final report reviews and publication, and coordination with FHWA.

Subtasks:

1. **Implementing the AASHTO Mechanistic-Empirical Pavement Design Guide Phase III (FFY22 New Project, Continuation of Phase II effort in subtask F.15)**
   A four phases approach was planned to complete this research effort. Phase I and Phase II was programmed through the FFY 20 and FFY 21 SPRII Work Programs. Phase I (Literature Review and State of Practice Assessment) was completed in June 2021 and Phase II (Develop an AASHTOWare Pavement ME User Manual and the Local Experimental Plan and Sampling Template) is currently in progress. Phase III (Sample and Test Mixtures for Local Calibration and Field Data Collection) will be based on the local experimental plan and sampling template developed under Phase 2, and a larger volume of mixtures will be tested to have the best local calibration possible for Massachusetts. Additionally, field data needed for calibration will be collected. All this lab and field data will be used in Phase IV (Calibrate and Validate the M-E Prediction Models). Consultant expenses in Phase III is expected to take place in FFY23 after the Phase II contract ends at the end of FFY22. Phase III scope development and approval, and the ISA approval and execution are anticipated to take place in FFY 22 Q4.

2. **Methods to Identify Problematic Carriers and Prevent Infrastructure Damage (FFY22 New Project)**
   This project aims to develop methods to connect and harmonize various Massachusetts datasets on carriers, permits, citations, road accidents, road

infrastructure inventory, freight restrictions to improve the use and availability of relevant datasets. Following a compilation of state-of-the-practice from other states, the available datasets would be examined to determine consistency and usability on mirrored or relational fields. Specific datasets and their fields will be categorized by relevancy to formulate data canisters for analysis across multiple enterprise platforms. Thresholds will be determined to identify overrepresented carriers and resulting trigger points on a rolling basis at which further investigation should be conducted. Additionally, experimentation of a comprehensive scoring system will assign individual factors a weight to best accommodate incomplete data in determining overall carrier risk to road and infrastructure safety. Research results will provide a solid foundation for conducting risk assessments of overweight/oversize use and flagging problematic use of existing weight-permit practices to further protect roadway assets and sensitive bridge structures.

3. **Feasibility Study of 3D Printing Applications for Bridge Elements in MA (FFY22 New Project)**

   Building on the promising experimental results of Phase I, i.e., additive repair of real corroded steel plates in the lab, the current project will aim at exploring the onsite feasibility of additive repair technology for corroded steel beam ends. Cold spray solutions as well as other applicable onsite technologies will be studied and tested. The project will further connect the interested MassDOT bridge engineers with additive manufacturing facilities to explore potential collaborative opportunities around implementation of candidate objects identified during Phase I. Additionally, the project will further characterize the cost and value of implementing these candidate components by using specific econometric models; this extends the previous work of Phase I, which is only to calculate the cost of printed components, and will contextualize that cost within MassDOT-specific operational models and planning.

4. **Data-Driven Approach for Transit Capital Planning (FFY22 New Project)**

   Developing MassDOT's statewide transit CIP has posed many unique challenges: the definition of the right data to collect, the proper cadence at which to collect it, and any tools or business process to facilitate its collection can significantly differ when aggregating across multiple external transit operators as compared to an internal, asset-operator-led initiative. This research will develop new approaches and identify best practices by peer State-level agencies for MassDOT to compile, aggregate and understand data that enables better decision making. It will also work to define a standard operating procedure, focusing on what data is currently being collected and the existing collection methods used at MassDOT, and how this data is ultimately integrated into or used to validate MassDOT's forecast of need. This research could eventually serve as the framework for a solution that will help to streamline time-consuming data collection efforts while ensuring the accuracy of the predicted need across MassDOT's grantees.

5. **BIM for Transit Infrastructure: A Feasibility and gap assessment with current practices and systems at the MBTA (FFY22 New Project)**

Research is needed on the importance of data governance and integration from the conception of a project's data dictionary, through the asset provisioning and commissioning process of new infrastructure and data management, to computerized maintenance management systems. MBTA management of new projects and ongoing operations can be improved by implementing the Building Information Modeling (BIM) delivery methodology in the Capital Delivery department. The project will review practices at other state and regional agencies to recommend best practices for implementing a systemwide BIM workflow throughout the MBTA infrastructure design, construction, operations, and maintenance areas.

6. **Using Traffic Signals to Limit Speeding Opportunities on Arterial Roads (Continuing Project)**

   This project will provide guidance and case studies for developing traffic signal timing plans in Massachusetts that limit the number of speeding opportunities, while addressing other signal control objectives such as capacity and delay. This will be achieved by creating a method for determining the number of speeding opportunities afforded by a signal timing plan on an arterial with the similar inputs used in traffic signal timing design and developing an easy-to-use, no-cost tool that implements this method. In FFY21, MassDOT procured the consultant (Northeast University) through a Request for Proposal and issued the NTP at the beginning of Q4. Literature review is in progress and the consultant started to develop the online tool for evaluating speeding opportunities using outputs of standard traffic signal timing planning software.

7. **Uncovering the Root Causes for Truck Rollover Crashes on Ramps (Continuing Project)**

   This project will provide a better understanding of the causes of truck rollover crashes on highway ramps, and develop effective countermeasures (e.g., improved ramp design and traffic control). More specifically, the study will 1) review literature and best practices on reducing highway ramp truck rollovers; 2) analyze historical ramp truck rollover data in Massachusetts by utilizing existing traffic cameras on state-maintained highways and advanced video analytics tools to uncover the causes of truck rollovers on highway ramps and derive surrogate safety performance measures; and (3) establish correlations between truck rollovers and Intelligent Transportation System (ITS) devices, signage and markings, and roadway design practices. The NTP was issued, and the project was kicked off in FFY21 Q3. Study sites and data collection techniques were identified and background research was completed. Primary data collection is in progress.

8. **Synthesis study: Microfiltration Treatment and Design Options (Continuing Project)**

   This project involves synthesizing microfiltration treatment design and operations for projects by type and making recommendations on their potential use on MassDOT projects for stormwater management and water quality improvement particularly with sediment control barriers and bioswales. In FFY21, MassDOT

procured the consultant (Offshoots Inc.) through a Request for Proposal, and the NTP was issued in Q4. Literature review is in progress.

Accomplishments in prior year:

- Completed "Effectiveness of Bicycle Boxes in Massachusetts" project. Final report is anticipated to be accepted by FHWA and published at Research Group website and submitted to TRID and National Transportation Library.
- Completed "Short Sea Shipping in Southeastern Mass" project. Final report is anticipated to be accepted by FHWA and published at Research Group website and submitted to TRID and National Transportation Library.
- Completed "Future of the Commonwealth Curb " project. Final report was accepted by FHWA and published at Research Group website and submitted to TRID and National Transportation Library.
- Completed "Improved Rating for Deteriorated Bridge Steel Beams with Deteriorated Stiffeners" project. Final report is anticipated to be accepted by FHWA and published at Research Group website and submitted to TRID and National Transportation Library.
- Completed "Energy Consumption, Cost and Emissions of MBTA Rapid Transit Vehicles" project. Final report is anticipated to be accepted by FHWA and published at Research Group website and submitted to TRID and National Transportation Library.
- Contracted and initiated "Using Traffic Signals to Limit Speeding Opportunities on Arterial Roads" project. 5% completed.
- Contracted and initiated "Uncovering the Root Causes for Truck Rollover Crashes on Ramps" project. 10% completed.
- Contracted and initiated "Microfiltration Treatment and Design Options" synthesis project. 5% completed.
- Identified FFY22 short-term research projects.

Proposed activities for this year:

- Complete "Microfiltration Treatment and Design Options" synthesis project.
- Complete "Uncovering the Root Causes for Truck Rollover Crashes on Ramps" project.
- Advance "Using Traffic Signals to Limit Speeding Opportunities on Arterial Roads" project to 60% completion.
- Identify PIs, develop amplified work plans, and establish ISAs and contracts for FFY22 new short-term research projects.
- Kick off FFY22 new short-term projects.
- Solicit and identify FFY23 short-term projects.

Anticipated products:

- Contracts/ISAs for FFY22 short-term projects.
- Initiation of FFY22 short-term projects.
- Interim deliverables and final reports for the three continuing short-term research projects.

- List of short-term projects for FFY23.

Estimated task completion: Ongoing

Timeline for consultant support: 1. Implementing the AASHTO Mechanistic-Empirical Pavement Design Guide Phase III (FFY22 New Project, Continuation of Phase II effort in subtask F.15)

- Consultant Name: TBD
- Scope development and FHWA review/approval: May 2022
- Consultant procurement and selection: May 2022
- Contract negotiations and FHWA review/approval: August 2022
- Consultant notice to proceed: September 2022
- Total duration of task: 15 months

Timeline for consultant support: 2. Methods to Identify Problematic Carriers and Prevent Infrastructure Damage (FFY22 New Project)

- Consultant Name: TBD
- Scope development and FHWA review/approval: January 2022
- Consultant procurement and selection: January 2022
- Contract negotiations and FHWA review/approval: February 2022
- Consultant notice to proceed: March 2022
- Total duration of task: 15 months

Timeline for consultant support: 3. Feasibility Study of 3D Printing Applications for Bridge Elements in MA (FFY22 New Project)

- Consultant Name: TBD
- Scope development and FHWA review/approval: January 2022
- Consultant procurement and selection: January 2022
- Contract negotiations and FHWA review/approval: February 2022
- Consultant notice to proceed: March 2022
- Total duration of task: 15 months

Timeline for consultant support: 4. Data-Driven Approach for Transit Capital Planning (FFY22 New Project)

- Consultant Name: TBD
- Scope development and FHWA review/approval: January 2022
- Consultant procurement and selection: January 2022
- Contract negotiations and FHWA review/approval: February 2022
- Consultant notice to proceed: March 2022
- Total duration of task: 15 months

Timeline for consultant support: 5. BIM for Transit Infrastructure: A Feasibility and gap assessment with current practices and systems at the MBTA (FFY22 New Project)

- Consultant Name: TBD
- Scope development and FHWA review/approval: January 2022

- Consultant procurement and selection: January 2022
- Contract negotiations and FHWA review/approval: February 2022
- Consultant notice to proceed: March 2022
- Total duration of task: 15 months

Timeline for consultant support: 6. Using Traffic Signals to Limit Speeding Opportunities on Arterial Roads (Continuing Project)

- Consultant Name: Northeastern University
- Scope development and FHWA review/approval: Previously completed
- Consultant procurement and selection: Previously completed
- Contract negotiations and FHWA review/approval: Previously completed
- Consultant notice to proceed: Previously completed
- Total duration of task: 24 months

Timeline for consultant support: 7. Uncovering the Root Causes for Truck Rollover Crashes on Ramps (Continuing Project)

- Consultant Name: UMass-Lowell
- Scope development and FHWA review/approval: Previously completed
- Consultant procurement and selection: Previously completed
- Contract negotiations and FHWA review/approval: Previously completed
- Consultant notice to proceed: Previously completed
- Total duration of task: 19 months

Timeline for consultant support: 8. Synthesis study: Microfiltration Treatment and Design Options (Continuing Project)

- Consultant Name: Offshoots Inc.
- Scope development and FHWA review/approval: Previously completed
- Consultant procurement and selection: Previously completed
- Contract negotiations and FHWA review/approval: Previously completed
- Consultant notice to proceed: Previously completed
- Total duration of task: 12 months

Estimated task budget: $581,314.00

Staff salaries and benefits: $59,052.00

MassDOT staff members	% time to task
Michael Flanary	20%
Patrick McMahon	10%
Drew Pflaumer	20%
Hongyan Oliver	10%

Nicholas Zavolas	15%

Consultant costs: $522,262

Subtask / contract #	Total cost:	Spending Pre-FFY 2022:	FFY 2022 spending:	Post FFY 2022 spending:	Consultant/Post-Contractor Name	Consultant NTP	Contract End Date
1. Implementing the AASHTO Mechanistic-Empirical Pavement Design Guide Phase III (FFY22 New Project, Continuation of Phase II effort in subtask F.15) / TBD	$400,000	$0	$0	$400,000	TBD	TBD	TBD
2. Methods to Identify Problematic Carriers and Prevent Infrastructure Damage (FFY22 New Project) / TBD	$100,000	$0	$80,000	$20,000	TBD	TBD	TBD
3. Feasibility Study of 3D Printing Applications for Bridge Elements in MA (FFY22 New Project) / TBD	$150,000	$0	$120,000	$30,000	TBD	TBD	TBD
4. Data-Driven Approach for Transit Capital Planning (FFY22 New Project) / TBD	$100,000	$0	$80,000	$20,000	TBD	TBD	TBD
5. BIM for Transit Infrastructure: A Feasibility and gap assessment with current practices and systems at the MBTA (FFY22 New Project) / TBD	$100,000	$0	$80,000	$20,000	TBD	TBD	TBD
6. Using Traffic Signals to Limit Speeding Opportunities on Arterial Roads (Continuing Project) / 114372	$140,000	$43,663	$85,863	$10,474	Northeastern University	July, 2021	May, 2023
7. Uncovering the Root Causes for Truck Rollover Crashes on Ramps (Continuing Project) / 113772	$120,000	$73,601	$46,399	$0	UMass-Lowell	April, 2021	September, 2022
8. Synthesis study: Microfiltration Treatment and Design Options (Continuing Project) / 114903	$40,000	$10,000	$30,000	$0	Offshoots Inc.	August, 2021	July, 2022

Consultant notes:
Other costs: $0

F. Medium-term Research Projects

Task lead: Hongyan Oliver

Task purpose and need: To perform the studies contained within this task, MassDOT contracts directly with universities, research institutes and/or private companies. The respective anticipated duration of active investigation and report writing efforts for short-term, medium-term and long-term projects are, respectively: less than 15 months, 15-21 months, and longer than 21 months (including 3 months of final report review, approval and 508 compliance process). There may be occasion when a project actual duration doesn't align with the anticipated duration due to challenges arising during research investigation and beyond the project team's control. Under such circumstances, additional time may be granted pending FHWA's approval, and the project shall remain within the original category for fiscal tracking purpose. The Research Section conducts annual research problem statement (RPS) solicitations to collect research needs from agency staff. The submitted problem statements are then prioritized based on MassDOT Division/Shared-Service Office Senior Leaders' rankings, MassDOT overall priorities, and research funding eligibility and availability.

The Research Section assists MassDOT project champions with literature searches; the drafting of scopes of work; identification and selection of principal investigators, and the administration of project agreements/contracts, deliverables, final report reviews and publication, and coordination with FHWA.

Subtasks:

1. **Measuring Accessibility to Improve Public Health (Continuing Project)**
   This project aims to 1) develop a methodology to identify and classify gaps in accessibility to jobs, health care, and food across time, demographic groups, and locations, which impact the public health of the populations affected; and 2) provide a set of recommendations for actions to address the specific types of identified accessibility gaps to reduce inequities. These methods could support MassDOT's existing accessibility data dashboard to continuously monitor accessibility gaps and inequities that affect public health. The NTP was issued and the project was kicked off in FFY21 early Q3. Background research and literature review is in progress.

2. **A Method for Pavement Marking Inventory and Retroreflectivity Condition Assessment Using Mobile LiDAR (Continuing Project)**
   This study utilizes mobile LiDAR data to develop an automated method for the extraction, classification, localization, and condition (retroreflectivity) assessment for pavement markings in the Commonwealth. The Notice to Proceed was issued in FFY20. The project team completed the following: literature review, field data collection, algorithms development and validation, and georeferenced inventory and pavement marking condition assessments. A six-month NCTE was approved in FFY21 extending the project until the end of FFY22 Q2. Final report is expected in FFY22 Q1.

3. **Feasibility of the 3D Printing Application for Highway Infrastructure Construction and Maintenance (Continuing Project)**

   This project explores additive manufacturing innovations and their capabilities related to transportation infrastructure and as a potential future resource to assist the MassDOT Highway Division's construction and maintenance activities. The Notice to Proceed was issued in FFY20. In FFY21, the research team conducted a virtual workshop on 3D printing technologies and capabilities, met with MassDOT Districts to identify needs, performed 3D metal printing repairing of fabricated steel coupons in the lab and evaluated the structural features of repaired coupons. An 8-month NCTE was approved by FHWA in FFY21 extending the project end date into FFY22 Q3. The team will complete the remaining work and the final report is expected in FFY22 Q2.

4. **Using Grip Sensors to Control a Salt Spreader Application Rate (FFY22 New Project)**

   Deicing material expense for only state-owned roadways in the Commonwealth is over $10 million annually. Deicing material conservation makes fiscal sense and is also critical to protecting environmental resources while engaged in combating wintry precipitation on our roadways. There is growing interest in the design and utilization of systems that automatically adjust a salt spreader's deicing material (salt) dispensation rate based on observed grip levels, in real time. The project will aim at examining the efficacy of this concept for possible incorporation into its winter maintenance program. It is anticipated that a prototypical technology will be developed and equipped onto one or more of MassDOT's salt spreaders to calibrate a salter's material dispensation rate to observed grip levels.

5. **UAS for Surface Transportation Emergency Response (Continuing Project)**

   The intent of this project is to evaluate the types of incidents that are most suitable for using UAS; the key operational parameters for UAS operating in emergency incident response; and how to integrate UAS into the MassDOT emergency management team. The NTP was issued and the project was kicked off in FFY21 Q2. The team completed a review of suitable UAS senor technologies and deployed a new software to improve the visualization of crash data analysis results. The exercise flight to collect data on key operational parameters is in planning. The final report is expected in FFY22 Q2.

6. **Detecting Subsurface Voids Using UAS with Infrared Thermal Imaging (Continuing Project)**

   This project will evaluate whether UAS, using thermal imagers, can be deployed to provide more rapid detection of voids surrounding culverts and drainage pipes prior to failure. If step one results are positive, then the team will develop UAS operating procedures to successfully identify voids and will propose a roadmap for developing automated identification and data capture of voids. When completed,

this research will enhance and strengthen existing roadway inspection processes and increase the capacity to inspect culverts, while reducing inspection times and costs resulting in safer working conditions. The NTP was issued and the project was kicked off in FFY21 Q1. The team completed literature review, validation of computer algorithms for processing infrared images of a pavement mock-deck collected in the lab and is planning for field data collection with the support of Aeronautics Division drone team. The final report is expected in FFY22 Q2.

7. **Impact of Advanced Driver Assistance Systems (ADAS) on Road Safety and Implications for Education, Licensing, Registration and Enforcement (Continuing Project)**

   This research aims to examine the safety issues related to drivers' understanding of the capability and use of ADAS systems that fall under the Level 2 "autonomous" definition. The work efforts will include 1) a review of the current state of commercially available ADAS technology in MA; 2) examine drivers' knowledge of ADAS systems; types of driver errors associated with the use of ADAS; and potential for ADAS misuse and circumvention of driver monitoring systems; 3) develop and evaluate mitigation approaches; and 4) study the impact of drivers' knowledge of ADAS on its use/misuse. The Notice to Proceed was issued in FFY20. The team has completed major data collection activities and is developing mitigation approaches. The final report is anticipated in FFY22 Q1.

8. **Smart work zone control and performance evaluation based on trajectory data (FFY22 New Project)**

   Work zone merge control has significant impacts on traffic mobility and safety. Various merge control strategies such as late merge, early merge, and dynamic merge have been proposed to improve work zone traffic operations. The performance of these strategies is often evaluated based on traffic throughput and speed, which do not fully reflect work zone safety for not being able to inform driver behavior and the fundamental causes of crashes under different traffic and control conditions. The goal of this study is to develop computer vision technologies to extract trajectories of vehicles approaching work zones, and use the results to analyze driver behavior, identify safety hazards, and develop effective control strategies. The findings can be integrated into the existing MassDOT smart work zone systems for dynamic traffic control and can also be used to analyze and improve traffic operations at on-ramps and entrances of managed lane facilities.

9. **Developing Massachusetts Specific Trip Generation Rates for Land Use Projects (Continuing Project)**

   This project aims to assist MassDOT in developing trip generation rates for high-priority land uses in Massachusetts. It intends to develop an algorithm-based model for deriving accurate trip generation rates for development projects located in Massachusetts. It will also identify and study available innovative technologies such as machine learning models and video analytics that can be used to assist MassDOT's efforts to collect vehicular and multi-modal trip generation data. The

results of the project will improve the current methods used by MassDOT for projecting trip generation rates resulting from new, large urban development projects. The NTP was issued and the project kicked off in FFY21 Q3. The project champion established a wide-ranging group of technical experts as an advisory committee. Research team performed substantial background research and, in conjunction with the advisory group, established high-priority land uses. A preliminary trip generation model was largely completed during FFY21 Q4, to be tested, updated, and refined using data collected in FFY22.

10. Multisource Data Fusion for Real-Time and Accurate Traffic Incident Detection (Continuing Project)

This research will investigate how data from the various traffic data sources that MassDOT owns or has access to can be merged for accurate, real-time traffic incident detection, to improve travel time reliability. It will assess the current traffic incident detection methods employed by MassDOT and develop new tools for improved traffic incident detection based on available traffic data. The research will address the fusion of information from multiple sources of different temporal and spatial scales such as traffic data collected from loop detectors; information from the MassDOT Real Time Traffic Management (RTTM) system; and information available through third-party vendors (e.g., Waze, Google, INRIX). The fusion of these sources will be accomplished through evaluating the reliability of the various data sources and deploying advanced data analytical methods such as deep neural networks. The NTP was issued and the project was kicked off in FFY21 Q2. Literature review has been completed and data acquisition and algorithm development are in progress.

11. Post-Fire Damage Inspection of Concrete Structures in Tunnels Phase II (Continuing Project)

This phase focuses on physical testing of critical components of tunnels after being exposed to high combustion temperature. Key activities in this phase include identification of critical tunnel components for testing, physical testing of the components in a structural testing facility for their post-fire residual capacity, evaluating the non-destructive test methods identified in the Phase I literature review and owned by MassDOT based on the testing results, and adding new information resulting from lab testing to the inspection protocol checklist to assist field inspections. The NTP was issued and the second phase was kicked off in FFY21 Q3. The team has procured mock structure components with the same specifications as those used for MassDOT tunnels. The lab experiments will continue in FFY22.

12. Massachusetts Depth to Bedrock Project (Continuing Project)

This project includes the following: 1) Identify, collect, assemble and apply necessary data validation, quality control, attribution and processing to each of the existing geoformation data sources to unify the information for modeling soil thickness; 2) Combine soil thickness values with the constraints in the recently completed statewide surficial materials map (outcrops and shallow bedrock areas),

LiDAR data (surface elevation) and other sources to model a continuous soil thickness raster along with a data quality confidence raster using appropriate geostatistical or other methods; and, 3) Use the soil thickness raster along with existing shear wave velocity data to generate a National Earthquake Hazards Reduction Program soil classification map for Massachusetts. The main outcomes of this work will be resource maps in raster format showing the altitude of the top of bedrock and thickness of overburden that can be imported directly into MassDOT's Geographic Information System (GIS) for use in helping plan and design any highway project in Massachusetts. The NTP was issued, and the project started in FFY21 Q3. Initial data collection/compilation resulted in approximately 500,000 borehole and well drilling measurements across the State. FFY21 Q3-Q4 involved extensive data collection in areas with poor existing data availability. Data cleaning and analysis have occurred while the research team accounts for the differences in coordinate systems, borehole depth recording systems, reliability, and location anomalies in older data. Data analysis and mapping will continue in FFY22 and the final report is expected in FFY22 Q4.

13. Outdoor Information Panels to Convey Real-Time Travel Information for Ridership Recovery (Continuing Project)

This research aims to provide a better understanding of which transit Real Time Travel Information (RTTI) meets the needs of current ridership connecting to transit by vehicle; how RTTI can be used to incentivize off-peak travel; and how RTTI may lead to mode-shifting based on the value propositions of information presented. The NTP was issued and the project started in FFY21 Q3. Literature review is currently underway. Surveying large number of potential transit users is expecting in FFY22.

14. Post-Fire Damage Inspection of Concrete Structures Phase III Field Verification Phase (FFY22 New Project)

MassDOT has experienced several recent tunnel fires. Post event evaluation of damage has been difficult due to insufficient information and protocols. This project will directly address these issues and complement information collected in Phase II (May 2021 - August 2022). It will specifically address site conditions through in-situ heat testing of structural elements scheduled for demolition and evaluation of concrete patching materials subjected to high thermal load. This will allow for field results (including moisture content and thermal conductivity) to verify results from the laboratory tests, as well as proof of concept for using the heating set up in field testing. Testing will only be completed on components that are scheduled for demolition or removal and are expected to include both tunnel (wall or panel elements) and bridge components (deck, abutment or pier). In addition, Phase III will also evaluate the performance of concrete patches under extreme fire temperatures and test new materials which are currently proposed as protection methods for future tunnel structures in MassDOT. The proposed work does not depend on the results of Phase II and may start before the Phase II completion.

15. Implementing AASHTO M-E Pavement Design Guide Phase II (Continuing Project)

Building upon the outputs of Phase I, phase II will develop an AASHTOWare Pavement M-E user manual and develop a local experimental plan and sampling template. During this phase, the project team will develop a standalone manual that shows a user a thorough step-by-step procedure on how to use the AASHTOWare Pavement M-E Design software. The manual will guide users on how to generate data, in particular, materials properties, and climatic and traffic data as they relate to local locations within the state of Massachusetts. A statistical plan or sampling template to refine the calibration of the M-E distress and International Roughness Index prediction models based on local conditions, policies, and materials will be developed. The primary tier parameters in the sampling template should be distress dependent and likely will include pavement type; surface layer type and thickness; and subgrade soil type. This experimental and sampling plan will provide the foundation for Phase 3 efforts. The NTP was issued and the project started in FFY21 Q3. Manual development and lab experiments are currently in progress. The Final report is expected in FFY22 Q4.

16. Effectiveness of Two-stage Turn Queue Boxes in Massachusetts: A Comparison with Bike Boxes (FFY22 New Project)

Two-stage turn queue boxes and bike boxes are novel bicycle infrastructure treatments that are being installed in Massachusetts to improve bicyclist safety and comfort. Two-stage turn queue boxes are designated spaces that are installed to improve the safety of left turns at intersections when bicyclists are coming from a bike lane or a cycle track located on the right side (and less frequently to facilitate right turns from the left side bike lanes or cycle tracks). An ongoing MassDOT study has been investigating both motorist and bicyclist behavior only at bike box locations using field data from Massachusetts, and this project will assess the effectiveness of two-stage turn queue boxes. Results will be compared with the ongoing study to develop a design and implementation guideline for these two treatments. Data of interest that will be collected from field studies include how bicyclists are using these treatments (e.g., turning maneuvers, use of bike lane upstream) and how drivers behave when encountering these treatments, conflicts between bicycles and cars, as well as design characteristics. Design characteristics of specific bike box and two-stage turn queue box implementations, e.g., dimensions, the existence of green pavement markings vs. plain markings, and their impact on bicyclist and driver behavior and conflicts, will also be studied to inform design guidelines.

Accomplishments in prior year:

- Completed the "Implementing the AASHTO Mechanistic-Empirical Pavement Design Guide Phase I" project. Final report was posted on Research website and submitted to TRID and the National Transportation Library.

- Completed the "Post-Fire Damage Inspection of Concrete Structures in Tunnels Phase I" project. Final report was posted on Research website and submitted to TRID and the National Transportation Library.
- Advanced "A Method for Pavement Marking Inventory and Retroreflectivity Condition Assessment Using Mobile LiDAR" project. 80% completed.
- Advanced "Feasibility of the 3D Printing Application for Highway Infrastructure Construction and Maintenance" project. 60% completed.
- Advanced "Impact of Advanced Driver Assistance Systems (ADAS) on Road Safety and Implications for Education, Licensing, Registration and Enforcement" project. 85% completed. > Contracted and initiated "Measuring Accessibility to Improve Public Health" project. 10% completed.
- Contracted and initiated "UAS Network for Surface Transportation Emergency Response" project. 30% completed.
- Contracted and initiated "Detecting Subsurface Voids Using UAS with Infrared Thermal Imaging" project. 40% completed.
- Contracted and initiated "Developing Massachusetts Specific Trip Generation Rates for Land Use Projects" project. 10% completed.
- Contracted and initiated "Multisource Data Fusion for Real-Time and Accurate Traffic Incident Detection" project. 10% completed.
- Contracted and initiated "Post-Fire Damage Inspection of Concrete Structures in Tunnels Phase II" project. 20% completed.
- Contracted and initiated "Massachusetts Depth to Bedrock Project" project. 10% completed. > Contracted and initiated "Implementing the AASHTO Mechanistic-Empirical Pavement Design Guide - Phase II" project. 15% completed.
- Solicited and selected FFY22 medium-term research projects.

Proposed activities for this year:

- Identify PIs, develop amplified work plans, and establish ISAs and contracts for FFY22 new medium-term research projects.
- Complete "A Method for Pavement Marking Inventory and Retroreflectivity Condition Assessment Using Mobile LiDAR" project.
- Complete "Feasibility of the 3D Printing Application for Highway Infrastructure Construction and Maintenance" project. 60% completed.
- Complete "Impact of Advanced Driver Assistance Systems (ADAS) on Road Safety and Implications for Education, Licensing, Registration and Enforcement" project. 85% completed.
- Complete "UAS Network for Surface Transportation Emergency Response" project.
- Complete "Detecting Subsurface Voids Using UAS with Infrared Thermal Imaging" project. > Complete "Implementing the AASHTO Mechanistic-Empirical Pavement Design Guide Phase II" project. Advance "Developing Massachusetts Specific Trip Generation Rates for Land Use Projects" project to 75% complete.
- Advance "Measuring Accessibility to Improve Public Health" project to 75% complete.

- Advance "Multisource Data Fusion for Real-Time and Accurate Traffic Incident Detection" project to 75% complete.
- Advance "Post-Fire Damage Inspection of Concrete Structures in Tunnels Phase II" project to 67% complete.
- Advance "Massachusetts Depth to Bedrock Project" project to 80% complete.
- Initiate FFY22 new medium-term research projects.
- Solicitate and identify the list of FFY23 medium-term research projects.

Anticipated products:

- Contracts/ISAs for FFY22 medium-term projects.
- Initiation of FFY 22 medium-term projects.
- Interim deliverables and final reports for medium-term research projects that are scheduled to be completed in FFY22.
- Identification of FFY23 medium-term research projects.

Estimated task completion: ongoing

Timeline for consultant support: 1. Measuring Accessibility to Improve Public Health (Continuing Project)

- Consultant Name: UMass Amherst
- Scope development and FHWA review/approval: Previously completed
- Consultant procurement and selection: Previously completed
- Contract negotiations and FHWA review/approval: Previously completed
- Consultant notice to proceed: April, 2021
- Total duration of task: 22 months

Timeline for consultant support: 2. A Method for Pavement Marking Inventory and Retroreflectivity Condition Assessment Using Mobile LiDAR (Continuing Project)

- Consultant Name: UMass Amherst
- Scope development and FHWA review/approval: Previously completed
- Consultant procurement and selection: Previously completed
- Contract negotiations and FHWA review/approval: Previously completed
- Consultant notice to proceed: February 2020
- Total duration of task: 26 months

Timeline for consultant support: 3. Feasibility of the 3D Printing Application for Highway Infrastructure Construction and Maintenance (Continuing Project)

- Consultant Name: UMass Amherst
- Scope development and FHWA review/approval: Previously completed
- Consultant procurement and selection: Previously completed
- Contract negotiations and FHWA review/approval: Previously completed
- Consultant notice to proceed: June, 2020
- Total duration of task: 24 months

Timeline for consultant support: 4. Using Grip Sensors to Control a Salt Spreader Application Rate (FFY22 New Project)

- Consultant Name: TBD
- Scope development and FHWA review/approval: January, 2022
- Consultant procurement and selection: January, 2022
- Contract negotiations and FHWA review/approval: February, 2022
- Consultant notice to proceed: March, 2022
- Total duration of task: 21 months

Timeline for consultant support: 5. UAS for Surface Transportation Emergency Response (Continuing Project)

- Consultant Name: UMass Lowell
- Scope development and FHWA review/approval: Previously completed
- Consultant procurement and selection: Previously completed
- Contract negotiations and FHWA review/approval: Previously completed
- Consultant notice to proceed: March, 2021
- Total duration of task: 14 months

Timeline for consultant support: 6. Detecting Subsurface Voids Using UAS with Infrared Thermal Imaging (Continuing Project)

- Consultant Name: UMass Amherst
- Scope development and FHWA review/approval: Previously completed
- Consultant procurement and selection: Previously completed
- Contract negotiations and FHWA review/approval: Previously completed
- Consultant notice to proceed: November, 2020
- Total duration of task: 14 months

Timeline for consultant support: 7. Impact of Advanced Driver Assistance Systems (ADAS) on Road Safety and Implications for Education, Licensing, Registration and Enforcement (Continuing Project)

- Consultant Name: UMass Amherst
- Scope development and FHWA review/approval: Previously completed
- Consultant procurement and selection: Previously completed
- Contract negotiations and FHWA review/approval: Previously completed
- Consultant notice to proceed: June, 2020
- Total duration of task: 20 months

Timeline for consultant support: 8. Smart work zone control and performance evaluation based on trajectory data (FFY22 New Project)

- Consultant Name: TBD
- Scope development and FHWA review/approval: January, 2022
- Consultant procurement and selection: January, 2022
- Contract negotiations and FHWA review/approval: February, 2022
- Consultant notice to proceed: March 2022
- Total duration of task: 21 months

Timeline for consultant support: 9. Developing Massachusetts Specific Trip Generation Rates for Land Use Projects (Continuing Project)

- Consultant Name: UMass Lowell
- Scope development and FHWA review/approval: Previously completed
- Consultant procurement and selection: Previously completed
- Contract negotiations and FHWA review/approval: Previously completed
- Consultant notice to proceed: March, 2021
- Total duration of task: 21 months

Timeline for consultant support: 10. Multisource Data Fusion for Real-Time and Accurate Traffic Incident Detection (Continuing Project)

- Consultant Name: UMass Lowell
- Scope development and FHWA review/approval: Previously completed
- Consultant procurement and selection: Previously completed
- Contract negotiations and FHWA review/approval: Previously completed
- Consultant notice to proceed: April, 2021
- Total duration of task: 21 months

Timeline for consultant support: 11. Post-Fire Damage Inspection of Concrete Structures in Tunnels Phase II (Continuing Project)

- Consultant Name: UMass Amherst
- Scope development and FHWA review/approval: Previously completed
- Consultant procurement and selection: Previously completed
- Contract negotiations and FHWA review/approval: Previously completed
- Consultant notice to proceed: May, 2021
- Total duration of task: 21 months

Timeline for consultant support: 12. Massachusetts Depth to Bedrock Project (Continuing Project)

- Consultant Name: UMass Amherst
- Scope development and FHWA review/approval: Previously completed
- Consultant procurement and selection: Previously completed
- Contract negotiations and FHWA review/approval: Previously completed
- Consultant notice to proceed: March, 2021
- Total duration of task: 21 months

Timeline for consultant support: 13. Outdoor Information Panels to Convey Real-Time Travel Information for Ridership Recovery (Continuing Project)

- Consultant Name: UMass Amherst
- Scope development and FHWA review/approval: Previously completed
- Consultant procurement and selection: Previously completed
- Contract negotiations and FHWA review/approval: Previously completed
- Consultant notice to proceed: May, 2021
- Total duration of task: 20 months

Timeline for consultant support: 14. Post-Fire Damage Inspection of Concrete Structures Phase III Field Verification Phase (FFY 22 New Project)

- Consultant Name: TBD
- Scope development and FHWA review/approval: January, 2022
- Consultant procurement and selection: January, 2022
- Contract negotiations and FHWA review/approval: February, 2022
- Consultant notice to proceed: March, 2022
- Total duration of task: 18 months

Timeline for consultant support: 15. Implementing AASHTO M-E Pavement Design Guide Phase II (Continuing Project)

- Consultant Name: UMass Dartmouth
- Scope development and FHWA review/approval: Previously completed
- Consultant procurement and selection: Previously completed
- Contract negotiations and FHWA review/approval: Previously completed
- Consultant notice to proceed: July, 2021
- Total duration of task: 15 months

Timeline for consultant support: 16. Effectiveness of Two-stage Turn Queue Boxes in Massachusetts: A Comparison with Bike Boxes (FFY22 New Project)

- Consultant Name: TBD
- Scope development and FHWA review/approval: January, 2022
- Consultant procurement and selection: January, 2022
- Contract negotiations and FHWA review/approval: February, 2022
- Consultant notice to proceed: March, 2022
- Total duration of task: 18 months

Estimated task budget: $1,309,979.00

Staff salaries and benefits: $84,795.00

MassDOT staff members	% time to task
Michael Flanary	25%
Patrick McMahon	20%
Drew Pflaumer	25%
Hongyan Oliver	10%
Nicholas Zavolas	25%

Consultant costs: $1,225,184

Subtask / contract #	Total cost:	Spending Pre-FFY 2022:	FFY 2022 spending:	Post FFY 2022 spending:	Consultant/Post-Contractor Name	Consultant NTP	Contract End Date
1. Measuring Accessibility to Improve Public Health (Continuing Project)/114069	$149,999	$34,018	$94,569	$21,412	UMass Amherst	April, 2021	January, 2023
2. A Method for Pavement Marking Inventory and Retroreflectivity Condition Assessment Using Mobile LiDAR (Continuing Project)/110352	$200,000	$198,459	$1,541	$0	UMass Amherst	February 2020	March, 2022
3. Feasibility of the 3D Printing Application for Highway Infrastructure Construction and Maintenance (Continuing Project)/110756	$175,000	$105,871	$69,129	$0	UMass Amherst	June, 2020	May, 2022
4. Using Grip Sensors to Control a Salt Spreader Application Rate (FFY22 New Project)/TBD	$100,000	$0	$80,000	$20,000	TBD	TBD	TBD
5. UAS for Surface Transportation Emergency Response (Continuing Project) / 113771	$60,000	$31,000	$29,000	$0	UMass Lowell	March, 2021	April, 2022
6. Detecting Subsurface Voids Using UAS with Infrared Thermal Imaging (Continuing Project) / 112754	$60,000	$42,000	$18,000	$0	UMass Amherst	November, 2020	February, 2022
7. Impact of Advanced Driver Assistance Systems (ADAS) on Road Safety and Implications for Education, Licensing, Registration and Enforcement (Continuing Project) / 110757	$120,000	$109,165	$10,835	$0	UMass Amherst	June, 2020	November, 2021
8. Smart work zone control and performance evaluation based on trajectory data (FFY22 New Project) / TBD	$150,000	$0	$120,000	$30,000	TBD	TBD	TBD
9. Developing Massachusetts Specific Trip Generation Rates for Land Use Projects (Continuing Project) / 113773	$150,000	$64,147	$85,811	$42	UMass Lowell	March, 2021	December, 2022
10. Multisource Data Fusion for Real-Time and Accurate Traffic Incident Detection (Continuing Project) / 113774	$150,000	$36,875	$89,754	$23,371	UMass Lowell	April, 2021	December, 2022
11. Post-Fire Damage Inspection of Concrete Structures in Tunnels Phase II (Continuing Project) / 114201	$160,000	$62,965	$96,035	$1,000	UMass Amherst	May, 2021	February, 2023

12. Massachusetts Depth to Bedrock Project (Continuing Project) / 113776	$114,675	$44,762	$66,836	$3,077	UMass Amherst	March, 2021	November, 2022
13. Outdoor Information Panels to Convey Real-Time Travel Information for Ridership Recovery (Continuing Project) / 114217	$124,999	$40,455	$74,044	$10,500	UMass Amherst	May, 2021	January, 2023
14. Post-Fire Damage Inspection of Concrete Structures Phase III Field Verification Phase (FFY 22 New Project) / TBD	$180,000	$0	$144,000	$36,000	TBD	TBD	TBD
15. Implementing AASHTO M-E Pavement Design Guide Phase II (Continuing Project) / 114775	$200,630	$75,000	$125,630	$0	UMass Dartmouth	July, 2021	September, 2022
16. Effectiveness of Two-stage Turn Queue Boxes in Massachusetts: A Comparison with Bike Boxes (FFY22 New Project) / TBD	$150,000	$0	$120,000	$30,000	TBD	TBD	TBD

Consultant notes:
Other costs: $0

G. Long-term Research Projects

Task lead: Hongyan Oliver

Task purpose and need: To perform the studies contained within this task, MassDOT contracts directly with universities, research institutes and/or private companies. The respective anticipated duration of active investigation and report writing efforts for short-term, medium-term and long-term projects are, respectively: less than 15 months, 15-21 months, and longer than 21 months (including 3 months of final report review, approval and 508 compliance process). There may be occasion when a project actual duration doesn't align with the anticipated duration due to challenges arising during research investigation and beyond the project team's control. Under such circumstances, additional time may be granted pending FHWA's approval, and the project shall remain within the original category for fiscal tracking purpose. The Research Section conducts annual research problem statement (RPS) solicitations to collect research needs from agency staff. The submitted problem statements are then prioritized based on MassDOT Division/Shared-Service Office Senior Leaders' rankings, MassDOT overall priorities, and research funding eligibility and availability.

The Research Section assists MassDOT project champions with literature searches; the drafting of scopes of work; identification and selection of principal investigators, and the administration of project agreements/contracts, deliverables, final report reviews and publication, and coordination with FHWA.

Subtasks:

1. **Ultra-High-Performance Concrete Reinforced with Multi-Scale Hybrid Fibers and Its Durability-Related Properties (Continuing Project)**
   Ultra-high-performance concrete (UHPC) is a cementitious composite material composed of an optimized gradation of granular constituents; a low water-to-cementitious materials ratio; and a high percentage of discontinuous internal fiber reinforcement. Due to the excellent mechanical properties and ease of placement and volume stability, UHPC is often used in transportation infrastructures including roads, underground structures, and bridges. The study is to develop a novel UHPC reinforced with Multi-Scale Hybrid Fibers (MSHF) and nano-scale additives with enhancements in both early-age properties and long-term performance such as high early-age strength, low volume change, low permeability and extended service life in the presence of environmental threats in Massachusetts. The project will also develop a comprehensive understanding of the roles of MSHF, additives, and cement chemistry in improving
   durability-related properties of UHPC. The ISA is expected to be approved by FHWA during FFY21 Q4 with NTP shortly thereafter. It is anticipated that much of the literature review and other background research will occur during FFY21 Q4.

2. **Complete Streets v.2: Respecting the Roots (FFY22 New Project)**
   Trees contribute to the quality of life and landscape value of our communities. At the same time, the MassDOT capital improvement program, which includes

improvements for walking and cycling, also serves to contribute to the quality of our communities. However, these transportation improvements oftentimes impact the urban forest of the corridors they travel through. Focusing on soil impacts and root systems, the proposed research will bring a much-needed arboricultural perspective to early project development, as well as design and construction, when it can most effectively anticipate, minimize, and mitigate impacts to trees, at the same time identifying strategies for both restoration and enhancement of the urban forest. This research will include a multifaceted approach to surveying the state of the practice, including: a literature search of related professional journals; input from a cross-disciplinary panel of experts; an on-line survey of practicing professionals responsible for health of urban forest at select DOTs and cities. These information resources will yield guidance documentation for preliminary corridor tree-health evaluation and general impact analysis for engineers, planners, and landscape architects, as well as consulting arborists. Research will also provide guidance for soil area planting requirements for new trees, as well as best management practices for soil protection during construction.

3. **Asset Management Systems at Municipalities (Continuing Project)**
   This research is to compile local pavement management data and explore how to harmonize and report pavement condition data across the Commonwealth. The Notice to Proceed was issued in FFY20. The research team conducted and analyzed internet-based survey and created in-depth survey questionnaires and sample data collection plan in FFY21. The team will analyze the selected pavement management systems and sample data to evaluate whether and how these different management systems may be harmonized statewide. The final report is expected in FFY22 Q3.

4. **Revised Load Rating Procedures for Deteriorated Prestressed Concrete Beams (Continuing Project)**
   The project is to develop an approach to determine a safe working capacity realistically and reliably for existing precast, prestressed concrete bridges which exhibit deterioration to avoid unnecessary bridge closures while also keeping the public safe. This project is envisioned to be carried out through a combination of computer model simulations and full-scale testing of actual deteriorated beams in the laboratory. The NTP was issued and the project was kicked off in FFY22 Q3. Extensive literature review is currently under way. The MassDOT project champion will coordinate with scheduled bridge demolition project teams to secure sample beams for lab testing.

5. **Field Study to Determine Salt Usage Efficiency on Two Pavement Types (FFY22 New Project)**
   Winter maintenance activities are a high priority to MassDOT in order to ensure its roadways are safe for the motoring public during winter events. Winter road treatment usually includes the application of a magnesium chloride pre-wetted salt at a pre-determined application rate. The salt often ends up in waterbodies near roadways; the presence of salt (salinity) in surrounding water sources has indeed

become more pronounced. MassDOT concerns that certain pavement surface types may have been over-treated during winter maintenance. As such, there is a need to collect and analyze field data to understand if the current treatment applications and frequencies are correct, deficient or excessive. Through field study, the project will quantify the minimum safe level of salt application for typical pavement surface types and compare the results to the current application rates and frequency. The study will also investigate both safety and environmental aspects of the current salt treatment rate and those of the determined efficient rate.

6. **Development of Comprehensive Inspection Protocols for Deteriorated Steel Beam Ends (Continuing Project)**
   Drawing from research results of previously completed projects, this project is adding new measurements and classifications of important parameters to the bridge inspection manual and is developing enhanced inspection protocols for collecting important deterioration information needed for the new procedure. The NTP was issued in FFY20. In FFY21, the team performed a literature review on using UAS for bridge inspection by other agencies, collected beam corrosion LiDAR data in the lab environment, and refined corrosion measurement algorithms and load capacity calculation models, and started to draft the new comprehensive inspection protocols. A 5-month NCTE was approved by FHWA in FFY21 extending the project end date to FFY22 Q2. A final report is expected in FFY22 Q1.

7. **Optimization of MassDOT High Performance Thin Lift Mixtures (Continuing Project)**
   This project aims to 1) evaluate the three types of high-performance thin pavement lift mixture specifications and performance characteristics as they currently stand; 2) test the current MassDOT mixes and benchmark their performance and construction costs and determining if it is possible to optimize materials or design parameters to improve on the current specifications; and 3) perform a life cycle cost analysis for the optimized mixture types. The NTP was issued and the project was kicked off at the beginning of FFY21 Q4. Extensive literature review is currently under way. Extensive lab testing of mixtures is expected in FFY22.

8. **Development of Improved Inspection Techniques using LiDAR for Deteriorated Steel Beam Ends (FFY22 New Project)**
   Through past research (see subtask G.6.) MassDOT has developed new improved procedures to accurately describe the remaining load carrying capacity of deteriorated steel beams. In addition, using LiDAR scanning technology for acquiring crucial data for load rating has been explored in the lab environment. This project will employ the LiDAR scanner for a field verification of the methodology. This will produce field results reflecting challenges faced by bridge inspectors in the field, a comparison with lab results from Phase II, and verification of using the 3D scanning technology for bridge inspection in reality. More specifically, the study will collect data using the LiDAR in the field, develop

appropriate methods to process the data (filter noise, scale the problem, etc.) and use the output to provide important information for the estimation of the residual capacity.

9. **Accessibility-Focused User Research (FFY22 New Project)**
   There are many barriers that riders with disabilities encounter on a daily basis. The purpose of this research is to better understand if and how technologies including both existing products like MBTA.com, T-Alerts, and digital screens, as well as new products, could help specific segments of riders (e.g., riders in mobility devices, older adults, families with strollers, etc.) more easily use the transit system on a daily basis. The primary output of this research will be the artifacts of the research itself: journey maps and synthesis documents, possibly including video clips and interview transcriptions. The secondary output will be wireframes and prototypes, whether of new features for existing products (like MBTA.com or digital screens) or new technology concepts, that have been shown to riders for feedback and iteration. These outputs would help System-Wide Accessibility (SWA) and Customer Technology (CTD) understand problems holistically, rather than anecdotally, and prioritize amongst the many problems to work on, and the possible approaches in addressing them.

Accomplishments in prior year:

- Completed the "Transit Data Infrastructure" project. Final report was posted on Research website and submitted to TRID and the National Transportation Library.
- Completed the "Flexible Transit for Rural Areas" project. Final report is under FHWA review and will be posted on Research website and submitted to TRID and the National Transportation Library.
- Advanced the "Asset Management Systems at Municipalities" project. 50% completed.
- Advanced the "Development of Comprehensive Inspection Protocols for Deteriorated Steel Beam Ends" project. 80% completed.
- Contracted and initiated the "Ultra-High-Performance Concrete Reinforced with Multi-Scale Hybrid Fibers and Its Durability-Related Properties" project.
- Contracted and initiated the "Revised Load Rating Procedures for Deteriorated Prestressed Concrete Beams" project.
- Contracted and initiated the "Optimization of MassDOT's High Performance Thin Lift Mixtures" project.
- Solicited and selected FFY22 long-term research projects.

Proposed activities for this year:

- Complete the "Asset Management Systems at Municipalities" project.
- Complete the "Development of Comprehensive Inspection Protocols for Deteriorated Steel Beam Ends" project.
- Advance the "Ultra-High-Performance Concrete Reinforced with Multi-Scale Hybrid Fibers and Its Durability-Related Properties" project to 50% complete.

- Advance the "Revised Load Rating Procedures for Deteriorated Prestressed Concrete Beams" project to 50% complete.
- Advance the "Optimization of MassDOT's High Performance Thin Lift Mixtures" project to 50% complete.
- Identify PIs, develop amplified work plans, and establish ISAs or contracts for FFY22 new long-term research projects.
- Kick off FFY22 new long-term research projects.
- Solicit and Identify FFY23 long-term research projects.

Anticipated products:

- Contracts/ISAs for FFY22 long-term projects.
- Initiation of FFY22 long-term projects.
- Interim deliverables and final reports for long-term research projects that are scheduled to be completed during FFY22.
- Identification of FFY23 long-term projects.

Estimated task completion: Ongoing

Timeline for consultant support: 1. Ultra-High-Performance Concrete Reinforced with Multi-Scale Hybrid Fibers and Its Durability-Related Properties (Continuing Project)

- Consultant Name: UMass Lowell
- Scope development and FHWA review/approval: Previously completed
- Consultant procurement and selection: Previously completed
- Contract negotiations and FHWA review/approval: Previously completed
- Consultant notice to proceed: August, 2021
- Total duration of task: 24 months

Timeline for consultant support: 2. Complete Streets v.2: Respecting the Roots (FFY22 New Project)

- Consultant Name: TBD
- Scope development and FHWA review/approval: January 2022
- Consultant procurement and selection: January 2022
- Contract negotiations and FHWA review/approval: February 2022
- Consultant notice to proceed: March 2022
- Total duration of task: 33 months

Timeline for consultant support: 3. Asset Management Systems at Municipalities (Continuing Project)

- Consultant Name: UMass Dartmouth
- Scope development and FHWA review/approval: Previously completed
- Consultant procurement and selection: Previously completed
- Contract negotiations and FHWA review/approval: Previously completed
- Consultant notice to proceed: April, 2020
- Total duration of task: 24 months

Timeline for consultant support: 4. Revised Load Rating Procedures for Deteriorated Prestressed Concrete Beams (Continuing Project)

- Consultant Name: UMass Amherst
- Scope development and FHWA review/approval: Previously completed
- Consultant procurement and selection: Previously completed
- Contract negotiations and FHWA review/approval: Previously completed
- Consultant notice to proceed: May 2021
- Total duration of task: 27 months

Timeline for consultant support: 5. Field Study to Determine Salt Usage Efficiency on Two Pavement Types (FFY22 New Project)

- Consultant Name: TBD
- Scope development and FHWA review/approval: January 2022
- Consultant procurement and selection: January 2022
- Contract negotiations and FHWA review/approval: February 2022
- Consultant notice to proceed: March 2022
- Total duration of task: 36 months

Timeline for consultant support: 6. Development of Comprehensive Inspection Protocols for Deteriorated Steel Beam Ends (Continuing Project)

- Consultant Name: UMass Amherst
- Scope development and FHWA review/approval: Previously completed
- Consultant procurement and selection: Previously completed
- Contract negotiations and FHWA review/approval: Previously completed
- Consultant notice to proceed: February, 2020
- Total duration of task: 26 months

Timeline for consultant support: 7. Optimization of MassDOT High Performance Thin Lift Mixtures (Continuing Project)

- Consultant Name: UMass Dartmouth
- Scope development and FHWA review/approval: Previously completed
- Consultant procurement and selection: Previously completed
- Contract negotiations and FHWA review/approval: Previously completed
- Consultant notice to proceed: July 2021
- Total duration of task: 24 months

Timeline for consultant support: 8. Development of Improved Inspection Techniques using
LiDAR for Deteriorated Steel Beam Ends (FFY22 New Project)

- Consultant Name: TBD
- Scope development and FHWA review/approval: January 2022
- Consultant procurement and selection: January 2022
- Contract negotiations and FHWA review/approval: February 2022
- Consultant notice to proceed: March 2022
- Total duration of task: 24 months

Timeline for consultant support: 9. Accessibility-Focused User Research (FFY22 New Project)

- Consultant Name: TBD
- Scope development and FHWA review/approval: January 2022
- Consultant procurement and selection: January 2022
- Contract negotiations and FHWA review/approval: February 2022
- Consultant notice to proceed: March 2022
- Total duration of task: 24 months

Estimated task budget: $1,215,941.00

Staff salaries and benefits: $58,065.00

MassDOT staff members	% time to task
Michael Flanary	10%
Drew Pflaumer	10%
Hongyan Oliver	10%
Patrick McMahon	30%
Nicholas Zavolas	10%

Consultant costs: $1,157,876

Subtask / contract #	Total cost:	Spending Pre-FFY 2022:	FFY 2022 spending:	Post FFY 2022 spending:	Consultant/Post -Contractor Name	Consultant NTP	Contract End Date
1. Ultra-High-Performance Concrete Reinforced with Multi-Scale Hybrid Fibers and Its Durability-Related Properties (Continuing Project) / 115287	$206,538	$18,199	$97,653	$90,686	UMass Lowell	August, 2021	October, 2023
2. Complete Streets v.2: Respecting the Roots (FFY22 New Project) / TBD	$90,000	$0	$45,000	$45,000	TBD	TBD	TBD
3. Asset Management Systems at Municipalities (Continuing Project) / 110556	$200,497	$35,000	$165,497	$0	UMass Dartmouth	April, 2020	April, 2022
4. Revised Load Rating Procedures for Deteriorated Prestressed Concrete Beams (Continuing Project) / 114071	$199,955	$31,922	$111,654	$56,379	UMass Amherst	May 2021	August, 2023
5. Field Study to Determine Salt Usage Efficiency on Two Pavement Types (FFY22 New Project) / TBD	$450,000	$0	$236,033	$213,967	TBD	TBD	TBD
6. Development of Comprehensive Inspection Protocols for Deteriorated Steel Beam Ends (Continuing Project) / 110354	$149,998	$138,856	$11,142	$0	UMass Amherst	February, 2020	March, 2022
7. Optimization of MassDOT High Performance Thin Lift Mixtures (Continuing Project) / 114557	$249,997	$93,201	$145,897	$10,899	UMass Dartmouth	July 2021	September, 2023
8. Development of Improved Inspection Techniques using LiDAR for Deteriorated Steel Beam Ends (FFY22 New Project) / TBD	$200,000	$0	$120,000	$80,000	TBD	TBD	TBD
9. Accessibility-Focused User Research (FFY22 New Project) / TBD	$375,000	$0	$225,000	$150,000	TBD	TBD	TBD

Consultant notes:

Other costs: $0

H. National and Regional Collaboration

Task lead: Hongyan Oliver

Task purpose and need: To coordinate MassDOT's participation in national and regional transportation research activities, including the research committees, research statement submission and reviews, project panels, technical working groups, and task forces; to disseminate MassDOT's research efforts, products, program management and delivery approaches both nationally and regionally; and to distribute research results and activities of Transportation Research Board (TRB), American Association of State Highway and Transportation Officials (AASHTO) and other state DOTs within MassDOT.

Accomplishments in prior year:

- Coordinated within MassDOT Highway Divisions to establish participation in transportation pooled fund (TPF) projects funded through SPRII.
- Participated in and contributed to AASHTO Research Advisory Committee activities.
- Coordinated the TRB National Cooperative Highway Research Program (NCHRP) problem statement review process.
- Disseminated TRB research reports, technical webinars and NCHRP project panel member solicitations to appropriate MassDOT staff.
- Participated in and contributed to New England Transportation Consortium (NETC) program management and technical activities.
- Participated in and contributed to AASHTO's RAC Regional 1 activities including preparation activities for the RAC 2021 summer meeting.
- Applied for and received AASHTO RAC Committee Sweet-Sixteen High Value Research Project Award.
- Updated MassDOT research projects in the TRB Research-In-Progress database.
- Disseminated MassDOT research reports through the TRB E-Newsletter.

Proposed activities for this year:

- Coordinate within MassDOT to establish participation in pooled fund programs, and support AASHTO RAC activities, NCHRP research statement reviews, NCHRP technical panel participation, and TRB representative's visit.
- Lead and contribute to RAC Region I activities.
- Participate in and contribute to the NETC activities.
- Work with RAC Regional 1 committee and AASHTO meeting committee to plan and host the in-person RAC 2022 summer meeting, which was rescheduled from 2020 due to COVID.
- Participate in the TRB's Northeast state group visit.

Anticipated products:

- Distribution of research products and information from TRB, TPF and other state DOTs.
- Communication of MassDOT research reports through TRB E-Newsletter.
- Organizing and Participation in AASHTO RAC activities.
- Identification of MassDOT's position on problem statements for the annual NCHRP project cycle.
- Identification of MassDOT's position on problem statements for the annual NETC project cycle.
- Coordination of MassDOT subject matter experts' participation in NETC projects.
- Host RAC 2022 Summer Meeting.
- Participation in the TRB's Northeast state group visit.

Estimated task completion: Ongoing
Estimated task budget: $65,216.00

Staff salaries and benefits: $65,216.00

MassDOT staff members	% time to task
Hongyan Oliver	15%
Drew Pflaumer	10%
Michael Flanary	10%
Nicholas Zavolas	20%
Patrick McMahon	20%

Other costs: $0

Transportation Pooled Fund Projects

Below is a list of Transportation Pooled Fund projects with a total cost of $1,192,000 (eligible for 100% federal funds and thus not included in the SPR financial table but included in the FFY22 STIP as a line item collectively). The funds transfer will be initiate in Q1 with the exception of 5(420).They are noted here for informational purposes:

- 5(343) Roadside Safety Research for MASH Implementation, $50,000
- 5(370) Fostering Innovation in Pedestrian and Bicycle Transportation, $25,000
- 5(373) New England Transportation Consortium, $100,000
- 5(420) National Cooperative Highway Research Program, $723,000
- 5(437) Tech Transfer Concrete Consortium, $12,000
- 5(431) Application of Enterprise GIS for Transportation, Guidance or a National Transportation Framework (AEGIST), $100,000 (100% federal fund waiver is for SPRI)
- 5(447) Traffic Control Device (TCD) Consortium, $10,000
- 5(455) National Accessibility Evaluation Phase II, $38,000
- 5(456) Econworks, $4,000 ((100% federal fund waiver is for SPRI)
- 5(464) H&H software updates, $10,000
- 5(479) Clear Roads Phase III, $25,000
- 5(481) In-Service Performance Evaluation (ISPE) of Roadside Safety Features, $30,000
- 5(482) Development and Evaluation of Roadside Safety Systems for Motorcyclists, $40,000
- Anticipated additional requests during FFY 22: $25,000

MassDOT University (Workforce Training by MassDOT HR Office Training Program

Task lead: Claudia Smith-Reid

Task purpose and need: To support MassDOT University's (MassDOT U) activities that provide oversight and administration of the technical training, certification, and professional skills development for employees of the MassDOT Highway Division. The scope of work will include:

- Northeast Transportation Technician Certification Program (NETCP)
- MassDOT/Wentworth Construction Management Certificate Program (CMCP)
- Assistance to the MassDOT Aeronautics and Highway Division UAS Education/Certification
- Partnership. (To Assist with the implementation of the McKinsey Report on Highway Future Workforce Innovation Project.)
- Assistance to MassDOT Research & Materials (R&M) in the promotion of American Association of State Highway and Transportation Officials (AASHTO) TC3 Curriculum
- Assistance to Highway District Coordinators working with MassDOT Business Partners in the delivery of engineering (FE/PE) preparatory and industry standard and technical courses upon requests.

Subtasks:

Construction Management Certificate Program

Implement the year one of the 3-year partnership agreement with the Wentworth Institute of Technology (WIT). Deliver the Construction Management Certification Program to 30 participants representing all Highway districts. The annual expense is $ 60,000. This annual expense covers the delivery of the previously approved 7-week curriculum (the module contents had been jointly developed by WIT and MassDOT in FFY18 and approved by FHWA in FFY19). It is anticipated that about thirty (30) MassDOT Highway construction staff will attend the 7-week training program each year. The Contract was put in place in January 2021. However, due to the Pandemic, the FFY21 training was not delivered remotely or hybrid during Jan. March 2021 at the direction of MassDOT Highway Administration. The first program to be delivered under this contract will be January - March 2022.

Drone Pilot Program

MassDOT HR Training will administer program steps to support MassDOT Aeronautics and Highway Division UAS Education/Certification Partnership Program and launch the Drone Pilot Program -- a 7-week UAS certified program for highway staff who would use drones to support their daily functions. Next steps include procurement of a qualified consultant to develop

the curriculum in partnership with Highway and Aeronautics Divisions (may involve Highway Districts, relevant sections and Subject Matter Experts). The SOW for consultant procurement, the contract, and final deliverables will be submitted to FHWA for review and approval per the SPR SOP.

Accomplishments in prior year:

- Worked with R&M to pivot certification and testing requirements into an extension program, customized training, and targeted testing based on needs of each district. NETTCP is under a new administration of staff and ACI certification and training will operate as an independent vendor for services rendered. ($100,000 +).
- Established a new 3-year partnership agreement with Wentworth Institute to continue the delivery of the customized training program the Construction Management Certificate Program. Thirty staff (five in each District) will be selected and trained each year, 2021-2023. Rescheduled training start date:1/20/22.
- Supported the D2 partnership agreement with the School of PE to cover costs of course review for FE/SE/PE Civil Exams. ($1440)
- Worked with MassDOT Aeronautics to discuss and define a 'Statement of Work' and communication plan to discuss with FHWA in support of the Drone Pilot Program (DPP).
- It is projected that MassDOT Highway will spend close to $ 250,000 at end of FFY21.

Proposed activities for this year:

- Continue the administration of certification courses through the Northeast Transportation Technician Certification Program (NETTCP), which is required for several jobs for construction and materials testing. R&M projects spending closer to $350,000 in the year ahead as new staff are hired and new skills required for expanded bridge and roadway capital projects in FFY21 into FFY23.
- Implement the year one of the 3-year partnership agreement with the Wentworth Institute of Technology (WIT). Deliver the Construction Management Certification Program to 30 participants representing all Highway districts. The annual expense is $ 60,000. This annual expense covers the delivery of the previously approved 7-week curriculum (the module contents had been jointly developed by WIT and MassDOT in FFY18 and approved by FHWA in FFY19). It is anticipated that about thirty (30) MassDOT Highway construction staff will attend the 7-week training program each year.
- Continue to administer program steps to support the MassDOT Aeronautics and Highway Division UAS Education/Certification Partnership Program and launch the Drone Pilot Program -a 7-week UAS certified program for highway staff.
- Provide funding for MassDOT employees to participate in various trainings as identified throughout the year in the areas of design, construction, management, and maintenance of highways, public transportation, and

intermodal transportation systems. These activities include contracts, agreements, reimbursements, and invoices for technical training, certifications, and the enumeration of subject matter experts. AASHTO's TC3 online technical curriculum on construction, maintenance and materials will be used for these trainings.
- Support employees in training related to the Professional Engineering Preparatory Courses.
- Prepare quarterly reports on the status of MassDOT U professional development and training programs.
- Initiate planning and coordination for the 2022 MassDOT U professional development and training programs and services.
- Prepare FFY 2023 MassDOT U professional development and training work plan.

Anticipated products:
- Administration of certification courses through the Northeast Transportation Technician
- Certification Program (NETTCP) and American Concrete Institute (ACI). (Estimated Costs: $380,000). This dollar increase relates to the increased use of ACI tested materials (concrete +) in expanded Bridge Construction projects slated in the capital budget.
- Administration of the Mass DOT/Wentworth Construction Management Certificate Program.
- (Estimated Costs: 60,000 annual).
- Administration of FHWA approval process for MassDOT Aeronautics/Highway Drone Pilot Program (DPP). Next steps include procurement of a qualified consultant to develop a training program in collaboration with Highway and Aeronautic Division; and once the curriculum is approved, deliver the training. (Estimated Costs: $100,000 per year for 3 years)
- Assistance to MassDOT Staff taking industry/trade/engineering specific professional engineering preparatory. (Estimated Costs: ($60,000)

Estimated task completion: ongoing

Timeline for consultant support: Construction Management Certificate Program
- Consultant Name: Wentworth Institute of Technology
- Scope development and FHWA review/approval: Previously completed
- Consultant procurement and selection: Previously completed
- Contract negotiations and FHWA review/approval: Previously completed
- Consultant notice to proceed: Jan, 2021
- Total duration of task: 33 months

Timeline for consultant support: Drone Pilot Program
- Consultant Name: TBD
- Scope development and FHWA review/approval: Dec, 2021

- Consultant procurement and selection: Mar 2022
- Contract negotiations and FHWA review/approval: May 2022
- Consultant notice to proceed: May 2022
- Total duration of task: 36 months

Estimated task budget: $600,000.00

Consultant costs: $160,000

Subtask / contract #	Total cost:	Spending Pre-FFY 2022:	FFY 2022 spending:	Post FFY 2022 spending:	Consultant/Post -Contractor Name	Consultant NTP	Contract End Date
Construction Management Certificate Program / 113551	$180,000	$0	$60,000	$60,000	Wentworth institute of Technology	January 2021	September, 2023
Drone Pilot Program / TBD	$300,000	$0	$100,000	$200,000	TBD	TBD	TBD

Consultant notes:
Other costs: $440,000

SPR II Financial Table

Task	PARS #	Staff cost	Consultant cost	Other cost	Total task cost
A. Research Program Development, Administration, and Implementation	TBD	$82,213	$0	$0	$82,213
B. Massachusetts Cooperative Research Program (MCRP)	TBD	$37,204	$1,265,905	$0	$1,303,109
C. Local Technical Assistance Program (LTAP)	TBD	$15,364	$1,650,131	$0	$1,665,495
D. MassDOT Training Services (MTS)	TBD	$4,577	$1,005,907	$0	$1,010,484
E. Short-term Research Projects	TBD	$59,052	$522,262	$0	$581,314
1. Implementing the AASHTO Mechanistic-Empirical Pavement Design Guide Phase III (FFY22 New Project, Continuation of Phase II effort in subtask F.15)			$0		
2. Methods to Identify Problematic Carriers and Prevent Infrastructure Damage (FFY22 New Project)			$80,000		
3. Feasibility Study of 3D Printing Applications for Bridge Elements in MA (FFY22 New Project)			$120,000		
4. Data-Driven Approach for Transit Capital Planning (FFY22 New Project)			$80,000		
5. BIM for Transit Infrastructure: A Feasibility and gap assessment with current practices and systems at the MBTA (FFY22 New Project)			$80,000		
6. Using Traffic Signals to Limit Speeding Opportunities on Arterial Roads (Continuing Project)			$85,863		
7. Uncovering the Root Causes for Truck Rollover Crashes on Ramps (Continuing Project)			$46,399		
8. Synthesis study: Microfiltration Treatment and Design Options (Continuing Project)			$30,000		
F. Medium-term Research Projects	TBD	$84,795	$1,225,184	$0	$1,309,979
1. Measuring Accessibility to Improve Public Health (Continuing Project)			$94,569		
2. A Method for Pavement Marking Inventory and Retroreflectivity Condition Assessment Using Mobile LiDAR (Continuing Project)			$1,541		
3. Feasibility of the 3D Printing Application for Highway Infrastructure Construction and Maintenance (Continuing Project)			$69,129		
4. Using Grip Sensors to Control a Salt Spreader Application Rate (FFY22 New Project)			$80,000		
5. UAS for Surface Transportation Emergency Response (Continuing Project)			$29,000		
6. Detecting Subsurface Voids Using UAS with Infrared Thermal Imaging (Continuing Project)			$18,000		
7. Impact of Advanced Driver Assistance Systems (ADAS) on Road Safety and Implications for Education, Licensing, Registration and Enforcement (Continuing Project)			$10,835		

8. Smart work zone control and performance evaluation based on trajectory data (FFY22 New Project)			$120,000		
9. Developing Massachusetts Specific Trip Generation Rates for Land Use Projects (Continuing Project)			$85,811		
10. Multisource Data Fusion for Real-Time and Accurate Traffic Incident Detection (Continuing Project)			$89,754		
11. Post-Fire Damage Inspection of Concrete Structures in Tunnels Phase II (Continuing Project)			$96,035		
12. Massachusetts Depth to Bedrock Project (Continuing Project)			$66,836		
13. Outdoor Information Panels to Convey Real-Time Travel Information for Ridership Recovery (Continuing Project)			$74,044		
14. Post-Fire Damage Inspection of Concrete Structures Phase III Field Verification Phase (FFY 22 New Project)			$144,000		
15. Implementing AASHTO M-E Pavement Design Guide Phase II (Continuing Project)			$125,630		
16. Effectiveness of Two-stage Turn Queue Boxes in Massachusetts: A Comparison with Bike Boxes (FFY22 New Project)			$120,000		
G. Long-term Research Projects	TBD	$58,065	$1,157,876	$0	$1,215,941
1. Ultra-High-Performance Concrete Reinforced with Multi-Scale Hybrid Fibers and Its Durability-Related Properties (Continuing Project)			$97,653		
2. Complete Streets v.2: Respecting the Roots (FFY22 New Project)			$45,000		
3. Asset Management Systems at Municipalities (Continuing Project)			$165,497		
4. Revised Load Rating Procedures for Deteriorated Prestressed Concrete Beams (Continuing Project)			$111,654		
5. Field Study to Determine Salt Usage Efficiency on Two Pavement Types (FFY22 New Project)			$236,033		
6. Development of Comprehensive Inspection Protocols for Deteriorated Steel Beam Ends (Continuing Project)			$11,142		
7. Optimization of MassDOT High Performance Thin Lift Mixtures (Continuing Project)			$145,897		
8. Development of Improved Inspection Techniques using LiDAR for Deteriorated Steel Beam Ends (FFY22 New Project)			$120,000		
9. Accessibility-Focused User Research (FFY22 New Project)			$225,000		
H. National and Regional Collaboration	TBD	$65,216	$0	$0	$65,216
MassDOT University (Workforce Training by MassDOT HR Office Training Program)	TBD	$0	$160,000	$440,000	$600,000
Construction Management Certificate Program			$60,000		
Drone Pilot Program			$100,000		

Totals

Task	Staff cost	Consultant cost	Other cost	Total task cost
SPR II Totals	$406,486	$6,987,265	$440,000	$7,833,751

The SPR II is 25% of the overall SPR Work Program, meeting the 25% minimum threshold.