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New Hampshire DOT
Department of Transportation

THE STATE OF NEW HAMPSHIRE
DEPARTMENT OF TRANSPORTATION

Victoria F. Sheehan
Commissioner

William Cass, P.E.
Assistant Commissioner

Bureau of Materials & Research
April 27, 2022

His Excellency, Governor Christopher T. Sununu
and the Honorable Council
State House
Concord, New Hampshire 03301

REQUESTED ACTION

Authorize the Department of Transportation to amend a **SOLE SOURCE** Cooperative Project Agreement (CPA) with the University of New Hampshire Sponsored Programs Administration (Vendor 177867), Durham, New Hampshire, by increasing the total project funding by $54,000.00, from $159,757.00 to $213,757.00 for additional technology equipment that was not anticipated in the original scope of work, effective upon Governor and Council approval through August 31, 2023. The original contract for research related to a cooperative evaluation of an alternate method of exploring subsurface geological conditions, a technique known as Monitoring-While-Drilling (MWD) was approved by Governor and Council on May 5, 2021, Item #26. 100% Federal Funds.

Funding is available in the following account for FY 2023:

	FY 2023
04-96-96-962015-3036	
SPR Research Funds	
046-500464 General Consultants Non-Benefit	$54,000.00

EXPLANATION

The Department is collaborating with the University of New Hampshire (UNH) to conduct a cooperative research study, "Use of Drilling Parameters for Enhancing Geotechnical Site Investigations with Applications to Rock Assessment", to produce a continuous quantitative drilling record, and the correlated paraments can be applied more reliably to the design process. The research study addresses an immediate Department need; is unique to New Hampshire's environment and conditions, thereby requiring substantial local experience; and is directly aligned with a particular area of UNH's expertise.

On May 5, 2021, the original CPA was approved by Governor and Council (Item #26, copy of resolution attached) with a funding allocation of $79,878.00/year for FYs 2021 and 2022. The original scope included funds to support a collaborative effort for designing or purchasing a torque sensor that would alleviate some variables in MWD data collection and aid in the success of full implementation of MWD. As research with MWD is continually evolving, an off-the-shelf torque sensor has become available. This amendment will support acquisition of two torque sensors, one for the Department's current drill rig and the second for one that is currently in the bidding process. All other provisions of the agreement shall remain in effect.

The funding is 80% Federal Funds with 20% state match. Turnpike toll credits is used for the match requirement, effectively using 100% Federal Funds. The Capital Budget Overview Committee approved the use of Turnpike Toll Credits to meet funding match requirements for the Department's State Planning and Research Part II (SPR2) Work Program on September 13, 2021, Item CAP 21-013.

This amended Agreement has been approved by the Attorney General as to form and execution. A copy of the fully executed amendment is on file at the Secretary of State's Office and the Department of Administrative Services, and subsequent to the Governor and Council approval will be on file at the Department of Transportation.

It is respectfully requested that authority be given to amend this Agreement.

Sincerely,

Victoria F. Sheehan
Commissioner

Attachments

CAP 21-013

New Hampshire DOT
Department of Transportation

THE STATE OF NEW HAMPSHIRE
DEPARTMENT OF TRANSPORTATION

Victoria F. Sheehan
Commissioner

William Cass, P.E.
Assistant Commissioner

Bureau of Materials and Research
July 13, 2021

The Honorable John Graham, Chair
Capital Budget Overview Committee
State House
Concord, New Hampshire 03301

REQUESTED ACTION

Pursuant to the provisions RSA 228:12-a, Use of Toll Credits, the Department requests the Capital Budget Overview Committee approve the Department of Transportation's use of Toll Credits to meet funding match requirements for the Department's State Planning and Research Part II (SPR2) Work Program. The estimated cost of annual administrative and research related work is $600,000. Based on the estimated cost, the annual maximum amount of Turnpike Toll Credit needed is $120,000..

EXPLANATION

As part of the Federal-Aid Highway Program, the Federal Highway Administration (FHWA) requires that 2% of the State's apportioned funds be set aside for State Planning and Research activities with 75% dedicated to planning and 25% to research. This is a federally mandated program and these funds can only be used for these purposes. To meet this requirement, the NHDOT's State Planning and Research Part II (SPR2) annual Work Program includes a blend of administrative, in-house, and contracted research work.

Research activities included in the requested action are undertaken in accordance with federal regulations and state priorities. The Department's Research Advisory Council meets biennially to rate and prioritize research needs submitted by Department staff. Annual administrative projects fund implementation of promising results, training and certification the Department's technicians providing inspection and material testing on construction projects, and activities related to technology transfer.

Research studies conducted under the SPR2 program have led to numerous gains and innovations in the state's highway and bridge industry, including such successes as improved pavement treatment, alternative materials and methods for bridge construction and repair, validation of environmental compliance, and forensic analysis of transportation construction activities.

The New Hampshire Division of the Federal Highway Administration is provided our annual SPR2 Work Program for review and approval prior to the start of each federal fiscal year. FHWA funding authorization and Governor and Council approval of research contracts are reliant on Toll Credit approval.

Funding is from the annual State Planning and Research (SPR) program, a mandated federal program set-aside.

The balance of toll credits at the end of Federal Fiscal year 2020 is $202 million.

Your approval of the above action is respectfully requested.

Sincerely,

Victoria F. Sheehan
Commissioner

AMENDMENT #1 to
COOPERATIVE PROJECT AGREEMENT
between the
STATE OF NEW HAMPSHIRE, **Department of Transportation**
and the
University of New Hampshire of the UNIVERSITY SYSTEM OF NEW HAMPSHIRE

The Cooperative Project Agreement, approved by the State of New Hampshire Governor and Executive Council on **5/05/21**, item # **26**, for the Project titled "**Use of drilling parameters for enhancing geotechnical site investigations with applications to rock assessment (SPR 42372F),**" Campus Project Director, **Dr. Jean Benoit**, is and all subsequent properly approved amendments are hereby modified by mutual consent of both parties for the reason(s) described below:

Purpose of Amendment (Choose all applicable items):

☐ Extend the Project Agreement and Project Period end date, at no additional cost to the State.

☒ Provide additional funding from the State for expansion of the Scope of Work under the Cooperative Project Agreement.

☐ Other:

Therefore, the Cooperative Project Agreement is and/or its subsequent properly approved amendments are amended as follows (Complete only the applicable items):

- Article A. is revised to replace the State Department name of with and/or USNH campus from to .
- Article B. is revised to replace the Project End Date of with the revised Project End Date of , and Exhibit A, article B is revised to replace the Project Period with .
- Article C. is amended to expand Exhibit A by including the proposal titled, " ," dated .
- Article D. is amended to change the State Project Administrator to and/or the Campus Project Administrator to .
- Article E. is amended to change the State Project Director to and/or the Campus Project Director to .
- Article F. is amended to add funds in the amount of **$ 54,000** and will read:

  Total State funds in the amount of **$ 213,757** have been allotted and are available for payment of allowable costs incurred under this Project Agreement. State will not reimburse Campus for costs exceeding the amount specified in this paragraph.

- Article F. is amended to change the cost share requirement and will read:

  Campus will cost-share % of total costs during the amended term of this Project Agreement.

- Article F. is amended to change the source of Federal funds paid to Campus and will read:

  Federal funds paid to Campus under this Project Agreement as amended are from Grant/Contract/Cooperative Agreement No. from under CFDA# . Federal

Campus Authorized Official KJ
Date 4/25/22

regulations required to be passed through to Campus as part of this Project Agreement, and in accordance with the Master Agreement for Cooperative Projects between the State of New Hampshire and the University System of New Hampshire dated November 13, 2002, are attached to this document as **revised** Exhibit B, the content of which is incorporated herein as a part of this Project Agreement.

- Article G. is exercised to amend Article(s) of the Master Agreement for Cooperative Projects between the State of New Hampshire and the University System of New Hampshire dated November 13, 2002, as follows:

  Article is amended in its entirety to read as follows:
  Article is amended in its entirety to read as follows:

- Article H. is amended such that:

  ☐ State has chosen **not to take** possession of equipment purchased under this Project Agreement.
  ☐ State has chosen **to take** possession of equipment purchased under this Project Agreement and will issue instructions for the disposition of such equipment within 90 days of the Project Agreement's end-date. Any expenses incurred by Campus in carrying out State's requested disposition will be fully reimbursed by State.

- ☒ Exhibit A is amended as attached.

- ☐ Exhibit B is amended as attached.

All other terms and conditions of the Cooperative Project Agreement remain unchanged.

This Amendment, all previous Amendments, the Cooperative Project Agreement, and the Master Agreement constitute the entire agreement between State and Campus regarding the Cooperative Project Agreement, and supersede and replace any previously existing arrangements, oral and written; further changes herein must be made by written amendment and executed for the parties by their authorized officials.

This Amendment and all obligations of the parties hereunder shall become effective on the date the Governor and Executive Council of the State of New Hampshire, or other authorized officials approve this Amendment to the Cooperative Project Agreement.

IN WITNESS WHEREOF, the following parties agree to this **Amendment #1** to the Cooperative Project Agreement.

By An Authorized Official of:
University of New Hampshire
Name: Karen Jensen
Title: Director, Pre-Award Compliance
Signature and Date: Karen Jensen Digitally signed by Karen Jensen Date: 2022.04.26 17:37:35 -04'00'

By An Authorized Official of:
Department of Transportation
Name: Peter E. Stamnas
Title: Director of Project Development
Signature and Date: 5/2/2022

By An Authorized Official of: the New Hampshire Office of the Attorney General
Name: EMILY GOERING
Title: Assistant AG
Signature and Date: Emily C. Goering

By An Authorized Official of: the New Hampshire Governor & Executive Council
Name:
Title:
Signature and Date:

Campus Authorized Official KJ
Date 4/25/22

EXHIBIT A

A. Project Title: Use of drilling parameters for enhancing geotechnical site investigations with applications to rock assessment (SPR Project 42372F)

D. Scope of Work:

Task 1 – MWD Upgrade

Upgrade the MWD system with the latest generation Lutz equipment composed of some components provided by University of New Hampshire (UNH). The UNH system is 20 years old with only few components operational.

Task 3 – Torque sensor system:

Purchase two torque sensor systems; one for the MWD system installed on the NHDOT rig (Task 1) and for the MWD system on a second drill rig. These were designed and developed in collaboration with Central Mine Equipment Company and Jean Lutz North America. The systems are compatible to the remainder of the MWD system fitted to the mechanically driven drill rigs operated by the NHDOT.

F. Budget and Invoicing Instructions:

Budget Items	Original	Increased this Amendment	New Project Total
1. Salaries & Wages	$61,878	$0.0	$61,878
2. Employee Fringe Benefits	$3,156	$0.0	$3,156
3. Tuition	$18,636	$0.0	$18,636
4. Materials & Supplies	$8,000	$0.0	$8,000
5. Travel	$4,500	$0.0	$4,500
6. Equipment	*$27,000*	*$40,000*	*$67,000*
Total Direct Costs	$123,170	$40,000	$163,170
Facilities & Administrative	$36,587	$14,000	$50,587
Total Project Cost:	$159,757	$54,000	*$213,757*

Campus Authorized Official KJ
Date 4/25/22

New Hampshire DOT
Department of Transportation

Victoria F. Sheehan
Commissioner

THE STATE OF NEW HAMPSHIRE
DEPARTMENT OF TRANSPORTATION

G+C #26
Date 5/5/21

William Cass, P.E.
Assistant Commissioner

Bureau of Materials & Research
April 2, 2021

His Excellency, Governor Christopher T. Sununu
and the Honorable Council
State House
Concord, New Hampshire 03301

REQUESTED ACTION

Authorize the Department of Transportation to enter into a **SOLE SOURCE** Cooperative Project Agreement with the University of New Hampshire Sponsored Programs Administration (vendor 315187), Durham, New Hampshire, for a fee not to exceed $159,757.00, for a cooperative evaluation of an alternate method of exploring subsurface geological conditions, a technique known as Monitoring-While-Drilling (MWD) effective upon Governor and Council approval through August 31, 2023. 100% Federal Funds.

Funds to support this request are available in the following account for FY 2021 and is contingent upon the availability and continued appropriation of funds in FY 2022, with the ability to adjust encumbrances between State Fiscal Years through the Budget Office, if needed and justified.

04-96-96-962015-3036	FY 2021	FY 2022
SPR Research Funds		
046-500464 General Consultants Non-Benefit	$79,878.00	$79,879.00

EXPLANATION

The following research study will address an immediate Department need; is unique to New Hampshire's environment and conditions, thereby requiring substantial local experience; and is directly aligned with a particular area of University expertise. In addition, the Principal Investigator is a nationally recognized expert in his field. As such, the proposed work does not lend itself to a selection process that includes private industry or out-of-state organizations, and it is in the Department's and the State's best interest to work directly with the University of New Hampshire, requiring a **sole source** agreement.

This work is part of the Department's Statewide Planning and Research (SPR) program. The Department of Transportation and the University of New Hampshire (UNH) have a long-standing cooperative relationship in transportation research. This relationship has been mutually beneficial, culminating in savings to the State while enhancing work force development and maintaining New Hampshire's position on the leading edge of new technology. Research studies conducted by UNH for the Department have led to numerous innovations in the highway and bridge industry, including improved pavement design, increased use of recycled materials, stormwater management evaluation, and rapid construction techniques.

Statewide-SPR 42372F, Use of Drilling Parameters for Enhancing Geotechnical Site Investigations with Applications to Rock Assessment

The Department is collaborating with UNH to conduct a cooperative research study, "Use of Drilling Parameters for Enhancing Geotechnical Site Investigations with Applications to Rock Assessment". The Standard Penetration Test (SPT) of soil is a proven tool widely used in providing disturbed soil samples to aid in geotechnical site characterization along with estimating soil properties for the design of New Hampshire Department of Transportation (NHDOT) projects. Testing and sampling is typically done at 5 to 10 foot intervals and between these samples engineering judgement is used to identify the changes in stratigraphy and respective properties of the soils. The results from these tests are used to develop recommendations and aid in the design of the NHDOT projects.

A technique known as Monitoring-While-Drilling (MWD) makes use of the mechanical response of the drill rig and cutting tools while advancing a borehole. When combined with SPT testing, MWD can be used to produce a continuous quantitative drilling record, and the correlated parameters can be applied more reliably to the design process. For a total fee not to exceed $159,757 effective upon Governor and Council approval though August 31, 2023, this research will provide a thorough and accurate representation of subsurface conditions supporting higher quality and economical design for NHDOT projects.

The funding is 80% Federal Funds with 20% state match. Turnpike toll credit is being used for the match requirement, effectively using 100% Federal Funds. The Capital Budget Overview Committee approved the use of Turnpike Toll Credits on April 2, 2021.

This Agreement has been approved by the Attorney General as to form and execution. Copies of the fully-executed Agreement are on file at the Secretary of State's Office and the Department of Administrative Services, and subsequent to Governor and Council approval will be on file at the Department of Transportation.

It is respectfully requested that authority be given to enter into these sole-source Agreement for consulting services as outlined above.

Sincerely,

Victoria F. Sheehan
Commissioner

Attachments

CAP 21-002

New Hampshire DOT
Department of Transportation

Victoria F. Sheehan
Commissioner

THE STATE OF NEW HAMPSHIRE
DEPARTMENT OF TRANSPORTATION

Approved by the Capital Budget Overview Committee April 2, 2021

William Cass, P.E.
Assistant Commissioner

Bureau of Materials and Research
February 17, 2021

The Honorable Chairman
Capital Budget Overview Committee
State House
Concord, New Hampshire 03301

REQUESTED ACTION

Pursuant to the provisions RSA 228:12-a, Use of Toll Credits, the Department requests the Capital Budget Overview Committee approve the Department of Transportation's use of Toll Credits to meet funding match requirements for seven (7) proposed research projects as described in the federally approved Department's 2021 State Planning and Research Part II (SPR2) Work Program. The estimated cost of research related work is $863,409.70. Based on the estimated cost, the maximum amount of Turnpike Toll Credit needed is $172,681.94.

EXPLANATION

As part of the Federal-Aid Highway Program, the Federal Highway Administration (FHWA) requires that 2% of the State's apportioned funds be set aside for State Planning and Research activities with 75% dedicated to planning and 25% to research. This is a federally mandated program and these funds can only be used for these purposes. To meet this requirement, the NHDOT's State Planning and Research Part II (SPR2) annual Work Program includes a blend of in-house and contracted research work.

Research activities included in the requested action are undertaken in accordance with federal regulations and state priorities and were selected by the Department's Research Advisory Council and approved by the NH Division Federal Highway Administration. They include the following:

- Crushed Gravel for Shoulder Leveling 304.32
- Use of Drilling Parameters for Enhancing Geotechnical Site Investigations
- Subsurface Investigations for the 21st Century - Advancing our Practices beyond the Borehole
- Water Quality Test Site and Public Outreach at the Sutton Rest Area
- Wildlife Vehicle Collisions Data Gathering and Best Management Practices
- Concrete Slab Jacking
- Bus Stops and Passenger Amenities in Public Highway Right-Of-Ways

Research studies conducted under the SPR2 program have led to numerous gains and innovations in the state's highway and bridge industry, including such successes as improved pavement treatment,

alternative materials and methods for bridge construction and repair, validation of environmental compliance, and forensic analysis of transportation construction activities.

Funding is from the annual State Planning and Research (SPR) program, a mandated federal program set-aside.

The balance of toll credits at the end of federal fiscal year 2020 is $202.6 million.

Your approval of the above action is respectfully requested.

Sincerely,

Victoria F. Sheehan
Commissioner

Attachments

COOPERATIVE PROJECT AGREEMENT
between the
STATE OF NEW HAMPSHIRE, **Department of Transportation**
and the
University of New Hampshire of the UNIVERSITY SYSTEM OF NEW HAMPSHIRE

A. This Cooperative Project Agreement (hereinafter "Project Agreement") is entered into by the State of New Hampshire, **Department of Transportation**, (hereinafter "State"), and the University System of New Hampshire, acting through **University of New Hampshire**, (hereinafter "Campus"), for the purpose of undertaking a project of mutual interest. This Cooperative Project shall be carried out under the terms and conditions of the Master Agreement for Cooperative Projects between the State of New Hampshire and the University System of New Hampshire dated November 13, 2002, except as may be modified herein.

B. This Project Agreement and all obligations of the parties hereunder shall become effective on the date the Governor and Executive Council of the State of New Hampshire approve this Project Agreement ("Effective date") and shall end on **8/31/23**. If the provision of services by Campus precedes the Effective date, all services performed by Campus shall be performed at the sole risk of Campus and in the event that this Project Agreement does not become effective, State shall be under no obligation to pay Campus for costs incurred or services performed; however, if this Project Agreement becomes effective, all costs incurred prior to the Effective date that would otherwise be allowable shall be paid under the terms of this Project Agreement.

C. The work to be performed under the terms of this Project Agreement is described in the proposal identified below and attached to this document as Exhibit A, the content of which is incorporated herein as a part of this Project Agreement.
Project Title: **Use of drilling parameters for enhancing geotechnical site investigations with applications to rock assessment**

D. The Following Individuals are designated as Project Administrators. These Project Administrators shall be responsible for the business aspects of this Project Agreement and all invoices, payments, project amendments and related correspondence shall be directed to the individuals so designated.

State Project Administrator	**Campus Project Administrator**
Name: Deirdre Nash	Name: Karen Rooney
Address: NHDOT Bureau of Materials & Research 5 Hazen Dr., PO Box 483 Concord, NH 03302-0483	Address: University of New Hampshire Sponsored Programs Administration 51 College Rd. Rm 116 Durham, NH 03824
Phone: 603-271-8995	Phone: 603-862-5412

E. The Following Individuals are designated as Project Directors. These Project Directors shall be responsible for the technical leadership and conduct of the project. All progress reports, completion reports and related correspondence shall be directed to the individuals so designated.

State Project Director	**Campus Project Director**
Name: Krystle Pelham	Name: Jean Benoit
Address: NH DOT Bureau of Materials & Research 7 Hazen Dr., PO Box 483 Concord, NH 03302-0483	Address: Civil & Enviornmental Engineering UNH/RM W177 Kingsbury Hall Durham, NH 03824
Phone: 603-271-1657	Phone: 603-862-1419

Campus Authorized Official KJ
Date 1/28/21

F. Total State funds in the amount of **$159,757** have been allotted and are available for payment of allowable costs incurred under this Project Agreement. State will not reimburse Campus for costs exceeding the amount specified in this paragraph.

Check if applicable
☐ Campus will cost-share % of total costs during the term of this Project Agreement.

☒ Federal funds paid to Campus under this Project Agreement are from Grant/Contract/Cooperative Agreement No. **N/A** from **Federal Highway Administration** under CFDA# **20.205**. Federal regulations required to be passed through to Campus as part of this Project Agreement, and in accordance with the Master Agreement for Cooperative Projects between the State of New Hampshire and the University System of New Hampshire dated November 13, 2002, are attached to this document as Exhibit B, the content of which is incorporated herein as a part of this Project Agreement.

G. Check if applicable
☐ Article(s) of the Master Agreement for Cooperative Projects between the State of New Hampshire and the University System of New Hampshire dated November 13, 2002 is/are hereby amended to read:

H. ☐ State has chosen **not to take** possession of equipment purchased under this Project Agreement.
☒ State has chosen **to take** possession of equipment purchased under this Project Agreement and will issue instructions for the disposition of such equipment within 90 days of the Project Agreement's end-date. Any expenses incurred by Campus in carrying out State's requested disposition will be fully reimbursed by State.

This Project Agreement and the Master Agreement constitute the entire agreement between State and Campus regarding this Cooperative Project, and supersede and replace any previously existing arrangements, oral or written; all changes herein must be made by written amendment and executed for the parties by their authorized officials.

IN WITNESS WHEREOF, the University System of New Hampshire, acting through the **University of New Hampshire** and the State of New Hampshire, **Department of Transportation** have executed this Project Agreement.

By An Authorized Official of:
University of New Hampshire
Name: Karen M. Jensen
Title: Director, Pre-Award
Signature and Date: Karen Jensen 1/28/21

By An Authorized Official of:
Department of Transportation
Name: Peter E. Stamnas
Title: Director of Project Development
Signature and Date: 4/7/21

By An Authorized Official of: the New Hampshire Office of the Attorney General
Name: Allison Greenstein
Title: Asst. Attorney General
Signature and Date: Allison B Greenstein 4/14/21

By An Authorized Official of: the New Hampshire Governor & Executive Council
Name:
Title:
Signature and Date:

MAY 05 2021

DEPUTY SECRETARY OF STATE

Campus Authorized Official
Date 1/28/21

EXHIBIT A

A. Project Title:

Use of drilling parameters for enhancing geotechnical site investigations with applications to rock assessment (SPR Project 42372F)

B. Project Period

Governor and Council approval through August 31, 2023

C. Objectives:

The Standard Penetration Test (SPT) of soil is a proven tool widely used in providing disturbed soil samples to aid in Geotechnical site characterization along with estimating soil properties for the design of New Hampshire Department of Transportation (NHDOT) projects. Testing and sampling is typically done at 5 to 10 foot intervals and thus between these samples, engineering judgement is used to identify changes in stratigraphy and the soils respective properties. The results from these tests are used to develop recommendations and aid in the design of the NHDOT projects. Performing the SPT in a continuous fashion is time consuming, labor intensive and not well-suited for many of the soils encountered in New Hampshire and cannot be used to characterize rock. Soils containing large particles such as gravel lead to poor sampling and unreliable results. A technique known as Monitoring-While-Drilling (MWD) makes use of the mechanical response of the drill rig and cutting tools while advancing a borehole. MWD can be used to explore the subsurface in any geological conditions. MWD data combined with SPT testing, a continuous quantitative drilling record is produced, and the correlated parameters can be applied more reliably to the design process. Additionally, data to objectively assess site variability is obtained and drilling parameters collected can provide a level of quality assurance for the soil classifications provided by incomplete testing and sampling exclusively by the SPT.

The objectives of this research are as follows:

1. Provide MWD as a tool for geotechnical site characterization that will result in a more thorough and accurate representation of subsurface conditions leading to safer and more economical designs. The MWD is an underutilized tool in the process of site soil characterization for infrastructure projects and is recognized by the Federal Highway Administration EDC-5: Advanced Geotechnical Methods in Exploration (A-GaME) initiative: https://www.fhwa.dot.gov/innovation/everydaycounts/edc_5/geotech_methods.cfm.

2. Support more efficient use of design and construction resources and reduce the chance of delays due to unexpected subsurface conditions. This effort will contribute to the

overall goal of improving efficiency of the Department by increasing delivery time of classifying subsurface conditions and decreasing the time it takes to complete the analysis.

3. Provide data to support other project design needs: a) depth of bedrock, which is of interest to other parties for mapping efforts and water quality studies, b) rock properties and joint orientations to support rock slope stability evaluations with the Smart Rock technology and, c) estimates of relative permeabilities to support project needs with the Permeafor project SPR 26962U.

D. Scope of Work:

The proposed research will assess the use of MWD to be used on roadway and bridge foundation projects for the Department. The scope of work includes the following tasks:

Task 1- MWD Upgrade:

Upgrade the MWD system with the latest generation Lutz equipment using some components from the existing *University of New Hampshire (UNH) system. The UNH system is 20 years old with only few components operational.*

Task 2 – MWD Installation:

Install the MWD system on one of the NHDOT drill rigs and perform initial evaluation on a site with both soil and rock.

Task 3 – Torque sensor design:

Design or purchase a torque sensor to be fitted to the mechanically driven drill rig operated by the NHDOT. Collaborators on this design will include Montana DOT, University of Florida, and Jean Lutz company.

Task 4 – MWD Testing:

Using project sites selected by a NHDOT technical advisory group, drilling parameters recorded will be compared to measurements traditionally collected by SPT and the associated soil samples, along with rock cores for deep foundations. The following parameters will be collected:

- thrust on drilling tool
- rotation rate
- drilling fluid rate
- advance rate
- torque
- fluid injection pressure

Campus Authorized Official **KJ**
Date **1/28/21**

- drilling fluid return rate

Other non-controlled parameters will be documented to include tool wear and changes in drilling fluid composition.

Task 5 – MWD Data Evaluation:

MWD data obtained in conjunction with key NHDOT projects identified as high-risk, will be evaluated to identify direct methods to correlate values to specific design parameters and will be documented for use on future Department projects.

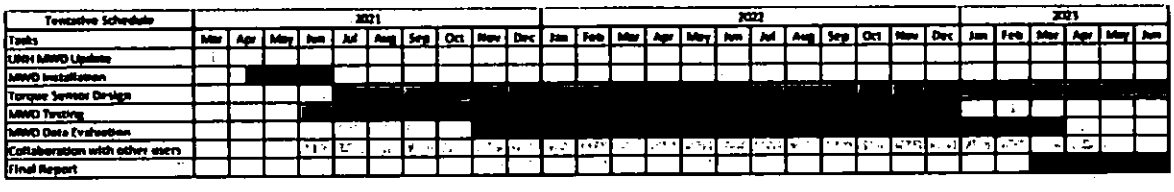
Task 6 – Collaboration with other users:

Collaborate with other DOT MWD users and Messrs. Derrick Dasenbrock and Benjamin Rivers of the FHWA Resource Center to develop a database of information for best practices for drilling under various soil and rock conditions.

Task 7- Final Report:

Provide a final report summarizing the research and providing recommendations for implementing the MWD in everyday site and soil exploration. The information will be summarized to be included in the DOT Geotechnical Manual.

Deliverables Schedule:



Quarterly summary reports will be submitted at the end of each three-month calendar year. The research group will meet with the Technical Advisory Group (TAG) quarterly or at major milestones. At these meetings, presentations of progress to-date and plans for continuing work will be presented to the TAG for comments and suggestions.

F. Budget and Invoicing Instructions:

UNH will submit invoices to State on regular UNH invoice forms no more frequently than monthly and no less frequently than quarterly. Invoices will be based on actual project expenses incurred during the invoicing period and shall show current and cumulative expenses. State will pay UNH within 30 days of receipt of each invoice. UNH will submit its final invoice not later than 60 days after the Project Period end date. State may withhold 10% of funds until receipt of final report from UNH. State will provide final payment within 30 days of receipt of the accepted final report.

Campus Authorized Official KJ
Date 1/28/21

Budget Items	
1. Salaries & Wages:	$61,878
2. Employee Fringe Benefits:	3,156
3. Tuition:	18,636
4. Materials & Supplies:	8,000
5. Travel:	4,500
6. Equipment:	27,000
Total Direct Costs:	123,170
Facilities & Administrative:	36,587
Total Project Cost:	$159,757

The Materials & Supplies include the following:

- Design and construction of torque sensor
- Portable MWD drill
- Sensors
- Field PC/Tablet

Equipment will remain property of the NHDOT

Campus Authorized Official KJ
Date 1/28/21

EXHIBIT B

This Project Agreement is funded under a Grant/Contract/Cooperative Agreement to State from the Federal sponsor specified in Project Agreement article F. All applicable requirements, regulations, provisions, terms and conditions of this Federal Grant/Contract/Cooperative Agreement are hereby adopted in full force and effect to the relationship between State and Campus, except that wherever such requirements, regulations, provisions and terms and conditions differ for INSTITUTIONS OF HIGHER EDUCATION, the appropriate requirements should be substituted (e.g., OMB Circulars A-21 and A-110, rather than OMB Circulars A-87 and A-102). References to Contractor or Recipient in the Federal language will be taken to mean Campus; references to the Government or Federal Awarding Agency will be taken to mean Government/Federal Awarding Agency or State or both, as appropriate.

Special Federal provisions are listed here: ☒ None or **Uniform Guidance issued by the Office of Management and Budget (OMB) in lieu of Circulars listed in paragraph above.** .

Campus Authorized Official *KJ*

Date 1/28/21