

PROJECT KICK-OFF MEETING
MINUTES

Project Title	<i>Development of P-Y curves for analysis of laterally loaded piles in Montana</i>		
Date of Meeting	June 29, 2022	Time	1:00-2:00 PM

1. Meeting Objective

1. Introduction of the project, research tasks and schedule
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2. In Attendance

Name	Organization	Affiliation	Role
Mohammad Khosravi	MSU	Assistant Professor	Consultant
Paul Hilchen	MDT	Geotechnical and Pavements Bureau	Technical Panel Chair
Jeff Jackson	MDT	Geotechnical and Pavements Bureau	Technical Panel
Vaneza Callejas	CTC & Associates LLC	Research and Project Associate	Research Project Manager
Rebecca Ridenour	MDT	Research Section Supervisor	Research Program Manager
Lee Grosch	MDT	Geotechnical and Pavements Bureau	Technical Panel
Lenci Kappes	MDT	Structural Engineer	Technical Panel

Meeting Minutes

<i>Agenda Item</i>	<i>Action by</i>	<i>Description of Discussion</i>
<i>Introduction</i>	All the panel members	Presentation of each of the panel members and role in this project
<i>Important points to remember about the contract</i>	Vaneza Callejas	<ul style="list-style-type: none"> • Project was approved in December 2021 • Contract started in May • It's a 4-year contract • Progress reports to deliver quarterly
<i>Project explanation "Development of P-Y curves for analysis of laterally loaded piles in Montana"</i>	Mohammad Khosravi and Vaneza Callejas	<p><u>Mohammad:</u></p> <ul style="list-style-type: none"> • Primary objective: Study the response of laterally loaded piles in Montana soils under both saturated and unsaturated conditions. • Identify available methods for the development of p-y curves and to determine which is the most appropriate for the soil conditions encountered in Montana • Overview of tasks and schedule: • Task 0: Project Management (Kick-off meeting). <p><u>Vaneza</u></p> <ul style="list-style-type: none"> • The start date should be May not June <p><u>Mohammad:</u></p> <ul style="list-style-type: none"> • Task 1: Review the current methods for analysis of laterally loaded piles • Task 2: Review and prioritize soil conditions in Montana for which laterally loaded pile behavior is not well known • Task 3: Perform a series of model-scale, instrumented centrifuge experiments • Task 4: Numerical modeling • Task 5: P-Y Curve Development • Task 6: Re-evaluate the Performance of a Laterally Loaded Pile from a Project Site in Montana • Task 7: Draft Final Report. • Task 8: TP Meeting #5.

		<ul style="list-style-type: none"> • Task 9: Draft Implementation and Performance Measures Reports. • Tasks 10: Draft Project Summary Report. • Tasks 11: Final Report, Webinar, Presentation, and Dissemination of Results.
<p><i>Project explanation Discussion</i></p>	<p>All the panel members</p>	<p>About tasks 2 and 3.</p> <p><u>Mohammad:</u> For this project numerical simulations and centrifuge test will be used. We are looking to collect soil data from different locations in Montana and present the results in a GIS format. Could we have access to MDT Geotech reports?</p> <p><u>Jeff, Paul, and Lee:</u> It may be hard to give you access to them, but we can find a way to work it out. Also, on the website there are some boring logs for different projects. We could have another meeting to understand better what you are looking for but sounds like a good idea.</p> <p><u>Mohammad:</u> We will work first with what we have and then we will come back to you with more questions. For now, we just want to define the type of soil we are going to use in our testing.</p> <p><u>Paul:</u> We haven't considered any new full-scale lateral loading on piles here.</p> <p><u>Jeff and Lee:</u> Might be interesting to apply one full-scale test considering the findings of this project on a phase 2.</p> <p><u>Lee:</u> Having a map of the soil around Montana become important to define how many of the bridges actually have similar soil conditions to what is considered on the testing.</p>
<p><i>Revision of contract</i></p>	<p>Mohammad Khosravi and Jeff Jackson</p>	<p><u>Mohammad:</u></p> <ul style="list-style-type: none"> • We don't want to put too many responsibilities on MDT. <p><u>Jeff:</u></p>

		<ul style="list-style-type: none"> It is important that we all are on the same page about what MDT has to provide. We could help providing samples without too much effort and problem. We normally are really busy. <p><u>Mohammad:</u></p> <ul style="list-style-type: none"> We will follow the tasks, if necessary, I will ask for additional meetings. We will try to use the samples that MDT has in inventory. <p><u>Jeff:</u></p> <ul style="list-style-type: none"> Are you expecting any type of specific samples? <p><u>Mohammad:</u></p> <ul style="list-style-type: none"> Based in task 2 we will define what is exactly needed for centrifuge testing. <p><u>Jeff:</u></p> <ul style="list-style-type: none"> We could help with that from different projects samples that we have in Montana.
<i>Travel</i>	Vaneza Callejas and Jeff Jackson	<p><u>Vaneza:</u></p> <ul style="list-style-type: none"> For meetings, I'm always going to attend online. We can arrange the meeting online or person. <p><u>Jeff:</u></p> <ul style="list-style-type: none"> We can meet in person if necessary.
<i>Budget</i>	Mohammad Khosravi and Vaneza Callejas	<p><u>Mohammad:</u></p> <ul style="list-style-type: none"> Asked about invoices? <p><u>Vaneza:</u></p> <ul style="list-style-type: none"> We can't have invoices more than 6 months apart.



Development of P-Y Curves For Analysis of Laterally Loaded Piles in Montana

Department of Civil Engineering
Montana State University

June 29, 2022



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RESEARCH TOPIC

Title: Development of P-Y Curves For Analysis of Laterally Loaded Piles in Montana

The response of a laterally loaded pile depends on:

- *Lateral stiffness of the soil,*
- *Pile stiffness,*
- *Interaction between the pile and the surrounding soil.*



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RESEARCH OBJECTIVES

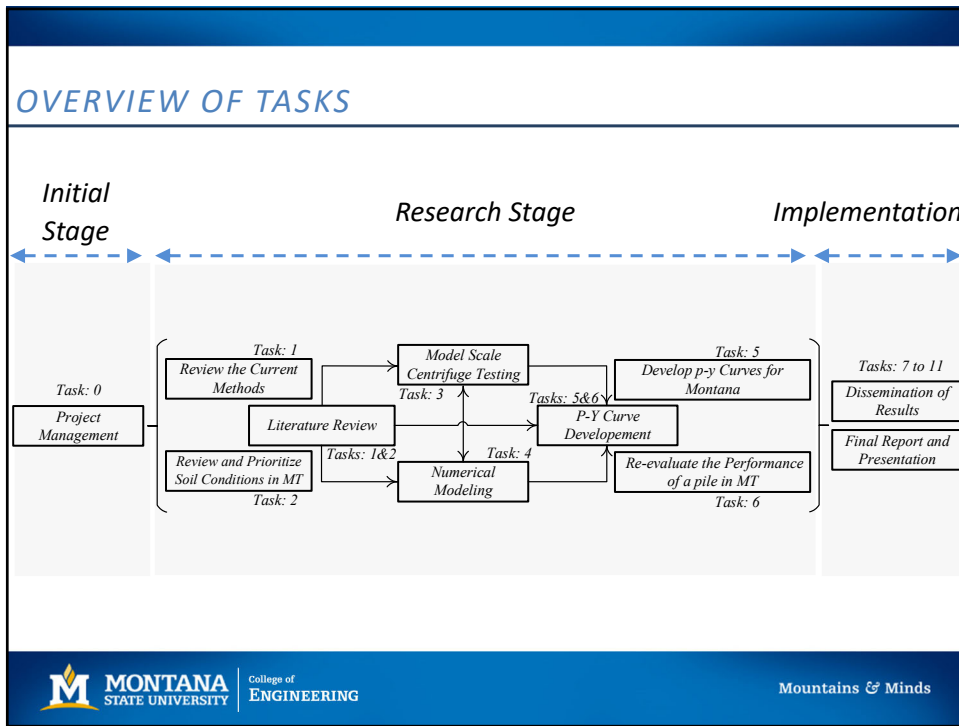
- Primary Objective:
 - Study the response of laterally loaded piles in Montana soils under both saturated and unsaturated conditions.
 - Identify available methods for the development of p-y curves and to determine which is the most appropriate for the soil conditions encountered in Montana

If successful, the results of this research will lead to more accurate prediction of pile response and less conservative design of pile foundations and improve the safety and economy of pile foundations.

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OVERVIEW OF TASKS AND SCHEDULE

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OVERVIEW OF TASKS



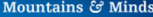
Research Task	Time Schedule												W													
	Year 1			Year 2			Year 3			Year 4																
	2022	2023	2024	2022	2023	2024	2025	2026	2027	2025	2026	2027														
	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A
Task #0: Project Management																										
Task #0.1 - TP Meeting #1: kick-off meeting																										
Deliverable: TP meeting attendance, presentation, minutes and notes																										
Task #1: Review the Current Methods for Analysis of Laterally Loaded Piles																										
Task #1.1: Literature Review																										
Task #1.2 - TP Meeting #2																										
Deliverable: Presentation and Quarterly progress reports																										
Task #2: Review and Prioritize Soil Conditions in Montana																										
Task #2.1: Literature Review																										
Task #2.2 - TP Meeting #3																										
Deliverable: Task 1 report and quarterly progress reports																										
Task #3: Model-Scale Centrifuge Experiments at the University of New Hampshire																										
Task #3.1 - Model design																										
Task #3.2 - Model testing at the University of New Hampshire																										
Task #3.3 - Laboratory data analysis																										
Task #3.4 - TP Meeting #4																										
Deliverable: Task 2 report and quarterly progress reports																										
Task #4: Numerical Modeling																										
Task #4.1 - Model development and validation																										
Task #4.2 - Synthesis of laboratory and numerical findings																										
Deliverable: Task 3 report and quarterly progress reports																										
Task #5: P-Y Curve Development																										
Task #5.1 - Develop p-y curves for analysis of laterally loaded piles in Montana																										
Task #5.2 - TP Meeting #5																										
Deliverable: TP meeting attendance, presentation, minutes and notes																										
Task #6: Re-evaluate the Performance of a Laterally Loaded Pile from a Project Site in Montana																										
Task #6.1 - Develop p-y curves for analysis of laterally loaded piles in Montana																										
Deliverable: Task 4 report																										
Quarterly Progress Reports																										
Deliverable: Quarterly Progress Reports																										
Task #7: Draft Final Report																										
Deliverable: Draft Final Report																										
Task #8: TP Meeting #6																										
Deliverable: TP meeting attendance, presentation, minutes and notes																										
Task #9: Draft Implementation and Performance Measures Reports																										
Deliverable: Implementation and Performance Measures Reports																										
Task #10: Draft Project Summary Report																										
Deliverable: Project Summary Report																										
Task #11: Final Report, Webinar, and Presentation																										
Deliverable: Final Report and Presentation																										

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OVERVIEW OF TASKS



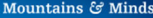
Initial Stage
Task 0: Project Management
 Time Frame: June 29, 2022

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OVERVIEW OF TASKS

Research Stage
Task 1: Review the current methods for analysis of laterally loaded piles
 Time Frame: July 2022 – Dec 2022
 Technical Panel Meeting #2
 Time Frame: Jan 2023

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METHODS OF THE DEVELOPMENTS OF P-Y CURVES

Method	Description	Advantages & Shortcomings
Full-Scale Field Test	<i>p-y</i> curves development based on full-scale instrumented piles in the field	+ accurate - expensive, time consuming
Model-Scale Lab Tests in 1g Gravity Field	Model-scale instrumented piles embedded in laminar box and/or on shaking table and subjected to static and cyclic lateral loading	+ more control on soil condition - different stress-strain behavior from field because of the lesser soil weight
Model-Scale Centrifuge Tests	Model-scale instrumented pile in soil box subjected to lateral loading in higher gravity accelerations	+ more accurate modeling of field condition - high energy consumption
In-Situ Tests	Relating <i>p-y</i> curve models directly to PMT/SPT/DMT/CPT parameters	+ fast & cheap - dependent on other methods and models
Numerical Simulations	<i>p-y</i> curves development for different soil-foundation conditions using FEM/FDM/DEM methods	+ considering several soil-foundation conditions - needs validation with field/lab data



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OVERVIEW OF TASKS

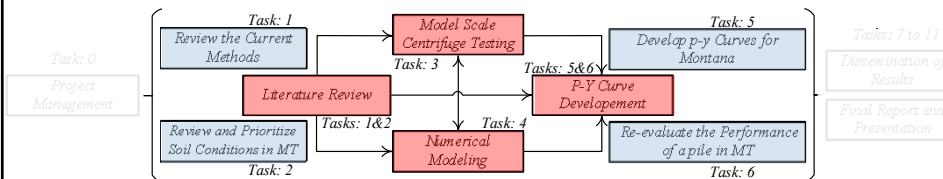
Research Stage

Task 2: Review and prioritize soil conditions in Montana for which laterally loaded pile behavior is not well known

Time Frame: Jan 2023 – June 2023

Technical Panel Meeting #3

Time Frame: July 2023



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OVERVIEW OF TASKS

Research Stage

Task 5: P-Y Curve Development
 Time Frame: Jan 2025 – June 2025

Technical Panel Meeting #5
 Time Frame: June 2025

Task 6: Re-evaluate the Performance of a Laterally Loaded Pile from a Project Site in Montana
 Time Frame: July 2025 – Dec 2025

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OVERVIEW OF TASKS

Implementation

Task 7: Draft Final Report. Jan 2026 – March 2026

Task 8: TP Meeting #6. March 2026

Task 9: Draft Implementation and Performance Measures Reports.
June 2026 – Aug 2026

Tasks 10: Draft Project Summary Report. June 2026 – Aug 2026

Tasks 11: Final Report, Webinar, Presentation, and Dissemination of Results.
July 2026 – Aug 2026

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DISCUSSION

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RESEARCH OBJECTIVES

- Centrifuge Modeling:
 - *Simulating the real soil weight by increasing gravity acceleration*
 - *Smaller model dimensions than 1g tests.*
 - *Capability of conducting experimental parametric study with respect to soil type and pile shape*
 - *Easier control over the soil hydraulic condition (fully saturated, dry, or partially saturated)*
- Numerical Simulation:
 - *Possibility of running a comprehensive parametric study with respect to soil type and properties, hydraulic condition, loading condition, and pile characteristics.*
 - *Result validation with experimental data from centrifuge tests*

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IMPLEMENTATION

- Full-Scale Field Test:
 - *Use the findings from this research to re-evaluate the performance of a laterally loaded pile from a project site located on Interstate 15 in Lewis and Clark County, MT and validate the findings of the new research.*