

Data Management Plan

Name of Contractor: Purdue University

Name of the Project: Field Testing and Long-Term Monitoring of Selected High-Mast Lighting Towers (Phase 2)

Project Duration: Start Date: 9/01/2019 End Date: 3/31/2023

DMP Version: 1

Date Amended, if any:

Name of all authors, and ORCID number for each:

Jason B. Lloyd, PhD, PE, 0000-0001-8792-3278

Robert J. Connor, PhD, PE, 0000-0002-6964-3317

WYDOT Project Number: RS07220

- Name of all peer reviewed publications, which have been generated using data from this project to include: none to date
- Any Digital Object Identifier (DOI), assigned to any peer reviewed publication or data generated by this project: none to date
- URLs for all peer reviewed publications which have been generated using data from this project: none to date
- Dataset URL, if available: none to date

What constitutes data will be determined by the Principle Investigator, Project Champion, and the Research Manager. In general, your plan should address final research data. This includes recorded factual material commonly accepted in the scientific community as necessary to validate research findings. Final research data do not include laboratory notebooks, partial datasets, preliminary analyses, drafts of scientific papers, plans for future research, peer review reports, communications with colleagues, or physical objects, such as gels or laboratory specimens. As part of your research, you may also generate unique data, which are data that cannot be readily replicated. Your DMP should also address unique data that may arise from your research.

WYDOT expects the timely release and sharing of data to be no later than the acceptance for publication of the main findings from the final dataset, unless the Principle Investigator will be

embargoing the data. In such a case, the data cannot be embargoed for a period longer than 12 months. See Chapter 11 for information on retention and embargos.

1. Introduction

The purpose of this research project is to:

Phase 1 field monitoring of four high-mast lighting towers (HMLTs) was previously reported on in March 2020. Due to the rare nature of the large amplitude vibration events, a second phase of monitoring was conducted to continue collecting data and to maximize the potential for recording the rare data. Similar to Phase 1, monitoring, Phase 2 included four HMLT instrumented with sensors to monitor weather and structural response to wind-induced vibrations. The four HMLTs were in different locales within the state of Wyoming, each site being selected specifically due to a history of failed HMLTs at those locations, or nearby. Several HMLTs have failed in recent years, some catastrophically, within Wyoming, from fatigue crack growth at the base plate-to-tube wall welds. Hence, the motivation for the study.

Amateur video and some limited data from previous research both supported the possibility that large-amplitude mode i vibration events could be causing the premature fatigue failures. In some cases, it was surmised that ice or snow accumulation on an HMLT could be contributing to changes in the aerodynamic response to varying wind events. The research team remotely monitored the four HMLTs with wind-based and stress-based triggers recording data of ambient weather conditions and the aerodynamic response of the HMLTs. Phase 1 monitoring confirmed the rarity of the large-amplitude events, but could not confirm the contribution of ice or snow accumulation.

Phase 2 monitoring was carried out continuously for an additional 18 months. Identical to Phase 1, Phase 2 instrumentation included an ice sensor, anemometer for wind speed and direction, thermocouple for temperature, and strain gages. In this way, the research team was able to determine what the structural response to the large-amplitude events were and if a build-up of ice could be correlated to its occurrence. Two large-amplitude events were recorded during the period of Phase 2 field monitoring. Extreme stress ranges were observed during both events, reaching peak stresses of about 28.5 ksi (ranges of up to 57 ksi) and lasting a few minutes. The extreme events were found to be relatively rare and unpredictable in terms of when they might occur.

2. Definitions

- a. Code or scripts include code used in the collection, manipulation, processing, analysis or visualization of data, but may also include software developed for other purposes.
- b. Copyright is a set of legal rights extended to copyright owners that govern such activities as reproducing, distributing, adapting, or exhibiting original works fixed in tangible forms.

- c. Data means the recorded factual material commonly accepted in the scientific community as necessary to validate research findings, but not any of the following: preliminary analyses, drafts of scientific papers, plans for future research, peer reviews, communications with colleagues. Recorded material excludes physical objects (e.g. laboratory samples). Research data also does not include trade secrets, commercial information, materials necessary to be held confidential; and personnel and medical information and similar information the disclosure of which would constitute a clearly unwarranted invasion of personal privacy.
- d. Data Archive is a site where machine-readable materials are stored, preserved or possibly redistributed to individuals interested in the materials.
- e. Data Management Plan is a document that specifies your plans for managing your data and files for a research project.
- f. Dataset means collection of data.
- g. Metadata refers to structured data about data that helps define administrative, technical, or structural characteristics of the digital content.

3. Data Types and Storage

The types of data and/or datasets generated and/or used in this project include:

Data included strain, wind speed, wind direction, temperature, and presence of icing, photographs, and drawings.

Provide a description of the data that you will be gathering in the course of your project. You should address the nature, scope, and scale of the data that will be collected. Describe the characteristics of the data, their relationship to other data, and provide sufficient detail so that reviewers will understand any disclosure risks that may apply. Discuss value of the data over the long-term. Please provide the name of all repositories where the data will be housed during the lifetime of the project.

Checklist

- What type of data will be produced?
- How will data be collected? In what formats?
- How will the data collection be documented?
- Will it be reproducible? What would happen if it got lost or became unusable later?
- How much data will it be, and at what growth rate? How often will it change?
- Are there tools or software needed to create/process/visualize the data?
- Will you use pre-existing data? From where?
- Storage and backup strategy?

4. Data Organization, Documentation, and Metadata

The plan for organizing, documenting, and using descriptive metadata to assure quality control and reproducibility of these data include:

All data will be archived on the Purdue University servers. Instrumentation plans will be developed provided information as to the type, location, and method of data acquisition utilized in the research. Filed formatting will be consistent with those used by the manufacturer and are self-explanatory in the actual data files.

Your DMP should describe the anticipated formats that your data and related files will use. To the maximum extent practicable, and in accordance with generally accepted practices in your field, your DMP should address how you will use platform-independent and non-proprietary formats to ensure maximum utility of the data in the future. If you are unable to use platform-independent and non-proprietary formats, you should specify the standards and formats that will be used and the rationale for using those standards and formats.

NOTE: Attach the Metadata Schema, URL for data generated, and all peer reviewed publications from this project.

Checklist

- What standards will be used for documentation and metadata?
- Is there good project and data documentation format/standard?
- What directory and file naming convention will be used?
- What project and data identifiers will be assigned?
- Is there a community standard for metadata sharing/integration?

5. Data and/or Database Access and Intellectual Property

What access and ownership concerns are there:

None that the research team are aware of.

Protecting research participants and guarding against the disclosure of identities and/or confidential business information is an essential norm in scientific research. Your DMP should address these issues and outline the efforts you will take to provide informed consent statements to participants, the steps you will take to protect privacy and confidentiality prior to archiving your data, and any additional concerns. If necessary, describe any division of responsibilities for stewarding and protecting the data among Principal Investigators.

If you will not be able to deidentify the data in a manner that protects privacy and confidentiality while maintaining the utility of the dataset, you should describe the necessary restrictions on

access and use. In general, in matters of human subject research, your DMP should describe how your informed consent forms will permit sharing with the research community and whether additional steps, such as an Institutional Review Board (IRB), may be used to protect privacy and confidentiality.

Checklist

- What steps will be taken to protect privacy, security, confidentiality, intellectual property or other rights?
- Does your data have any access concerns? Describe the process someone would take to access your data.
- Who controls it (e.g., PI, student, lab, University, funder) ?
- Any special privacy or security requirements (e.g., personal data, high-security data) ?
- Any embargo periods to uphold?

6. Data Sharing and Reuse

The data will be released for sharing in the following way:

Only upon direction and/or permission by the Wyoming Department of Transportation.

Describe who will hold the intellectual property rights for the data created by your project. Describe whether you will transfer those rights to a data archive, if appropriate. Identify whether any copyrights apply to the data, as might be the case when using copyrighted instruments. If you will be enforcing terms of use or a requirement for data citation through a license, indicate as much in your DMP. Describe any other legal requirements that might need to be addressed.

Checklist

- If you allow others to reuse your data, how will the data be discovered and, shared?
- Any sharing requirements (e.g., funder data sharing policy) ?
- Audience for reuse? Who will use it now? Who will use it later?
- When will I publish it and where?
- Tools/software needed to work with data?

7. Data Preservation and Archiving

The data will be preserved and archived in the following ways:

Data will be stored on Purdue University servers. Further, all data, including reports, photographs, etc. will also be provided to the Wyoming Department of Transportation in digital format.

Describe how you intend to archive your data and why you have chosen that particular option. You may select from a variety of options including, but not limited to:

- Use of an institutional repository.
- Use of an archive or other community-accepted data storage facility.
- Self-dissemination.

You must describe the dataset that is being archived with a minimum amount of metadata that ensures its discoverability. Whatever archive option you choose, that archive must support the capture and provision of the National Transportation Library metadata requirements. In addition, the archive you choose must support the creation and maintenance of persistent identifiers and must provide for maintenance of those identifiers throughout the preservation lifecycle of the data. Your plan should address how your archiving and preservation choices meet these requirements.

Checklist

- How will the data be archived for preservation and long-term access?
- How long should it be retained (e.g., 3-5 years, 10-20 years, permanently) ?
- What file formats? Are they long-lived?
- Are there data archives that my data is appropriate for (subject-based? Or institutional)?
- Who will maintain my data for the long-term?

NOTE:

Researchers evaluating data repositories as the option(s) for storing and preserving their data should examine evidence demonstrating that the repository:

- a. Promotes an explicit mission of digital data archiving.
- b. Ensures compliance with legal regulations, and maintains all applicable licenses covering data access and use, including, if applicable, mechanisms to protect privacy rights and maintain the confidentiality of respondents.
- c. Has a documented plan for long-term preservation of its holdings.
- d. Applies documented processes and procedures in managing data storage.
- e. Performs archiving according to explicit workflows across the data life cycle.
- f. Enables the users to discover and use the data, and refer to them in a persistent way through proper citation.
- g. Enables reuse of data, ensuring appropriate formats and application of metadata.
- h. Ensures the integrity and authenticity of the data.
- i. Is adequately funded and staffed, and has a system of governance in place to support its mission.
- j. Possesses a technical infrastructure that explicitly supports the tasks and functions described in internationally accepted archival standards like Open Archival Information

System (OAIS).

NOTE: This DMP is created as a derivative from the DMP belonging to the University of Minnesota and can be found at <https://www.lib.umn.edu/datamanagement/DMP>

Metadata Schema

Elements	Example of what is expected for each element
Title¹	Field Testing and Long-Term Monitoring of Selected High-Mast Lighting Towers (Phase 2)
Creator/contact point	Jason B. Lloyd, PhD, PE, 0000-0001-8792-3278 Robert J. Connor, PhD, PE, 0000-0002-6964-3317
Publication Date(s)	2023
Description/Abstract	Several HMLTs have failed in recent years, some catastrophically, within Wyoming, from fatigue crack growth at the base plate-to-tube wall welds. Hence, the motivation for the study.
Subject and Keywords	High mast lighting tower, fatigue, vibration, wind, lock-in, Wyoming
Identifier² and/or source	
Collection and Related Documents	
Edition	1
Related Documents	
Coverage	
Language	English
Publisher/Distributor	Wyoming Department of Transportation
Funding agency	Wyoming Department of Transportation
Access Restrictions	
Intellectual Property and Other Rights	Copyright ©2017. All rights reserved, State of Wyoming, Wyoming Department of Transportation, and Purdue University.
License	
Code and software needs	

¹ To include alternate title; conference title; and journal title, if they are different.

² To include record numbers; report numbers; NTIS number; TRIS Accession Number; OCLC Number; ISBN; ISSN; contract number; and DOI if available.

Elements	Example of what is expected for each element
Format	
Choice of Repository	Wyoming Department of Transportation and Purdue University

NOTE: Each separate report, dataset, collection, existing collection, and software developed must have its own table. All fields in this Schema must be completed at the time of the final report.

NOTE: This Metadata Schema is created as a derivative from the Common Core required fields which can be found at <https://project-open-data.cio.gov/schema/>.