Data Management Plan

Name of Contractor	**Colorado State University**
Name of project	**Multi-Measure Performance Assessment and Benchmarking of the Divisions of the Wyoming Highway Patrol**
Project Duration	**Start date : October 2012** **End: December 2015**
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Date Amended, if any	**3/30/16**
Name of all authors, and ORCID number for each author	**Mehmet E. Ozbek, PhD, Maral Jalili, and Duygu Akalp**
WYDOT Project Number	**RS08212**
Any Digital Object Identifier (DOI), including any CROSSREF number, which has been assigned to any peer reviewed publication or data generated by this project	**N/A**
Name of all peer reviewed publications which have been generated using data from this project	**Jalili, M., Ozbek, M.E., McCarthy, J.G. and Rabbani, E. (2015). "Effective Performance Measures for Highway Patrol Agencies to Change Poor Driver Behaviors." In: *Proceedings of the 6th International Conference on Applied Human Factors and Ergonomics (AHFE 2015) and the Affiliated Conferences, AHFE 2015,* 2450-2457, July 26-30, Las Vegas, NV.**
URLs for all peer reviewed publications which have been generated using data from this project	**N/A**
RiP RH Display ID Number	**35609**
Dataset URL, if available	**N/A**

1. Introduction

The purpose of this research project is to:

The overarching purpose of this study is to develop a comprehensive framework that could be implemented by the Wyoming Highway Patrol (WHP) in an attempt to improve their overall organizational performance while addressing the following questions:

- How can the performance of an organization be assessed in the presence of different performance measures?
- How can different units within an organization be compared to each other on a fair level? (In the context of this question, a unit is defined as any main point within the organization that is of importance to the decision makers).
- How can an organization improve its performance on the way to be both more efficient and more effective?

This study will use Data Envelopment Analysis (DEA) as a tool to develop a comprehensive framework that could measure the overall performance of WHP's divisions in the presence of multiple performance measures while also considering the external factors' effects on that overall performance. DEA is based on the concepts of linear programming and production theory and is equipped to deal with the presence of multiple measures as well as uncontrollable variables (those that could affect the performance of a unit but are beyond the control of the decision makers). DEA measures the efficiency of each unit and is not only capable of identifying the best performing and poor performing units, but it can also identify the appropriate benchmarks for poor performing units. This will help recognize the best practices of 100 percent efficient units, which can further be implemented in the poor performing units in an effort to benefit them and improve their performance.

The steps in getting to the final framework are as follows:

- Developing consistent and effective performance measures that reflect the main purposes of WHP.
- Collecting data representing the variables that can be used in the defined performance measures.
- Identifying the uncontrollable variables and collecting the appropriate data.
- Analyzing the data and preparing them to be used in the DEA context.
- Selecting the best DEA framework and running the models.
- Post processing the results of the DEA analyses to identify the poor performing units and their respective efficient peers.

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 which 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 …

In order to come up with the initial comprehensive list of inputs and outputs and further refine them to form the final set of variables to be used in the models for this research; the WHP databases were used for the years 2011, 2012 and supplemented with one-on-one audio-recorded interviews with the WHP officers who are best suited in providing inputs for the research purposes. From this standpoint, the inputs and outputs are fixed on the WHP data sets for the years 2011, 2012; the data set will be reproducible.

Captain Derek Mickelson, the Champion of the research in WHP and Mr. Joe McCarthy who is an independent consultant working for Wyoming Department of Transportation (WYDOT) were the primary points of contacts for getting the necessary data and resolving the issues that came up in the process of preparing the data.

The needed data was gathered in Excel spreadsheets and a good amount of time was spent on preparing them in the right format that could be used in the DEA models. A big portion of what the preparation process entailed was to break down the state level bulk information presented in the original databases into the 17 divisions of WHP. For this reason, first the jurisdiction of each division along with the highways and roads within those boundaries was identified. For all the other databases, the characteristic under study (e.g., AADT, citation data) was broken down to fall under the jurisdiction of each division and was then transferred into the appropriate division. During these procedures, certain assumptions were made to deal with existing issues and problems in the data sets (e.g., missing data points and discrepancies).

After finalizing the preparation of the data on the divisional level, the models were run using the software entitled Frontier Analyst. There are several software platforms available on the

market that are capable of running DEA calculations (some are independent software while others are Excel Add-ins). A handful of these platforms were studied before deciding to utilize Frontier Analyst due to its user interface and ability to generate outputs and reports in a spreadsheet format.

Variables used in this study

These processes are explained in three different sections to delineate between different variables (i.e., controllable (inputs, outputs) and uncontrollable variables) as following:

Controllable variables

Inputs
The number of troopers in each division was provided on a monthly basis to account for the inputs in the model. The average of monthly manpower counts was calculated in each division. It was decided that supervisors should be considered in each divisions as well. Since every division has one supervisor at any time over the course of the year, one unit was added to the yearly manpower count.

Outputs
There are two main categories of outputs defined to measure the WHP's patrol performance: activity and visibility. Citations and crashes are needed to calculate the activity outputs**,** while for the visibility measure, only the yearly P-26 forms (Time log sheet) for both troopers and supervisors in each divisions was needed.

Uncontrollable variables

The list of uncontrollable variables to be used in the study was listed as following:

- Divided mileage of highways in each division.
- Roadway mileage with shoulder width more than or equal to six feet in each division.
- Number of high-speed intersections in each division.
- Number of hours away from visibility and proactivity in each division.
- Centerline mileage of highways under the jurisdiction of each division.
- AADT and AADTT in each division.

Research records, audiotapes, and transcripts will be kept in an electronic file format for Windows and secured with Colorado State University's protocol for three years and the access permission is only given to the research team.

3. Data Organization, Documentation and Metadata

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

At the time this project was undertaken and completed, no data documentation standard was used. However, all data files are named based on division and variable names.

4. Data and/or Database Access and Intellectual Property

What access and ownership concerns are there…

The researchers audiotaped the one-on-one interviews with the participant's permission. At the beginning of the interviews, all the necessary information was explained to the interviewees (i.e., how the results from their audio- recorded interviews was going to be used in the research and possibly for future publications) and their signatures on the consent forms were collected. Later on, after transcribing all the six interviews, the final transcripts were sent to the interviewees for their review and approval.

The research records, audiotapes and transcripts will be securely stored in Dr. Mehmet Ozbek's office at Colorado State University during and following the study. The research records, audiotapes and transcripts will only be used for the purposes of compiling data for this research and will be destroyed three years after the completion of the last interview. Research records, audiotapes, and transcripts will be kept in an electronic file format for Windows and secured with Colorado State University’s protocol for three years and the access permission is only given to the research team.

5. Data Sharing and Reuse

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

Raw data for citations and crashes will not be shared with anyone other than the research team as per the initial agreement made with the Wyoming Highway Patrol as it may contain sensitive information. Raw data will not be available for reuse either. Overall results will be submitted for publication in proceedings and journals.

6. Data Preservation and Archiving

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

The research records, audiotapes and transcripts will be securely stored in Dr. Mehmet Ozbek's office at Colorado State University during and following the study. The research records, audiotapes, and transcripts will only be used for the purposes of compiling data for this research and will be destroyed three years after the completion of the last interview. Research records and audiotapes will be kept in an electronic file format for Windows and secured with Colorado State University's protocol for three years and the access permission is only given to the research team.

METADATA TRANSMITTAL FORM

Title[1]	Multi-Measure Performance Assessment and Benchmarking of the Divisions of the Wyoming Highway Patrol
Creator	Mehmet E. Ozbek
Publication Date(s)	December 2015
Description	With many lives lost every year in traffic related crashes, traffic safety is a major concern all around the world. One way to improve traffic safety is to improve the organizational performance of agencies responsible for enforcing traffic safety. Internal benchmarking would be the first step to accomplish that goal, in order to compare the units of an organization, identify the best performing ones, and learn from their best practices so that other units within the organization can take advantage and improve their performance as well. Wyoming Highway Patrol (WHP) is a data-driven organization, which uses multiple measures to assess its performance. These measures can be used by WHP to perform comparisons between its 17 divisions. However, this process involves the utilization of a single performance measure at a time and may result in difficulties in identifying the overall performance. Therefore, there is a need to develop a performance assessment framework that can identify the overall performance of these divisions in the presence of multiple measures. This research presents a performance assessment system developed for WHP using Data Envelopment Analysis. This system can incorporate multiple measures, enabling WHP to identify its best-performing divisions to be able to use those as benchmarks.
Keywords	Wyoming Highway Patrol, Benchmarking, Organizational Performance
Subject	Performance Assessment

[1] *To include alternate title; conference title; and journal title if they are different.*

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Abstract	With many lives lost every year in traffic related crashes, traffic safety is a major concern all around the world. One way to improve traffic safety is to improve the organizational performance of agencies responsible for enforcing traffic safety. Internal benchmarking would be the first step to accomplish that goal, in order to compare the units of an organization, identify the best performing ones, and learn from their best practices so that other units within the organization can take advantage and improve their performance as well. Wyoming Highway Patrol (WHP) is a data-driven organization, which uses multiple measures to assess its performance. These measures can be used by WHP to perform comparisons between its 17 divisions. However, this process involves the utilization of a single performance measure at a time and may result in difficulties in identifying the overall performance. Therefore, there is a need to develop a performance assessment framework that can identify the overall performance of these divisions in the presence of multiple measures. This research presents a performance assessment system developed for WHP using Data Envelopment Analysis. This system can incorporate multiple measures, enabling WHP to identify its best-performing divisions to be able to use those as benchmarks.
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Contact Point	Mehmet E. Ozbek, PhD Department of Construction Management Colorado State University 113C Guggenheim Hall 1584 Campus Delivery Fort Collins, CO 80523-1584 (970) 491-4101
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	Research Center 5300 Bishop Blvd Cheyenne WY 82001 307-777-4182
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