Wisconsin Department of Transportation
Policy Research Program

Request for Proposal

Identifying Highly Correlated Variables Relating to the Potential Causes of Reportable Wisconsin Traffic Crashes

May 2, 2016

Proposal Deadline

Proposals must be received no later than
4:30 p.m. CST on June 24, 2016

For more information regarding this RFP
Contact the WisDOT Research & Library Services Unit
at: research@dot.wi.gov.

I. Definitions

The following definitions are used throughout the RFP:

1. **POC** means the project oversight committee, comprised of WisDOT and/or other representatives to oversee the research
2. **Proposer** means a company or individual submitting a proposal in response to this RFP
3. **Researcher** means proposer awarded the contract
4. **SPF** means Safety Performance Function and is an equation used to predict the average number of crashes per year at a location as a function of exposure and, in some cases, roadway or intersection characteristics (e.g., number of lanes, traffic control, or median type) *(1)*. For highway segments, exposure is represented by the segment length and Annual Average Daily Traffic (AADT) associated with the study section as shown by the sample SPF in Equation 1.
   - Predicted Crashes = exp[a + *β* * ln(AADT) + ln(Segment Length)] {1}
   - For intersections, exposure is represented by the AADT on the major and minor intersecting roads as shown by the sample SPF in Equation 2.
   - Predicted Crashes = exp[a + *β1* * ln(AADTmajor) + *β2* * ln(AADTminor)] {2}
   - *Example 1: The SPF from the Highway Safety Manual (1) for total multiple-vehicle (MV) crashes at urban, four-legged signalized intersections using Equation 2 where α, β1 and β2 were calculated separately is:*
     - *Predicted MV crashes = exp[-10.99 + 1.07*ln(AADTmajor) + 0.23*ln(AADTminor)]*
     - *For an urban, four-legged signalized intersection with a major road traffic volume (AADTmajor) of 25,000 vehicles per day and a minor road traffic volume (AADTminor) of 10,000 vehicles per day, the predicted number of MV crashes is computed as follows for the given SPF.*
     - *Predicted MV crashes = exp[-10.99 + 1.07*ln(25,000) + 0.23*ln(10,000)] = 7.13 crashes/year*[1]
5. **WisDOT** means the Wisconsin Department of Transportation

II. Background

Presently, the Wisconsin Department of Transportation lacks a systemic method in identifying the most pertinent behavioral and non-behavioral variables and/or their combination, which factor into reportable crashes involving motor-vehicles, pedestrians and bicyclists statewide.

Crash statistics are presently generated using a tabulation and/or rate process, which may involve a limited degree of data normalization. The data normalization is achieved through the use of an exposure variable, such as Vehicle Miles Traveled (VMT) or by generating a rate per 100,000 people within the scope of the population being analyzed. The overarching problem is the lack of an established relationship between variables related to crashes and the potential

[1] http://safety.fhwa.dot.gov/tools/crf/resources/cmfs/docs/safety_performance_funtions.pdf

identification of how the variables interact to create potential Safety Performance Functions (SPFs) related to particular crash types.

In order to more closely align with the "Zero in Wisconsin" vision and achieve the most optimal outcomes that eliminate reportable fatal and other types of crashes in Wisconsin, the department has a need to quantify and qualify the reportable motor vehicle crashes and identify possible countermeasures that can be implemented to mitigate those crashes.

III. Objectives

The expected product in phase I of the research project is a statistical model (regression, Poisson, etc.) that through narrative and equations depicts the relationship between the most important variables identified as being correlated to accurately predicting crashes by collision type (intersection, head-on, single vehicle, etc.), crash severity type (fatal, injury, and property damage), user type (car, truck, pedestrian, bicycle) and the functional classification of road type, if possible, in Wisconsin. The results should be presented in semi-technical terms that can be understood by someone with a semester of college-level statistics. Phase II of the project will provide possible Safety Performance Functions (SPFs) that are created with the most pertinent variables selected from the initial phase. The project's results which include the causes of reportable traffic crashes in Wisconsin, should be able to be explained to a general audience.

The starting point of the variables to be analyzed will come from a variables list generated from a brain-storming session with a panel of traffic safety analysts working for the Bureau of Transportation Safety. Relevant outputs will allow transportation safety practitioners in Wisconsin to move to the next level of analyses and conclusions of reportable traffic crashes by allowing the consideration of multiple variables and looking at how their interactions may alter the outcomes or prevent motor vehicle, pedestrian, and bicycle crashes going into the future.

IV. Scope of work

Phase I

1. Conduct a comprehensive literature review and report the results back to the project oversight committee (POC).

2. Based upon the literature review findings, the researcher, with approval from the POC, will decide on the optimal statistical model that best frames and describes the outcomes of the stochastic events known as traffic crashes occurring on Wisconsin roadways that meet the reportable crash criteria within specified time periods and locations.

3. Decide on a list of variables that would most likely predict fatal, injury and property damage traffic crashes. Please note an initial list of variables is provided in Appendix A, however the vendor can add, subtract or modify the list in their proposal if they believe

the change would create more accurate crash predictions. Please see the Crash Regression Analysis Data Elements in Appendix A at the end of this document to see examples of possible variables to review.

4. Decide what statistical process modeling technique or method is best at analyzing the traffic crash data (Linear Least Squares Regression, Nonlinear Least Squares Regression, Weighted Least Squares Regression, Negative Binomial Regression, Logistic Regression, Poisson distribution, etc.).

5. Decide how the implemented statistical model technique or method will be tested for fit and validation.

6. After implementing the optimal statistical process model and its related functional method, display the most pertinent variables and explain their statistical relationships, with the understanding they may later be used in possible Safety Performance Functions, after approval from the POC.

7. The researcher must develop and present a draft interim report to the POC. After the POC's comments are received, the researcher will develop the final approved interim report. The researcher will also present an interim presentation to the POC that includes an overview of phase I and its findings.

Phase II

The second phase of the project will research the causes of the various crash types. This will allow the initial phase of the project to reach its goal of identifying the most important factors involved in traffic crashes when creating potential SPFs.

1. Research the causes of various crash types. These factors should incorporate a mixture of behavioral and engineering variables. Also, the researcher should identify whether these factors and the resulting SPFs are amenable to having their effects lessened, by the use of countermeasures and other possible CMFs. The research results from the second phase of the project should include the creation of SPFs. Individual SPFs should be of a type involving engineering or human factors only, or a combination of engineering and human factors making up the equation(s), where possible and feasible.

2. Create a set of potential SPF equations from the selected data model and applied statistical technique(s), in conjunction with the pertinent variables identified and approved by the POC. Safety practitioners should be able to incorporate these finalized equations into their day-to-day traffic crash analyses and processes. The finalized equation(s) should also allow for the potential creation of Crash Modification Factors (CMFs) for a combination of behavioral, engineering, plus behavioral and engineering factors going into the future.

3. The researcher must develop and present a draft final report to the POC. After the POC's comments are received, the researcher will develop the final approved report. The researcher will also present a final presentation to the POC that includes an overview of phase II and its findings.

V. Project requirements (interactions required and deliverables expected)

1. Project oversight

WisDOT will assign a POC to the project comprising program experts in the Bureau of Transportation Safety and possibly other business areas. A WisDOT project manager will chair the POC and serve as the key point of contact for the researcher on research-related issues. A WisDOT administrative contact from the Office of Policy, Finance and Improvement's Research and Library Services Unit will serve as the key point of contact for the researcher on administrative issues.

2. Project meetings and approval points

The researcher will be expected to interact regularly with the POC to approve task methods, discuss task findings, review the remaining steps of the project and consider any outstanding barriers, issues, concerns or questions that need to be addressed prior to proceeding. The POC will ultimately establish the full schedule of meetings and approval points, but at a minimum, proposals should plan for a:

- Project kickoff meeting
- Presentation of the phase I findings
- Presentation of the phase II findings

Meetings and interactions may occur in person or electronically. Certain tasks, meetings or approval points may occur concurrently with POC approval.

3. Quarterly progress reports

The researcher must provide written reports of progress to WisDOT and the POC at the end of each calendar quarter (March 31, June 30, September 30, December 31) for the duration of the contract using WisDOT's quarterly report template.

4. Draft reports and presentation

- After completion of the phase I tasks, the researcher must submit a draft interim report to the POC and conduct a presentation either in person or through a teleconference or webinar.
- After completion of the phase II tasks, the researcher must submit a draft final report and conduct a presentation either in person or through a teleconference or webinar. The final report must include an executive summary and an implementation plan that outlines steps WisDOT may take to implement study results and recommendations.

- The researcher is expected to submit the reports with quality technical writing and proper grammar. It is acceptable to include a technical editor on the research team to ensure these requirements are met.

5. Final report

The researcher must provide the interim and final research reports to WisDOT in electronic (Adobe PDF) format and six (6) printed copies once they are vetted, edited and approved by the POC. The WisDOT administrative contact will collaborate with the researcher to provide the cover, the technical documentation page and a legal disclaimer page.

VI. Duration and budget

1. Project duration

The contract shall be effective on the date it is executed and continue for six (6) months from that date. Proposals should include a detailed schedule showing the timing of the tasks, meetings and expected review periods.

2. Project budget

Proposals should not exceed $100,000. Any proposal that exceeds this amount shall be considered non-responsive to the RFP requirements and will not be accepted.

VIII. Proposal submission deadlines and guidelines

The issue date for this RFP is May 2, 2016. Proposers may direct any questions, noted errors, discrepancies, ambiguities or deficiencies concerning this proposal via e-mail to: research@dot.wi.gov by 4:30 PM CST on May 16, 2016. WisDOT will collectively post all questions and answers to: http://wisdotresearch.wi.gov/rfps-and-proposals by 4:30 PM CST on May 23, 2016. Proposers must direct questions about this RFP only to this designated e-mail and not to any other staff or agent of WisDOT.

Proposers must submit an electronic version of a proposal (Adobe PDF required) by 4:30 PM CST on June 24, 2016 via e-mail to: research@dot.wi.gov. Proposals submitted after the deadline will not be accepted for evaluation.

All proposals should conform to the WisDOT policy research guidelines that are posted in Appendix B.

APPENDIX A: CRASH REGRESSION ANALYSIS DATA ELEMENTS

Crash Regression Analysis Data Elements	
Element	**Source**
DOT CRASH DATABASE (Accident, Occupant, Vehicle, Fixed Object)	DMV
Traffic Reconstruction Unit	TRU Data
Distance/Time to medical care	EMS
Length of Time a driver was licensed	Driver Record File
State in which they received they're first license	Driver Record File
Traffic Counts on segmented roa per day	DOT engineers
Income of Driver if possible	Department of Revenue or estimated in some way
Gas Prices for State of Wisconsin	??
Economic Growth (WI GDP) by Month	Economic sources
License Plate Renewal history	DMV
Drivers License Renewal history	DMV
How long have you owned the vehicle	DMV??
Mileage on vehicle	DMV
Vehicle Age	DMV
Points on Drivers License (how many or little)	Driver Record File
Emission Testing	DMV
Insured / Uninsured Data	??
Metamanager	??
I-Pass	??
Planned distance of travel	??
Distance from home of crash	Crash Data Base
Out of State Licenses	Crash Data Base
Boat Ownership - boat trailor or other type of trailor	DNR ??
Marital Status, kids, risk factors	Driver Record File
Organ Donor Status on license	DMV
Sheet on Haddons Matrix	??
Issuance of hang tags (disability)	DMV
Driver Training (new drivers & where they were trained	??
Vehicle engine size (especially for motorcycles)	DMV
Manual or Automatic Transmission	??
Billboard number and locations	DOT
DMV Transactions (if trouble w/ DMV then may not be a good driver)	DMV
Traffic Volume (Average Daily Traffic Counts) ADT	DOT
Deer Population / harvest (other animal)	DNR
Bike Routes (proximity)	Bike Federation
Alcohol Taxes	Dept. of Revenue
Cell Phone Coverage maps	??
Packer Schedule	Packers website
Corridors of roadways (maps)	?? DOT
Many models by road type (interstate vs. local) etc..	??
Dealership vs. Nondealership purchases	DOT
Plate status at crash event	DMV
Residency duration (how long in WI)	tax record ??
Number of winters living in WI	??
Which out of State driver will crash	??
Level of trauma service (what hospital)	hospitals

***A question mark (?) indicates that the source is unknown**

APPENDIX B: WISDOT POLICY RESEARCH GUIDELINES

WisDOT Policy Research Program
Proposal Preparation Guidelines
Identifying Highly Correlated Variables Relating to the Potential Causes of Reportable Wisconsin Traffic Crashes
May 2, 2016

The Wisconsin Department of Transportation (WisDOT) Policy Research Program funds projects that focus on safety, operations, policy, financing, planning, economy, environment and other topics. WisDOT contracts with colleges, universities, consultants, foundations and other research institutions to complete policy-related studies. This document provides instructions to interested parties to submit proposals for the Policy Research Program in response to a Request for Proposal (RFP).

1. PROPOSAL PROCESS & FORMAT

a. Proposers must submit an electronic version of their proposal (Adobe PDF required) on or before the deadline specified in the RFP via e-mail to: research@dot.wi.gov. Proposals submitted after the deadline will not be accepted for evaluation.

b. Proposals should include page numbers, use single spacing and use a minimum 10-point font. WisDOT recommends that proposals should be concise; however, there is no page limit to the proposal except for the work plan section as indicated below.

c. Proposers may direct any questions, noted errors, discrepancies, ambiguities or deficiencies concerning this proposal via e-mail to: research@dot.wi.gov by the deadline indicated in the RFP. WisDOT will collectively post all questions and answers to the website designated in the RFP and by the date designated in the RFP. Proposers must direct questions about this RFP only to this designated e-mail and not to any other staff or agent of WisDOT.

d. WisDOT staff and project committees will review and evaluate all proposals. WisDOT will notify each proposer of the status of the proposal only after a project is awarded or after the department makes a decision not to conduct the project.

2. REQUIRED ELEMENTS

a. Cover – The cover must contain the title of the project, limited use disclaimer and identification of the submitting agency. An example cover page is provided in Figure 1.

b. Summary page – The summary page should immediately follow the cover and include the information in Figure 2.

c. Table of contents.

d. Background – The proposer should demonstrate a clear understanding of the problem statement as described in the RFP. The proposal should address how the project relates to state DOT practices and how it will benefit WisDOT. The proposer should demonstrate an awareness of recent research and current practice on the topic.

e. Work plan – The proposal must limit the work plan to ten (10) pages. The plan should outline the approach the researcher(s) will take to address the objectives, the scope of work, the project requirements and project deliverables. The work plan should demonstrate the following qualities and will be evaluated on the same:

    i. The work plan should display a clear understanding of how the tasks relate to the overall research objective, especially as it focuses on the needs of WisDOT.

    ii. The work plan should utilize established and valid research techniques while at the same time providing for creative methods and ideas to deliver effective results.

    iii. The plan must specify deliverables and note the activities needed to provide those deliverables according to the timeline specified.

f. Expected contribution from WisDOT staff – The proposal must identify involvement or guidance required or expected from WisDOT staff or agents to support completion of the project.

g. Implementation plan – The proposal must include a plan or approach for WisDOT to implement the findings of the research, focusing on the following:

    i. Expected findings (or type of findings) from the research;

    ii. The stakeholder or intended audience that will likely be impacted by the research findings;

    iii. The activities, tools, practices, policies or methods in WisDOT and other agencies that would be impacted by the research findings; and

    iv. The expected benefits to WisDOT and other agencies that could be achieved by implementing the research findings.

h. Timeline – The time allowed to complete the research project is indicated in the RFP. The proposal must provide a project timeline including a Gantt chart showing the start and end dates of major tasks, project milestones and submittal of deliverables.

i. Utilization of staff resources – The proposal must detail the number of hours by task committed to the project by each individual member of the research team, including subcontractors, with the Principal Investigator(s) clearly indicated. A template is provided in Figure 3.

j. Itemized budget – The maximum funding available for the project is provided in the RFP. The proposal must provide a detailed budget based on project tasks. Any proposal that exceeds this amount will not be accepted for evaluation. Proposers should not include matching funds or in-kind contributions in the proposal or the budget. As per WisDOT contracting / consulting policies, the prime contractor / lead agency must perform at least 30% of the work on the project as measured by the budget. A proposal that does not call for at least 30% of the work by the prime contractor / lead agency will not be accepted for evaluation. **For the deliverables, the researcher will provide six (6) print copies and one (1) electronic copy of both the interim and final reports.** A budget template is provided in Figure 4.

k. Qualifications of research team – The proposal should list experience and qualifications for the principal investigator(s) and all other key project team members, including subcontractors, with a focus on how the experience and qualifications relate to the project.

l. Experience and references – The proposal should describe the experience of the organization(s) contributing to the project by identifying up to five previous initiatives that are relevant to the research project. The descriptions should include nature of the work, dates, locations, results and client reference contact information. WisDOT reserves the right to contact any client listed by the proposer as a reference either before or after evaluating the proposal.

3. PROPOSAL EVALUATION

a. WisDOT staff and project committees will evaluate and score all valid proposals based on the following criteria and points:

Criteria	Guideline section	Points
Background / awareness of recent work	2.d.	5
Work plan – understanding of problem	2.e.i.	20
Work plan – activities & techniques	2.e.ii.	25
Work plan – deliverables	2.e.iii.	10
Anticipated results and implementation plan	2.g.	10
Utilization of staff	2.i.	15
Qualifications of research team	2.k.	15
TOTAL		**100**

Figure 1

WisDOT Policy Research Program

Project Title

WisDOT Policy Research Program
LIMITED USE DOCUMENT

This proposal is for use of the recipient in selection of a research agency to conduct work for WisDOT. Proposals are regarded as fully privileged, and dissemination of the information included therein must be approved by WisDOT.

Agency Name
Date

Figure 2

Summary Page

Project Title:

Proposing Agency and Contact Information: (Use the name, address and telephone number that will appear on a contract for work.)

Person Submitting the Proposal: (Name and title)

Proposal Written By: (Name and title)

Proposal Date:

Principal Investigator: (Name and title, address, telephone number, and email address)

Administrative Contact: (Name and title, address, telephone number, and email address)

Proposed Contract Period: (In months)

Total Contract Amount:

Overhead/ Indirect Cost Portion at ____%

Figure 3: Utilization of staff / subcontractor resources

INDIVIDUALS	**TASKS** (add columns as necessary)				**TOTAL HOURS**
	1	2	3	4	
					0
					0
					0
					0
TOTALS	0	0	0	0	0

Figure 4: Budget Worksheet

[PROJECT TITLE]

Table 1 Work Effort by Task

INDIVIDUALS	TASKS				Total Salaries	Fringes	Total Salaries and Fringes
	1	2	3	4			
Principal Investigator					$0		$0
Graduate Students/Senior Staff					$0		$0
Hourly Students/Junior Staff					$0		$0
Office Staff					$0		$0
TOTALS	$0	$0	$0	$0	$0	$0	$0

Table 2 Total Contract Summary by Fiscal Year

					Year 1*	Year 2	TOTALS
Total Salaries, Wages and Fringes (From Table 1)							$0
Sub-Contracts (Please list each subcontract seperately)							
Subcontractor 1 (Provide Name)							$0
Subcontractor 2 (Provide Name)							$0
Subtotal	$0	$0	$0	$0	$0	$0	$0
Other Direct Costs							
Item 1							$0
Item 2							$0
Item 3							$0
Subtotal	$0	$0	$0	$0	$0	$0	$0
Materials & Supplies (List all items over $1000 seperately)							
Item 1							$0
Item 2							$0
Subtotal	$0	$0	$0	$0	$0	$0	$0
Travel (State number of trips and estimated cost/trip)							
Trip 1							$0
Trip 2							$0
Subtotal	$0	$0	$0	$0	$0	$0	$0
Communications (Printing is required)							
Printing (8 printed final reports are required)							$0
Other							$0
Subtotal	$0	$0	$0	$0	$0	$0	$0
TOTAL DIRECT COSTS							$0
TOTAL INDIRECT COSTS (Provide Rate and Base)							**$0**
Fixed Fee if Applicable							**$0**
TOTAL CONTRACT COST							**$0**

NOTES: *Year 1 starts with the date of the contract and ends September 30th of the following year and is based on the federal fiscal year.