MoDOT

105 West Capitol Avenue
P.O. Box 270
Jefferson City, Missouri 65102

Missouri Department of Transportation
Patrick K. McKenna, Director

1.888.ASK MODOT (275.6636)

September 25, 2020

Dear Research Partner:

The Missouri Highways and Transportation Commission requests proposals from qualified organizations—namely private consultants, universities, and research organizations—to furnish professional services as described in the following request for proposal to be coordinated by the Research Unit of the Construction and Materials Division.

Please submit a proposal for project **TR202102** entitled, **"Safety Evaluation of Permissive Flashing Yellow Arrows for Left-Turn Movements in Missouri."** Your submittal must include a work plan, the proposed project team and its background, and any related projects now active or recently completed by your firm. The project team must be led by a licensed professional engineer in the state of Missouri and the final report must be sealed, in accordance with the provisions of Chapter 327 RSMo.

The selection committee will use Qualification Based Selection. A "not to exceed" budget amount is included in the RFP to assist with the required scope, but budgets are not to be included with the proposal submissions, and will not be presented to the selection committee.

Please submit all proposals to MoDOTResearchRFP@modot.mo.gov by **November 3, 2020** at **10:00 AM (CST)**. More information about project contracting in general can be found at https://www.modot.org/information-researchers under RFP documents.

Sincerely,

Jen Harper
Research Director

Background

The Federal Highway Administration approved the use of flashing yellow arrows (FYA) for permissive left turn movements in the Manual on Uniform Traffic Control Devices (MUTCD) in 2009, following the interim approval for designated DOTs and agencies in 2006, and the completion of The National Cooperative Highway Research Program (NCHRP) Project 03-54, "Evaluation of Traffic Signal Displays for Protected/Permissive Left-Turn Control" prior to that, which was published in 2003. The Missouri Department of Transportation (MoDOT) has been utilizing flashing yellow arrows for permissive left turn movements on state routes since 2006 after receiving interim approval from FHWA.

MoDOT has been installing these signal indications at new signalized intersections where a permissive left turn movement is needed and updating current locations with a circular green ball for permissive movements to the flashing yellow arrow across the state. Typically, permissive left turn movements are not installed on those roadways where there are more than two through lanes, or where there are multiple left-turn lanes.

A flashing yellow arrow for permissive left turn movements means left turns are permitted, but you must first yield to oncoming traffic and pedestrians and then proceed with caution. The flashing yellow arrow for permissive left turn movements does not replace the solid yellow arrow and its meaning; it replaces the circular green "ball" indication at a signal for a permissive left turn movement. The solid circular green indication is often misunderstood as a protected left turn movement indicator. This is because drivers naturally think "green means go". Traffic making a left turn on a solid circular green indication sometimes does not yield to oncoming traffic, which can result in more crashes. The flashing yellow arrow allows permissive left turn movements, but at the same time communicates the "caution" message to drivers. The flashing yellow arrow for permissive left turn movements is especially effective at intersections with high volumes of traffic.

For various reasons, there have been questions on whether it is effective in reducing crashes in permissive left turn scenarios over recent years. Given that there is sufficient crash data at this point, this project will provide a valuable Missouri-focused study on the before and after safety of flashing yellow arrows for permissive left turn movements.

Objectives

The objectives for this project are as follows:

- In cooperation with MoDOT Districts, develop an inventory of permissive turn movements designating which indication is currently in use; flashing yellow arrow or green balls on MoDOT travelways.

- Update MoDOT's Transportation Management System (TMS) inventory, including installation date by approach for flashing yellow arrows, for locations in which adequate data can be provided

- Safety analysis of intersections with permissive flashing yellow arrow movements. At a minimum, analysis for each location will include:
    - Impact to the types of crashes;
    - Impact to crashes involving pedestrians;

    - Lane configuration before and after installation; and,
    - Crash severity.

- Analyze safety study results together with deployment costs to formulate benefit-cost values for the implementation of flashing yellow arrows.

- If adequate data is available, develop one or more crash modification factor (CMF) values for flashing yellow arrows on Missouri travelways.

- Dependent on the finding of a favorable benefit cost analysis and creation of an applicable CMF, identify risk factors that a FYA may mitigate and associated benefit cost (including lives saved/reduction of serious injuries) for deploying FYA based on these risk factors.

Project Requirements

Task 1: Project Management

The Contractor will facilitate a kickoff meeting with MoDOT to review the work plan, scope, and schedule; and establish a protocol for regular ongoing communication and coordination with the team. This proposal will serve as the Draft Work Plan, to be discussed in the kickoff meeting. Upon comments received during the meeting and/or in writing, the Contractor will incorporate those comments into a Final Work Plan.

The Contractor will schedule and conduct a quarterly status meeting to review progress for the previous period and anticipated work for the next period. Contractor will also develop minutes for the kickoff meeting and each of the quarterly status meetings.

Task 2: Collect Permissive Left-turn Movement Indication Inventory

In coordination with MoDOT District personnel, the Contractor will collect information related to location and installation date by approach for flashing yellow arrows for permissive left turns within respective district areas. Data will be provided by Districts for known locations and installation dates by approach. The Contractor will scrub and organize the collected data, as the information being provided will likely be in different forms/formats.

For an approximation of current District records, please refer to the attached spreadsheet.

Task 3: Update MoDOT's Transportation System Management System

The Contactor will create a categorized and formatted Microsoft Excel spreadsheet with applicable fields needed for updating MoDOT's Transportation Management System (TMS), based on the findings from Task 2.

The Contractor, in coordination with MoDOT personnel, will update TMS signal inventory based on the information categorized on the aforementioned spreadsheet.

Task 4: Identify Flashing Yellow Arrow Intersections for Safety Analysis

The Contractor will prepare a preliminary list of FYA intersections to be used in the safety analysis, which will be presented to the Technical Advisory Committee (TAC) for review prior to

analysis in Task 5 or Task 6. The list should be formatted, grouped and presented in a manner that facilitates an expedited TAC review.

The Contractor should document their methodology, including criteria, for identifying locations that should be included or excluded from the analysis.

Task 5: Evaluate the Safety Performance of Flashing Yellow Arrow for Left Turns Locations

The Contractor will perform a safety study of flashing yellow arrows for left turns at locations identified and approved by the TAC in Task 4. The analysis for each crash at the locations must include, at a minimum, the lane configuration before and after FYA installation, crash type and crash severity. Other items to consider during analysis may include phasing prior to and following FYA installation and phasing at the time of the crash.

The proposed methodology for evaluating the observed safety performance of FYA, such as a before and after safety study, should be outlined and explained in the submitted proposal.

Task 6: Evaluate Benefit-Cost of Flashing Yellow Arrows for Left Turns

The Contractor will calculate benefit-cost values using historical deployment cost information and the analysis results from previous tasks. If enough data is present, the Contractor will also evaluate the benefit cost based on various factors, including but not limited to:

- Urban/rural split; and,
- Volume (AADT, % left turns, other).

Task 7: Assess Viability of Additional Analysis

Following the conclusion of Task 6, the Contractor will draft a memo (maximum 5 pages) providing recommendations against or for continuing on to Task 8 if enough intersection and crash data is available. Upon completion, the Contractor will submit the memo to MoDOT for review. Within two weeks of submittal, the Contractor and MoDOT will meet to discuss the recommendations and plan further action as required. At a minimum, the following will be addressed in the memo:

- Provide summarized results identified in Tasks 5 and 6;
- Recommendation for or against completing activities outlined in "Task 8: Evaluate Risk Factors and Develop Crash Modification Factor (CMF) Value(s)"; and,
- If recommended, anticipated crash types and discerning factors expected in Task 8.

Task 8: Evaluate Risk Factors and Develop Crash Modification Factor (CMF) Value(s)

If it is determined to proceed with Task 8 after the Contractor and MoDOT have discussed the recommendations from Task 7, the Contractor, utilizing the information collected in previous tasks along with crash data, will develop CMF values. The Contractor will utilize crash data to formulate one or more CMF values for flashing yellow arrows for left turns based on various risk factors, such as those identified in Task 6.

Additionally, the Contractor will attempt to identify the lives saved, serious injuries reduced, and benefit cost ratio from implementing flashing yellow arrows based on the identified risk factors.

Task 9: Develop Report, Research Summary and Presentation

The Contractor will develop a final report detailing the tasks completed during the project, including any and all findings generated during the project's duration. The Contractor will provide a 1-2 page research summary that states the project objectives, findings and conclusions. A presentation for MoDOT staff, summarizing important or significant details of the project, may also be provided, if warranted by MoDOT personnel. Please refer to the Publications Guidelines for the report and research summary, which can be found on the website.

Project Deliverables

For templates and forms for reports and plans, visit https://www.modot.org/information-researchers.

Email Communications

E-mail and phone communications between the Principal Investigator(s) and MoDOT contacts as necessary are required to provide on-going updates of progress throughout the project.

Data Management Plan

The plan is a formal document that describes the data that is acquired, created or produced during the project, specifies who owns it and who can access it as well as information on how it will be described, managed, analyzed, stored, shared and preserved during and after the project is over. Please refer to templates on the website.

Quarterly Reports

Quarterly reports should be submitted throughout the project on the last day of March, June, September and December. The quarterly reports are not intended to replace any additional correspondence between the research team and MoDOT needed to keep the project moving. Please refer to template on the website.

Draft Final Report and Research Summary

These drafts should be final products except for revisions based on MoDOT's review. A final report must include a completed Technical Report Documentation page. Please refer to **Publication Guidelines** and summary template on the website.

Final Report and Final Research Summary

After MoDOT's review is complete and documents have been edited to MoDOT's satisfaction, final documents should be submitted as a Word documents (unless otherwise instructed). Please refer to **Publication Guidelines** and summary template on the website.

Final Presentation

May be required. The Contractor will present the results, recommendations, and implementation ideas to MoDOT and other stakeholders. The Contractor will coordinate location, date, and meeting fees with MoDOT. For stakeholder and agency participants, any travel and lodging fees are to be covered by individual attendees or their firms. MoDOT and stakeholders will provide feedback to the Contractor.

Task-Specific Deliverables

Task	Deliverables
1	Schedule and conduct kickoff meeting. Kickoff meeting minutes. Draft and final work plans. Quarterly project status meetings.
2	Complete detailed inventory of flashing yellow arrows for left turns on MoDOT travelways, with assistance from District personnel and District records.
3	Update FYA for left turns inventory in the TMS signal inventory. Provide summarized and properly formatted data in an Excel spreadsheet.
4	List of FYA intersections for TAC review.
5	Safety analysis for TAC-reviewed/approved permissive flashing yellow arrow left turn movement intersections.
6	Benefit Cost Evaluation
7	Interim Project Recommendation
8	Crash Modification Factor value(s), if decision is made by MoDOT and Contractor following Task 6 recommendations.
9	Final report & research summary. Presentation. Final project meeting.

Project Schedule

The following is an estimate of the project timeline or information on key dates within the project, presuming the project starts **December 29, 2020**. Proposals need to include a work plan with a proposed timeline. For a sample of a work plan template, see link below. Changes to our estimated project timeline below will be considered, however, timeline extensions cannot be guaranteed. The project timeline will be discussed and finalized during the kickoff meeting.

For report templates and forms, visit https://www.modot.org/information-researchers.

Date	Milestone
On or before 1/5/2021	A kickoff meeting with MoDOT will be scheduled to discuss project requirements and deliverables. The dates of key milestones and deliverables will be determined from this meeting.
3/31/2021	Quarterly report due.
6/30/2021	Quarterly report due.

Date	Milestone
9/30/2021	Quarterly report due.
12/31/2021	Quarterly report due.
3/31/2022	Quarterly report due.
3/18/2022	Draft report and draft research summary are due. The draft documents shall be submitted to MoDOT approximately two months prior to the final report.
5/18/2022	Final report, research summary and presentation are due. The final documents shall be due approximately one month before the end of the contract. This is to allow all billing to be completed prior to the end of the project.
6/17/2022	Final invoice due and contract ends.

Special Notes

Project budget is not to exceed **$150,000**. A budget is not to be included in the proposal, but will be required for the contract and must be within this limit. For a sample Budget template, report templates and forms, see https://www.modot.org/information-researchers.

RFP Requirements

- "Contracting Documents" provide further details and links to the required forms. They are available at https://www.modot.org/information-researchers.
    - **Organization's Project Experience**: The proposal must clearly identify the Organization's experience in offering the services requested in this RFP during the past three (3) years. The description should include a list of the agencies which your organization has served during this time period or currently serves. Please highlight any work you have done with other state agencies or local governments.
    - **Team Member Experience**: Please list all team members (including subcontractors) proposed to work on the project. Attach licenses, certifications and resumes for key personnel.
    - **Organization's Client References**: Proposals should indicate the name, title, and telephone number of at least three clients within the past three years.
- Proposals must be no more than 10 pages in length with a font size no less than 11 points. This length limit **does not include** the Proposal Submission Form, Organization's Project Experience, Team Member Experience, Organization's Client References and optional cover letter (if included, one page maximum).

- Proposals must be submitted as one combined PDF document. The submission should **only include the required documents** organized in the following order: 1) Proposal Submission Form; 2) Cover Letter (Optional; 1 page maximum); 3) Body of Proposal (including work plan); 4) Organization's Project Experience; 5) Team Member Experience; and 6) Organization's Client References.
- The Offeror must respond to this RFP by submitting all the information required herein for its proposal to be evaluated and considered for award. Failure to submit all the required information shall be deemed sufficient cause for disqualification of a proposal from consideration.
- Proposals will be evaluated by an agency and stakeholder team with knowledge and backgrounds in relevant areas for this project. Selection of the successful Offeror will be based on the Offeror's demonstrated knowledge in the required areas, the merit of the proposed methods and approach in achieving the desired goals, the experience and qualifications of the team, the plan for ensuring implementation of results, and the adequacy and availability of team members to complete the work in a timely manner.
    - Correct proposal submission is one of the evaluation criteria. If submission instructions in this section are not followed, the **Offeror risks an automatic 10 point deduction (out of 100 total points)** when points are awarded during the Proposal Evaluation Process.

RFP Schedule

This document constitutes an RFP from qualified organizations to conduct the TR202102 - Safety Evaluation of Permissive Flashing Yellow Arrows for Left-Turn Movements in Missouri study for the MHTC and Missouri Department of Transportation (MoDOT). MHTC reserves the right to reject any and all proposals for any reason whatsoever.

The following RFP Schedule of Events represents MoDOT's best estimate of the schedule that shall be followed. The time of day for the following events shall be between 7:30 am and 4:00 pm, Central Standard Time unless otherwise noted. MoDOT reserves the right at its sole discretion to expand this schedule, as it deems necessary, without any notification except for the deadline date for submitting a proposal. Time is of the essence for responding to the RFP within the submission deadlines.

The following timeline must be met for a proposal to be accepted.

Date	Action
9/25/2020	MoDOT posts RFP to the website at https://www.modot.org/research-requests-proposal.
10/12/2020 4:00 PM (CST)	Written comments or questions must be submitted to Research Director.
10/19/2020	MoDOT will post written responses publicly on the website at https://www.modot.org/research-requests-proposal.
11/3/2020 10:00 AM (CST)	Written proposals must be submitted to Research Director.
11/20/2020	MoDOT will notify submitters about project selection, or if needed about interviews to finalize selection.

Contracting Requirements

The successful team will be required to complete additional documentation and enter into a contract such as a "Standard Research Agreement" or "Task Order." Applicants should be aware of these additional needs so contracting can proceed in a timely manner.

As part of the eAgreements process, MoDOT uses an electronic signature tool, DocuSign, for signing agreements electronically. All parties of the agreement must agree to sign electronically in order to utilize the electronic signature option. If your proposal is selected, you will be informed about how to obtain your credentials for electronic signatures (including how to become a MoDOT vendor if you are not already).

Standard contracts, forms, attachment templates and additional information are available from the website at https://www.modot.org/information-researchers.

Proposal Submission

Submission Deadline

Proposals must be emailed by **10:00 AM (Central Standard Time)** according to email time stamp by the submission date in the RFP Schedule to the Research Director's attention (Jen Harper) at: MoDOTResearchRFP@modot.mo.gov. Please reference the project title since more than one RFP may be due at one time. Electronic proposals are required.

Submission Confirmation

You will receive an email confirmation after your proposal has been received. If you do not receive such a confirmation by **12 noon (Central Standard Time)** on the day of the deadline, please contact us at MoDOTResearchRFP@modot.mo.gov as soon as possible. Your submission should not be considered received until you have received your email confirmation.

1. Current status of District Flashing Yellow Left-Turn Arrow install records (in essence, are they up-to-date) and availability of project relevant data for each location in those records (location/intersection details, FYA installation dates by approach, etc.);

NW	TMS is our main form for keeping track of what intersections have FYA. We have a spreadsheet that is used for tracking which locations need FYA and how many approaches. When locations are completed, we update both TMS with dates and approaches. We also update the spreadsheet but only with general 'complete' information to imply it no longer needs to be counted in our FYA needs.
NE	They are up to date and include location and date of installation by approach.
KC	We have recent plans, but no specific install dates.
CD	Most intersections have been surveyed to identify what would be required to update to FYA by approach, but we have not been consistent with updating when the FYA was installed. Best guess is that we have 50% of completed intersections identified.
SL	The general work was done in 2014-2015, but where those records are kept is unknown. If needed we could dig deep to find them, but the jobs were scattered pretty far and wide.
SW	Up-to-date
SE	What we have been doing is if our crew installs FYA we note in the cabinet log the date that we installed and made operational. If it was done under contract we would have the plans in Construction.

2. The format of each District's aforementioned FYA records (i.e., spreadsheet, etc.);

NW	Excel spreadsheet
NE	TMS
KC	Any records would be in TMS
CD	Spreadsheet
SL	They would be in a spreadsheet from 2014-maybe 2017, but after that the records haven't been kept
SW	TMS and spreadsheets
SE	TMS

3. What percent of the respective District's FYA inventory is up-to-date in TMS (general approximation, not high-precision); and,

NW	95%-100%
NE	100%
KC	Perhaps 50%
CD	50%
SL	Potentially 20%, we have pretty decent signal photos taken to about 90% accuracy
SW	90% should be up-to-date
SE	50%