EXHIBIT A
SCOPE OF SERVICES

TRAFFIC IMPACTS OF BICYCLE FACILITIES

BACKGROUND

Federal, state, and local policies such as Complete Streets encourage multi-modal planning and the design of roadways and streets to accommodate bicyclists and pedestrians as well as motor vehicles. As roads are resurfaced, county and municipal engineers have opportunities to restripe and change lanes provided for vehicles, bicycles, and parking. Engineers have implemented a variety of innovative multimodal designs, but few of these designs have been evaluated. County and municipal engineers have identified gaps in the technical guidance for multimodal facilities associated with the lack of evaluation. For example, the AASHTO Guide for the Development of Bicycle Facilities (AASHTO 2012), the NACTO Urban Bikeway Design Guide (NACTO 2011), and the MnDOT Bikeway Facility Design Manual (MnDOT 2007) do not provide guidance on travel lane widths in combination with bike lanes, and none provides guidance on the effect of lane width on vehicle speeds in shared facilities. The Highway Capacity Manual (HCM) acknowledges that bicycles have an effect on traffic and assigns Passenger-Car Equivalent factors on bicycles ranging from 0.5 to 1.2 cars based on total lane width, but the HCM does not relate these numbers to any of the particular bicycle lane designs. Gaps in existing guidance documents related to the effects of bicycle lanes on vehicular traffic speed, vehicular displacement, and safety can be filled with evaluations of recent innovative designs. This research will identify gaps in technical guidance documents related to design and evaluation of multimodal facilities, complete field observations of traffic flows on multimodal facilities, and document changes in traffic flows and patterns, indicators of safety, and other performance indicators. Benefits to county and municipal engineers will include increased understanding of policies and designs to increase safety and efficient operations for all traffic modes.

OBJECTIVE

This project will leverage the knowledge of county and municipal engineers responsible for implementation of multimodal policies and designs by increasing their understanding of the effects of these designs on *all* modes of traffic. The benefits will include new information about the impacts of innovative multimodal designs, new technical guidance for design engineers, and increased safety of new facilities. Users will include county and municipal engineers, planners, consultants, MnDOT employees, other state and local officials, and advocates for multimodal policies. There will be many implementation opportunities. For example, each time a county or municipality undertakes a pavement mill/overlay or chip seal project and has the opportunity to restripe a roadway, there is opportunity to consider multimodal designs. The results of this study will inform decisions of county and municipal engineers and help them ensure that new innovative designs undertaken to fulfill policy objectives like Complete Streets will maintain efficient traffic flows and increase safety for all modes of traffic.

SCOPE

The research will include a literature review, observational studies, and, depending on priorities established by the Technical Advisory Panel (TAP), surveys of drivers and/or cyclists. The approach involves completing a literature review to identify and describe innovative designs, including those that have been implemented in Minnesota; summarizing what is known about the effects of these designs on all modes of traffic; conducting original research to evaluate those relevant designs that have not been assessed previously; and developing technical guidance to fill gaps in the guidance documents written by federal and state agencies (e.g., MnDOT). The research, including selection of designs to be evaluated, will be guided by a technical advisory panel (TAP) comprised of county and municipal engineers, MnDOT employees, and other practitioners in the public and private sectors engaged in implementing multimodal projects.

ASSISTANCE

TAP participation is essential to the progress of the project. MnDOT engineers and practitioners will help prioritize the knowledge gaps identified by the research team and help select the locations for the field studies.

WORK PLAN

Task Descriptions

Task 1: Review of Literature and Identification of Knowledge Gaps
Task 1 will be a review of the literature on (a) innovative multi-modal designs to implement Complete Streets and other policies, and (b) the effects of bicycle and other facilities on all modes of traffic, particularly motorized traffic. This literature review will include the AASHTO Guide for the Development of Bicycle Facilities (2012), the NACTO Urban Bikeway Design Guide, the MnDOT Bikeway Facilities Design Manual, other guidance documents, and evaluations of facilities published in journals and by federal, state, and local agencies. The literature review will identify which designs have been implemented in Minnesota and others that hold promise for implementation. A primary product of the literature review will be a matrix that identifies designs to achieve different goals, the designs that have been implemented in Minnesota, and which designs have been evaluated for impact on traffic. The matrix also will summarize the effects of implementation. Through construction of this matrix, the research team will identify gaps in our understanding of the impacts of different designs. For example, a recent study by a team of graduate students in Minneapolis documented that experimental installation of bike lanes on Como Avenue generally reduced vehicle encroachment on cyclists and the frequency of vehicular lane deviation, but the study did not assess vehicle displacement, changes in vehicular speed after implementation of the bike lane, or driver attitudes towards the bike lane. If the research team identifies no field studies of the effects of bike lanes on vehicular displacement, slowing, or congestion, we would add these topics to a list of candidates for field study.

The University will perform a thorough review of the literature and will seek all existing knowledge or observations made in regards to the effect non-motorized traffic facilities have on motorized traffic. Based on the results of this review, the University will identify gaps in the understanding of the impacts of different designs. The University will, with the assistance of the TAP, prioritize these gaps of knowledge for further investigation.

Task 2: Design of Field Study and Pilot
Task 2 will involve both the design of the field study structure and a pilot field study that is undertaken concurrently with the literature review. The pilot field study will inform both the research team as well as the TAP on the feasible information that can be collected through observation and develop a number of surrogate measures of mobility and safety for both motorized and non-motorized traffic. This task will also inform the TAP of the cost of conducting field studies, which, in turn, will inform the subsequent selection of designs for inclusion in the field studies. This task may not include deployment of equipment since the MTO is in possession of substantial video records from bicycle facilities in Minneapolis.

The University will design a pilot field study will serve as the guide to the University and TAP in understanding the different information needed to be extracted and how the data collection needs to be set up. For this task, already collected video can be used to minimize cost and/or data collected on one selected site. This task will also assess the cost of executing the subsequent field studies. This task will assist in prioritizing the knowledge gaps discussed in task 1.

Task 3: Field Study Sites Engineering
Task 3 will be the preliminary engineering of the field studies to evaluate the impacts of multimodal facilities that have been implemented in Minnesota. Based on the literature review and "gap analysis", the research team will work with the TAP to select specific designs that have not been evaluated in formal studies. For example, Minneapolis and other communities across the country have implemented "road diets" when adding bike lanes, reducing vehicular traffic from four to three lanes. If the research team finds that no field studies of the effects of road diets on all modes of traffic have been completed, road diets would be a candidate for field study.

The designs to be evaluated will be determined in consultation with the practitioners on the TAP based on relevance to Minnesota and importance of understanding their impact. The team will work with the TAP to ensure the facilities that are studied reflect key design parameters including a range of posted speed limits (e.g., 30-50 mph.); ranges of average annual daily traffic (AADT); the presence or absence of bike lanes, parallel parking and raised medians; different cross-section widths; and other features such as bicycle level of service (LOS). The members of the TAP also will be involved in the design of the field evaluations.

Based on the results of tasks 1 and 2, the University will select a number of existing facilities for collecting field measurements. For each site selected a second site with no bicycle or other facilities will be selected to act as reference or control. Priority will be given on Complete Street implementations outside the metro area. A minimum of 8 site pairs will be selected with the potential for more study sites depending on the results of task 2.

Task 4: Data collection and reduction
Task 4 will be the conduct of the field evaluations by the Minnesota Traffic Observatory (MTO), including data collection and reduction. These evaluations will include observations of video of traffic flows and interactions collected by the MTO and also, as appropriate, surveys of drivers. Although the team will try to capitalize on data video available at the MTO from recently completed projects for the City of Minneapolis, it is expected that designs from different communities throughout Minnesota will be included in the field studies. The specific number of studies will depend on the number of gaps, the priorities of the TAP members, and the tradeoffs in elements of design. The product will be a technical memorandum that summarizes the outcomes of the field studies. The outcomes will include measures of greatest interest to the practitioner community such as impacts on speed and safety.

As soon as weather permits data collection on bicycle facilities, the MTO will deploy surveillance equipment. Data reduction will be concurrent to data collection to minimize the overall project duration.

Task 5: Development of Recommendations for Local Engineering Practice and Future Research
Task 5 will involve the development of recommendations for local engineering practice and future research. These recommendations will include general engineering and technical guidance based on findings from the field studies. By providing county and municipal engineers, planners, and others new information on the impacts likely to be associated with different designs, these practitioners will be in better position to both choose among designs and mitigate potential adverse effects of those designs. The guidance, which will discuss the types of designs appropriate in particular contexts, will be summarized in a technical memo. Tasks 6 and 7 will involve preparation, review, editing, and publication of the final report.

The University will translate the study findings into recommendations for local engineering practice and future research. These recommendations will include general guidance that will provide new information that county and municipal engineers can use to assess design options for resurfacing and other projects, complement existing design guidelines in the MnDOT and AASHTO manuals, and inform future research and projects to revise these existing design manuals.

Task 6: Compile Report, Technical Advisory Panel Review and Revisions
The University will prepare a draft report, following MnDOT's publication guidelines, to document project activities, findings and recommendations. This report will need to be reviewed by the Technical Advisory Panel (TAP), updated by the University's Principal Investigator, and then approved by the Technical Liaison before this task is considered complete. Holding a TAP meeting to discuss the draft report and review comments is strongly encouraged. TAP members may be consulted for clarification or discussion of comments.

Task 7: Final Published Report Completion
During this task, the Approved Report will be processed by MnDOT's Contract Editors. The editors will review the document to ensure the document meets the publication standard. The University's Principal Investigator will then prepare the Final Report and submit it for publication through MnDOT's publishing process.

Task Deliverables

Task:	Deliverable(s):
1:	Literature review and report on prioritized knowledge gaps
2:	Report on the minimum requirements and cost of a field study
3:	Report on sites selected and result of preliminary site engineering
4:	Report summarizing the data collected
5:	Report containing the formulated design guidance
6:	A Draft Report and Final Report Approved for Publication
7:	Final Published Report

PROJECT SCHEDULE

Task Completion Dates

Task:	Draft Deliverable Due Date:	Final Task Approval Date:
1:	December 31, 2014	January 31, 2015
2:	October 31, 2014	November 30, 2014
3:	March 28, 2015	March 30, 2015
4:	October 31, 2015	November 30, 2015
5:	December 31, 2015	January 31, 2016
6:	February 28, 2016	April 30, 2016
7:	N/A	June 30, 2016

Key Milestones

Key Milestones	Target Date	Description
Prioritizing knowledge gaps	January 2015	The TAP must be convened and a priority of knowledge gaps decided by this date in order to be able to perform the data collection during the summer months.
Select project sites	January 2015	TAP members also will be engaged in selection of sites for field study.

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