Public Abstract
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Work zone safety and operations are of growing concern through recent years. With increasing traffic demand on the transportation system and advancing technology raising new situations, such as texting while driving and the proliferation of portable devices, new approaches and solutions need to be formed relating to transportation safety. This thesis addresses two issues pertaining to work zone safety. This first issue related to the increase of distracted driving through mobile work zones leading to an increase in collisions with work zone vehicles. Mobile work zones are continuous slow moving operations utilized for various maintenance applications such as pavement striping, sweeping, and pothole repair. This type of work zone is unique because no portion of the work zone is static and the use of and advance signage must remain mobile. The speed differential between the work zone vehicles and normal traffic flow, and the rise in distracted driving can lead to potential collisions. A possible solution to this problem involves the use of an audible warning system. This thesis evaluates two types of mobile work zone alarm systems: an Alarm Device and a Directional Audio System (DAS). Three modes of operation were tested: continuous, manual, and actuated. The evaluation consisted of sound level testing, analysis of merging distances and speeds, and observations of driving behavior. The mobile work zone alarm study found that the Alarm Device and DAS operate within national noise standards. All of the tested configurations increased vehicle merging distance except for the Alarm Actuated setup. The DAS Continuous setup reduced vehicle speeds and the standard deviation of merging distance. Some instances of undesirable driving behavior were observed for some configurations; however, it is unclear whether these behaviors were due to the use of the audible warning system. Analysis of the alarm activations showed that horizontal and vertical curves had a significant effect on false alarm and false negative rates. This research found that the use of an audible warning system has potential to be an effective tool in improving safety through mobile work zones. Further tests to the system, such as modifying the alarm sounds, could improve the warning system's effectiveness.
The second issue relates to the rising trend of utilizing innovative geometric designs to address increasing traffic and increase traffic safety. Currently there are no guidelines within the Manual on Uniform Traffic Control Devices (MUTCD) on construction phasing and maintenance of traffic (MOT) through retrofit construction projects involving innovative geometric designs. The research presented in this thesis addressed this gap in existing knowledge by investigating the state of the practice of construction phasing and MOT for several types of innovative geometric designs including the roundabout, single point urban interchange (SPUI), diverging diamond interchange (DDI), restricted-crossing left turn (RCUT), median U-turn (MUT), and displaced left turn (DLT).Goals through the innovative geometric design portion of this thesis include providing guides for transportation practitioners in developing construction phasing and MOT plans for innovative geometric designs. This involves providing MOT Phasing Diagrams to assist in traffic control measures such as barriers, delineators, and striping. Guidelines were developed for MOT through a review of literature, survey and interview of industry experts, and review of plans from innovative geometric design projects. These guidelines are provided as a tool to assist in improving work zone safety through construction of projects with innovative geometric designs. A literature review, survey of industry experts, interviews of industry experts, and analysis of project plans provided knowledge of existing practices for these types of designs for the development of MOT Phasing Diagrams for each of these intersection types.