



**Autonomous Truck Mounted Attenuator (TMA)**

***What Was The Research Need?***

**PROJECT NUMBER:**

RES2019-15

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Work Zone safety is a major concern to federal, state and local agencies. Periodic maintenance of roadways requires workers to be exposed to hazardous conditions, often working next to traffic traveling at high rates of speed. The Tennessee Department of Transportation (TDOT), in its continuous efforts to target the reduction of work zone fatalities and to provide safe working conditions to its employees, decided to explore the applicability of an Autonomous Truck Mounted Attenuator (ATMA) to improve work zone safety. The main benefit of such a system is the enhanced operational safety provided by the removal of the Truck Mounted Attenuator (TMA) driver from harm’s way. In addition, an ATMA system is designed to maintain the proper buffer distance to the service vehicle with greater accuracy than a human driver, therefore providing additional worker safety. In operation, the Leader Vehicle (LV) system transmits its position, speed, and heading to the ATMA follower vehicle in a sequential series of Vehicle-to-Vehicle (V2V) “*e-Crumb”* electroniccrumb messages. The ATMA then maneuvers from one *e-Crumb* to the next precisely following the path of the LV at a user-defined vehicle-gap.

 A Literature Review was conducted, but due to the novel concept of the ATMA system, the information available was limited. A few state DOT’s provided feedback to a request of information. The Colorado Department of Transportation has performed validation tests on the system and has undertaken a phased approach with the deployment of the ATMA. Currently, in Colorado, the ATMA system is authorized to operate on roads with AADT of less than 5,000 vehicles per day and is used for painting stripping typically on long, flat, rural roadways.

The research team contacted TDOT representatives from the Occupational Health and Safety Division to learn about current TDOT practice regarding TMAs. We learned that TDOT provides comprehensive periodic training on TMAs and work zones and that maintaining consistent follow and roll ahead distances was identified as an important desired ATMA system asset. Meanwhile, the research team recommended TDOT to explore the use of rangefinders with laser technology to minimize the aforementioned concern.

The ATMA testing in Tennessee was conducted during a pilot demonstration in coordination with TDOT, where a set of twenty-four case scenarios analyzed the various operational components of the system. It concluded primarily that the ATMA system is better suited for work zone operations that require continuous movement for longer periods of time, due to its speed/gap algorithm configuration. The ATMA system tested is not currently designed to accommodate stop-and-go applications, like pothole patching for example. In addition, the system demonstrated the capability to operate in Global Positioning System (GPS) denied locations, but only for a short period of time. Therefore, the tested ATMA system requires additional refinement for operations at locations with overpasses, heavy foliage, tunnels and any other locations with long periods of sustained loss of GPS signal. Furthermore, due to the “*e-crumb*” following technology, the testing pointed to the current inability of the ATMA system to consistently shadow/protect the service vehicle at all times. When the leader/service vehicle encroaches in the lane from a shoulder, for example, the autonomous follower vehicle will not immediately shift to the lane behind the service vehicle, having to follow the *e-crumbs* laid out by the service vehicle first. The ability to offset the follower vehicle from the leader vehicle “*on the fly*” is necessary to accommodate such scenario. Since the pilot testing in Tennessee, an offset functionality has been developed for the system. Extensive training and practice is imperative to assure the safe operation of the ATMA system.

Finally, the ATMA system is an innovative and promising asset to improve work zone safety for all users. The aforementioned issues can potentially be minimized by the continuous fine tuning the ATMA system algorithm, by implementation of additional functionalities and further testing, greatly enhancing the system capabilities.

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