



## Connected Intersections Project

As systems engineers and subject matter experts, ConSysTec worked on a project supported by USDOT ITS Joint Program Office to develop and publish Connected Transportation Interoperability (CTI) 4501 - the Connected Intersection (CI) Implementation Guide. CTI 4501 defines the key capabilities and interfaces a connected signalized intersection must support to ensure interoperability with production vehicles for state and local infrastructure owner/operators (IOO).

Early deployments of Connected Intersections (CI) have demonstrated that a common understanding and agreement on interpreting and implementing existing standards is needed between IOOs and automotive original equipment manufacturers (OEMs). These variations in interpreting connected vehicle standards have led to a lack of interoperability that prevents infrastructure and vehicles from using data at connected signalized intersections across different jurisdictions to fully

realize the safety benefits of vehicle applications.

The CI effort established an open dialogue between the IOOs, OEMs and the signal controller industry to develop a CI Implementation Guide. The result: interoperable connected intersections that enable safety applications to be developed for production vehicles.

As the lead systems engineer, ConSysTec led the effort to assemble the CTI 4501, guiding the five task forces and one subcommittee that are developing guidance for specific standards areas with interoperability issues. Following the systems engineering process, CTI 4501 contains a Concept of Operations, a Systems Requirements section, and a system design details section that provides the guidance.



*Typical New York City Intersection  
Deploying Connected Vehicle Equipment*



*New York City Traffic  
Signal Detail*





ConSysTec staff were also the subject matter experts for two standards areas: SPaT/MAP messages and Testing/Conformity.

For SPaT/MAP messages, ConSysTec helped define mandatory data elements to enable interoperable Red-Light Violation Warning (RLVW) vehicle applications. In addition, guidance was provided on how to construct SPaT and MAP messages to represent different intersection configurations.



*Illustration of a Connected Intersection*

For Testing and Conformity, ConSysTec's expertise helped to define a framework to verify an implementation's conformance with the CTI 4501.

ConSysTec also supported the validation phase of this project, where 15 deployment sites across North America volunteered to collect and provide field data; and to provide feedback on the draft CI Implementation Guide. The field data, consisting of broadcasted SPaT and MAP messages, was analyzed for conformance. From the IOO's perspective, the validation phase provided insight on how to perform future testing. Observations from these analyses, lessons learned and the feedback was documented by ConSysTec in CTI 4502 – Connected Intersections Validation Report.

A CI Phase 2 effort began in Winter 2022 to update and enhance the existing guidance moving forward.

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