Connected Vehicle Certification Program

Task 3 - State and Local Needs Assessment

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Cooperative Transportation Systems Pooled Fund Study
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November 18th 2011

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EXECUTIVE SUMMARY

This paper reports the results of interviews conducted on behalf of the Cooperative Systems/Connected Vehicle Pooled Fund Study concerning state and local needs relative to the establishment of a Connected Vehicle Certification Program. It also provides preliminary analysis of comments collected during the interview process.

A set of interview participants, comprised of members from agencies currently involved with the Pooled Fund Study was identified, provided a questionnaire, and interviewed during the time span from October 5th, 2011 to November 9, 2011. The questionnaire and interviews solicited participant response on a number of topics ranging from questions concerning general awareness of Connected Vehicle programs to specific questions regarding deployment plans, system security policies, and implementation. Topics also included questions intended to solicit opinions and feedback on where such emerging programs may fit within current state and local agency structures. All were geared to help establish a general understanding of concerns and needs from the state and local perspective.

Several common threads emerged in the responses that were gathered. First, there seems to be unanimous agreement that the USDOT role is critical for the success of any Connected Vehicle Certification program. Further, Connected Vehicle devices must be governed by open standards and be interoperable, with program and product development that is championed at a national level. Second, there is a strong common desire that there be a mechanism to ensure compliance and proper function of these devices. Respondents generally agreed that an organized, effective, impartial, and consistent certification body or program would contribute greatly to confidence in device performance, standards compliance, and reliability. Lastly, there is a common desire that the USDOT continue to lead, guide, and coordinate certain aspects of Connected Vehicle standardization and certification until at least a point where the technology is considered mature and its utilization is better understood and further integrated into the mainstream operations of state and local transportation agencies.

Agencies within state and local organizations that are involved with traffic operations, signalization systems, and freeway management will likely be responsible for some facet of approval, design, integration, or implementation of Connected Vehicle systems. Agency resources are likely to include in-house staff, in-house consultant staff, outside consultants/contractors, and others. However, all will likely be working under the direction of a state or local official with overall responsibility for traffic operations.

In summary, state and local entities desire support and guidance that will reduce their risks of implementation, ownership, and operation of Connected Vehicle systems. Most agree that technical risks can be mitigated through product evaluation and certification against mature

and well-crafted functional specifications. Most appear to desire national guidance and development of technical specifications that allow competitive bidding of equipment from a qualified group of manufacturers.

Participants also felt there is value in certification and marking. Most wish that equipment be validated and vetted through testing, pilot projects, and perhaps formal certification. If executed properly, certification and marking of connected vehicle equipment would help establish state and local confidence in products.

Finally, state and local agencies desire national guidance on deployment and use of Connected Vehicle Technologies. The need for USDOT leadership emerged as a common theme. Multiple participants referenced mainstream organizations and publications, such as AASHTO and the MUTCD, as having possible applicability. Such organizations and publications help establish and document "best practices" and this is often used to support and defend decisions made by local and regional agencies. All respondents indicated interest in legal and liability issues concerning the Connected Vehicle technology and most drew parallels to familiar liability issues that often surround proper roadway/sign designs and proper operation of signals and other traffic control devices. Beyond helping to establishing guidance, foster uniformity, and facilitating information exchange, the "best practice" and rules/guidance established by such stakeholder groups and publications were noted by respondents as often being valuable in the defense of local and state agencies during legal challenges.

Overall, there appears to be a strong case for a well-structured and well-executed certification program for Connected Vehicle devices. The keys to the success of such a program will be its basis on stable, well-vetted, comprehensive standards; and the establishment of an entity able to coordinate and establish rules that will ensure comprehensive, impartial, consistent, and credible independent product evaluations and certification.

The interviews and data compilation described herein allow preliminary development of a needs list that can be used to determine future action items. Needs and desires expressed by participants included:

- The need and desire for continued USDOT leadership in Connected Vehicle Specifications that can simply be adopted by states and locals.
- The need to promote general awareness of Connected Vehicle technology and the real-world applications it will likely support in the near future. Awareness is currently very limited, and this is a program/technology that is expected to involve direct presentation of information (traffic data, warnings, etc.) to drivers. For instance, traffic signals are familiar to the public. SPaT information is not.

- The need and desire for USDOT to consider legacy equipment and backwards compatibility as they work to advance connected vehicle technology.

- The need for a “one-stop” certification or Qualified Product List program. States and locals may not have the resources or familiarity with these devices to pick “good” from “bad”. A listing of validated products or a credible certification mark to identify quality, reliable products would help them.

- The need for national guidance on product development and deployment that fosters uniformity and interoperability. Consider models such as the MUTCD and NTCIP.

- The need for states and locals to have convenient mechanism (forum, web portal, working group, etc.) to express their needs/desires/concerns directly to USDOT Connected Vehicle Program leadership.

- The desire for, and possible establishment of, a concise set of “guiding principals” that the USDOT should consider for various aspects of connected vehicle technology development and deployment. Examples might include “ensure future device specifications take into account legacy system needs”, “consider ease of deployment and maintenance”, etc.

- Desire for increased awareness and sharing of “best practices”, including policies, data use/data sharing agreements, and general mainstreaming of connected vehicle technology and devices.

- Desire for high-level “architecture” documents.

- The need for national policy, guidance, or other resources that will help limit state and local liability for damages or injury that may somehow arise from, or relate to, connected vehicle systems that they choose to deploy and operate.

- The need to make the complexity of connected vehicle technology simple. While the underpinnings of connected vehicle must be complex, the end product must be reasonably simple to deploy, operate, and understand. Traffic Signal Systems and their communication networks are complicated and specialized. Most citizens are not even aware of the infrastructure and equipment required for signalization. They are, however, very aware and familiar with “traffic lights”.

INTRODUCTION

The objective of Task 3 is to establish and quantify state and local needs for the deployment of a Cooperative System/Connected Vehicle certification program. This research was conducted through interviews and surveys to determine the needs of state and local authorities and how much variability there is in this target population. A questionnaire document was created that included 52 questions divided into 6 categories. A group of pooled fund study participants was identified as interview candidates and were contacted to request their participation. The interviewees were sent the questionnaire ahead of time. The following is a list of participants contacted who responded with written responses to the questionnaire or participated in telephone interviews.

Person	Agency
Greg Larson	CalTrans
Elizabeth Birriel	FDOT
Faisal Saleem	MCDOT
Ray Starr	MnDOT
Rick McDonough	NYDOT
Gary Piotrowicz	RCOC
Barry Pelilis	Transport Canada
Melissa Lance	VDOT
John Corbin	WisDOT
Bill Legg	WashDOT

The results of the interviews and responses were used to create a short survey that is focused on items which solicited the greatest amount of response and interest from the pool of initial participants. This survey instrument may be distributed in the future to gather additional data from a broader group of participants. The summary survey is much shorter and only takes a few minutes to complete. The survey provides the Pooled Fund Study (PFS) with a mechanism to reach out to other agencies to gain their perspective on Cooperative System/Connection Vehicle certification. The questions in the summary survey were selected and refined based on review and analysis of responses from the participants identified above and includes questions concerning key issues that appeared to have a high interest among the initial interview participants.

The following sections are divided into three parts. The first part summarizes the responses received from the interviewees in a tabular format.

The second part contains the survey questions that were derived from the interviews. The survey can be formatted, possibly as a web-based instrument, and used by the PFS to solicit input from additional agencies. An example of the survey, in electronic form, can be placed online for the PFS's convenience.

The third part contains a compilation of observations that were made during the interviews, data gathering, and subsequent organization of materials. Additional analysis is planned as a separate task (Task 4) within the Pooled Fund Study project. However, preliminary analysis was possible during this task, so the team involved has taken the opportunity to identify and note certain trends which appeared during the course of this portion of the project. These trends and preliminary analysis show both the commonality and variability of the interviewees and, in turn, state and local needs concerning a Connected Vehicle certification program.

PART I – INTERVIEW RESULTS

The following table provides the summarized responses that were received during the oral and written interviews conducted.

Category	Questions	Responses
Awareness and Involvement		
1.	Is your organization familiar with Connected Vehicle systems and devices?	Yes. Made investments and have program. New executive team may not be aware of Connected Vehicle. Yes. Yes. Yes. Highly. Yes. Yes. Yes. Some individuals are very familiar, but across organization - probably not so much. Yes.
2.	Does your organization envision Connected Vehicle systems as part of your future traffic management strategies and systems?	Yes. Supports Commercial Vehicle Operations in particular. Yes. Yes. Yes. To be determined. It depends upon the results of

Category	Questions	Responses
		tests such as the safety pilot. If the systems are demonstrated to provide significant safety and mobility benefits, they would be considered among other safety and mobility solutions. Most likely, if the system as currently conceptualized materializes. Yes. A number of provinces and municipalities are aware and considering technology, but how it will be implemented and mature is yet to be determined. Yes.
3.	How important is your organization's level of direct involvement with the USDOT Connected Vehicle Program?	Important, but more important that USDOT address and manage certain aspects for states to successfully deploy. USDOT must lead and promote interoperability. Without USDOT leading and managing national effort it will not be successful. Direct involvement is important. Important and we are very much involved with USDOT and others (ITE, for instance). Very important. Involvement with the USDOT's program is important and has been beneficial in moving forward with various pilot projects related to connected vehicles. Important. Important. Involvement is important. Our agency is more involved at higher level. We do not typically deploy or operate, but establish policy. In that sense, it is very important to be involved at the committee and

Category	Questions	Responses
		working group levels.
4.	Does your organization already have plans to deploy Connected Vehicle infrastructure? If so, for what application and when?	We have deployed Infrastructure for pilot projects and want to deploy more. It is important note that future upgrades and maintaining backwards compatibility are important issues. Upgrades and advances in technology MUST BE COORDINATED. While RITA and other entities are to be commended for their work in laying early groundwork and establishing program momentum, their specialty is research. Research needs and focus do not always match the needs and focus of those who must deploy and operate this equipment. USDOT must be more cooperative and considerate of current state deployment needs. USDOT must strive to ensure everyone is in unison and give additional consideration to real world needs. Currently in planning stage. We have plans but have not identified what and where. Our agency goal is to have something on the ground within 1-3 years. Funding is set aside and areas of application and interest exist. Yes. In planning stages. Current concepts being explored involve multimodal signal operations. Concepts developed for incident management and emergency vehicle priority. Likely to involve JAE 2735 SpAT messages, actuated signals, and vehicle detection. Yes. Test bed deployed and in process of update. System includes a variety of DSRC equipment at

Category	Questions	Responses
		actuated intersections. Yes. Deployed test bed, but that is all. There have been no additional deployments primarily because of uncertainty as to what to put in. If product was mature, we would be adopting and deploying at every new intersection, maybe. We would likely consider DSRC roadside equipment as another tool to stick in the design toolbox. We have had the infrastructure side of a Cooperative Intersection Collision Avoidance System - Stop Sign Assist (CICAS-SSA) system operational in the field for nearly 2 years, with a dynamic sign providing information to the public. As part of a pilot project we are doing now, we will test providing the warning in the vehicle through use of DSRC from the roadside. This test will involve 5 vehicles at one test intersection. No current plans. No plans for production, but several in planning stages for pilot deployment. Very interested in commercial vehicle applications (weigh/clear for border crossings, etc.). CVO is viewed as low hanging fruit and early opportunity. There may not be as many privacy concerns with CVO since commercial vehicle operators are already regulated and familiar with other forms of monitoring and governance (electronic permitting, etc.). Therefore, there is less likely to be a "big

Category	Questions	Responses
		brother" perception. Yes. We have deployed hardware and software on a limited test bed corridor. This effort was one of many initial activities to support safety pilot deployment and future long-term operation of Connected Vehicle systems and technologies. Our next steps are in the planning stage, with Concepts of Operation currently under development for continued Connected Vehicle V2I use cases and operation.
5.	Is your organization aware that the USDOT has awarded contracts to multiple vendors for the manufacture of Roadside Equipment and Vehicle Awareness Devices?	Yes Yes Yes. Aware, but not familiar with the details. Yes Yes Yes Yes Yes in the context of the safety pilot, but nothing in

Category	Questions	Responses
		production. Aware of some activities through AASHTO working group and VDOT pooled fund study.
6.	If your organization were to purchase a Connected Vehicle device from the USDOT selected vendors, would your organization expect the device to be certified interoperable?	"Absolutely". If that doesn't occur, justification for purchase would be difficult or impossible. Yes. Certainly a preference. Absolutely. Yes. I am a researcher. I can do things in a test bed environment. In the long run, there is preference for certification. Whether that is in-house or 3rd party may be determined later. Yes Yes, although my understanding is that the standards are still being refined, such that interoperability may only exist at a specific point in time among devices being tested against the same version of a standard. For example, I understand that the security approach is still being debated, and so devices manufactured now may not interoperate with devices manufactured once there is a final security standard. Most likely, depending on what "certified" means

Category	Questions	Responses
		Yes. We would hope it would be. However, understand that prototypes may not be. For production devices and systems you would absolutely expect that they be certified interoperable.
7.	Does your organization plan to perform your own evaluation or certification of Connected Vehicle devices or plan to have a 3rd party certify devices? If so, Why?	No. We want it to be evaluated and certified already. Uncertain. Prefer 3rd party. In-house evaluation may be cost prohibitive. To the point that we are comfortable with product. This would likely include pilot project field testing, etc. Essentially, this is similar to existing processes we use to evaluate the operational effectiveness of any new device. We have the ability, though we would prefer a 3rd party and perhaps some sort of in-house/3rd party balance. 3rd party. We do not want to commit resources, etc. to that effort. Want interoperability certification done by others. At this point we are using the devices in an experimental phase, and we would probably have our contractor evaluate compatibility of devices. This is because there is currently no 3rd party device certifier that I know of. In the long term the industry should take care of the whole issue and we should not have

Category	Questions	Responses
		to do anything. If we buy an Ethernet device or Bluetooth device or Windows software, etc., we can safely assume that some reasonable amount of certification or testing to standards has been done by the manufacturer. Hard to say at this point. To be determined. We expect to perform at least some level of product evaluation to gain confidence in proposed devices, such as testing at our internal research facilities, pilot project deployments, etc. We expect that the process will be similar to what is done for any new device introduced into our state transportation system. We have a history of evaluating and approving equipment for our statewide Approved Product List (APL) and believe this process will also benefit USDOT by providing feedback and lessons learned.
8.	Does your organization currently work with other agencies on the design and deployment of cooperative systems?	Yes. Yes. More with the research side, particularly University Partners and AASHTO group. We have a number of partnerships, both public and private

Category	Questions	Responses
		Yes. Our test bed is a partnership. We also have partnerships with Universities. Yes. Almost every test bed is a partnership. No. We have one test project. However we partner with Universities. At lease one university in our area has done some work with DSRC. Yes, via AASHTO and the CV PFS Yes. CVO, rail, etc. Yes.
9.	What role does your organization play in interstate road operations, arterial roadways, signalization, commercial vehicle operations/permitting, tolling, transit system information, 511 and others?	Statewide interstate and state highway owner and maintainer. We operate 511 and fund all transit operations. We are not involved with tolling (tolling is operated by specific authorities designed to do so). We are the lead agency for Federal Motor Carrier Safety. Interstate and arterial operations, signalization, 511. All roads except for 2 counties and cities. Primary scope is arterial roads, signalizations.

Category	Questions	Responses
		Regional Archive Data Server. A little to do with all, a lot to do with many. Responsible for building, operating, maintaining all interstates and start routes. Responsible for approximately 5000 signals statewide, out of approximately 40000. Others are operated by counties/cities. Responsible for CV permitting, tolling is handled mostly by regional agencies. 511 is run by regional agencies. About to launch state highway 511. Many state signals are transferred to local agencies. If state signals are given to locals, locals take all responsibility from that point forward. Yes. CVO, Tolling, Transit, 511 no. Others maybe. We do all the items on your list except for transit system information. That is done by the transit authority. We are a state DOT and have activities and responsibilities in all listed areas. Facilitator/leaders on 511, CVO (Road Safety). Much of the rest is carried forth by local agencies though we likely provide some level of funding. We work on all of the items mentioned in this list, though our direct involvement with tolling and transit information is limited.

Category	Questions	Responses
10.	What would help establish confidence that Connected Vehicle equipment from one vendor is likely to be interoperable and interchangeable with similar equipment from others?	Have an entity to test and guarantee interoperability. There is a need to ensure what is bought will work when taken out of the box. It is important to do pilot deployments; pure research and reports are good first steps, but not sufficient. States have to justify new technology and if it does not work will be difficult to get funding. Established Standards. For instance NTCIP, etc. has done a lot to advance interoperability for some devices. Test bed for local evaluation of equipment from different vendors. Also, national standards. For example, DMS NTCIP standards have afforded standardization. OBE will be portable device so national standards and interoperability are critical Safety pilot and adherence to standards. Evidence that equipment works in a close to real-world scenario. A golden stamp. Kidding aside, certification by an organization that is effective and supported by users. For instance, the UL listing model is attractive. Near term is really experimental stuff and I would assume we would need to have our contractor ensure interoperability. In the long term, this should be taken

Category	Questions	Responses
		care of by the manufacturers to the point where we need not concern ourselves with it much. When there is a widespread deployment of in-vehicle and roadside equipment, anyone whose equipment does not work according the standard will not be in business long. They will need to make sure it is right before they sell it. A true 3rd party managed certification program Projects like safety pilot are good first step. Goal is that pilots establish good level of confidence prior to widespread deployment/production. 1. Establish standards and protocols for all vendors to follow. 2. Having a testing facility to verify and certify devices. 3. Operational evaluation and review of detailed test reports and data from independent testing entities. A similar process is followed for the review and approval of other devices (such as traffic signals, controllers, ITS equipment, etc.) already. Our agency already relies upon a centralized statewide program to evaluate products against state requirements and national standards and accepts independent lab reports as evidence that certain requirements are met.
Federal Governance		
11.	Is your organization aware of any Connected Vehicle	Yes. OmniAir only. Details are not tremendously important but conceptually at a high level, the idea of

Category	Questions	Responses
	certification programs provided/supported by the USDOT?	certification and a certification program is desirable. Yes. Aware of OmniAir certification program activities. Yes. Only aware of OmniAir. Very little. Pooled fund, OmniAir, and nothing else. Not a lot of knowledge about OmniAir, but is aware of that organization. Just the pilot version being tested as part of the Safety pilot test. OmniAir is somehow involved, but I do not know if their efforts are sanctioned by the USDOT. I am aware of the work being done to determine what this will look like and the issues that need to be addressed Yes. OmniAir and perhaps some activities associated with Safety Pilot. 80% of what I have heard is knowledge gained from AASHTO working group. Yes, though statewide agency awareness is probably limited only to those that have had significant

Category	Questions	Responses
		firsthand exposure to the USDOT Connected Vehicle Program.
12.	Does your organization believe that the USDOT should provide a single certification program for Connected Vehicle technology?	Single process, yes. Single entity or firm, not so much. The end result being consistent and endorsed by USDOT is desirable. "I think it would be ideal" Yes, that would be important. Something that supports uniformity. For instance, many traffic control devices (signs, signals, etc.) are evaluated against MUTCD and other requirements. Yes as long as it doesn't become too costly. USDOT should take a leadership role. Yes. There needs to be a single point of governance for consistency. The definition of Connected Vehicle technology is restricted to DSRC for this question. I think it would be better if the industry took care of it rather than the government. Probably.

Category	Questions	Responses
		In a perfect world, yes, but doubtful it will end up this way. The more likely result that I can envision would be a system where USDOT has some degree of oversight and influence from policy and program perspective, but others would actually do the testing and certification (execution and delivery). A single certification program would seem to make sense. This could be a single entity or a consistently executed program whereby multiple certification bodies (test labs, etc.) could contribute. Whatever certification is ultimately established should be based on consistent standards and consistent testing.
13.	What testing directly conducted on behalf of the USDOT by independent third parties would help your organization select Connected Vehicle equipment?	Uniform interoperability testing to nationally supported and endorsed requirements, etc. QPL list for RSEs, equipments. Pick list of vendors would be helpful. If it is an independent IEEE or USDOT endorsed. Skeptical if that could be comprised of a Vendor group. Test climate, environment, functionality prescribed in standards. Same as signal controllers. Standards based interoperability testing. It is expected to plug and go. How good is it? Rugged, hardened, etc.

Category	Questions	Responses
		I do not know. An assurance by the USDOT that they have convinced themselves that the devices on their approved products lists are interoperable would be what I would be looking for. Besides the equipment, I would want some assurance that software applications offered for sale by vendors will operate properly with other software and with the hardware. Not sure at this time Pilot demonstrations helpful. If there was a 3rd party organization such as UL. Reputation, credibility, impartiality, and financial independence of such an organization is critical. Functional testing, environmental testing, and interoperability testing would all be beneficial. Our agency currently considers independent third party testing in the evaluation and certification of ITS equipment and other traffic control devices. We also expect to use our test bed as a production system that will help load testing of devices.
Requirements and Regulation		
14.	What restrictions, if any, do your organizational policies and laws place on purchasing devices used	Procurement rules must be followed. Often determined by volume. If it is consistently and frequently used then APL/QPL is desirable.

Category	Questions	Responses
	within your transportation system?	Purchasing rules, including a qualified vendors list. Purchasing rules. Should integrate with existing system. For instance, if CV equipment requires change to controller or other legacy. Typical purchasing requirements and rules. Statewide specifications govern and possible rules associated with getting on APL. Anything over 15,000 needs to be bid. Mostly policies and laws designed to ensure open competition and fair prices. Not much related to certifications. This is too broad of a question to respond to. We, as well as the State have many laws and policies that apply to purchasing Standard procurement rules and competitive bidding with functional requirements. At this time, it purchasing is probably more restricted by procurement policy than technical policy. Our agency has purchasing and procurement rules. In

Category	Questions	Responses
		addition, devices used within the transportation system are often required to meet our published statewide Specifications and be listed on the Approved Product List (APL).
15.	What restrictions, if any, do your organizational policies and laws place on purchasing devices certified by a third party?	None. Restrictions written into RFP. Purchasing rules. None; up to technical group to accept Our agency prefers competitive bidding. Currently buy parts that are 3rd party certified and look for specific standards like UL. Unaware of any restrictive provisions. There is no general policy or law related to 3rd party certification. This would be determined on a case by case by the agency for the particular procurement at hand. Unknown. None. Third party certifications and test results are often accepted to verify or confirm that a product functions as required.

Category	Questions	Responses
16.	Would your organization consider paying fees to third parties to perform testing on your behalf?	Unlikely. It is more typical for the cost of testing to be handled by the product manufacturer and reflected in the cost of the product. Unsure. Depends on the price. We do that already. For instance consultant evaluations and/or University partnerships. Yes. Yes, but depends on structure. Would prefer it not be direct payment, etc. Either federally handled or fees, etc. paid by vendors. In the near term as the industry is still immature it may be necessary. In the long term we should not pay for it directly. We do not pay directly for UL listing or other common certifications today. Not known at this time May pay for testing as component of pilot projects, etc. but unlikely. Unlikely that it would be done directly. However, our

Category	Questions	Responses
		agency does pay fees for services (for instance, for consultants to perform testing activities). We also perform internal product evaluations (for listing devices on the APL and QPL). In addition, we regularly sponsor university research that may include some degree of testing. For products and devices, the responsibility to provide 3rd party test results and evidence of compliance with requirements is often placed on manufacturers that submit products for APL/QPL consideration.
17.	Would your organization pay fees to access independent test results performed on connected vehicle equipment, applications, or services?	No. The end result is important (device is certified), not necessarily the test data. Possibly. University partners may be paid for testing services to approve products. We would accept the results of partner testing. Uncertain at this point. Prefer that USDOT lead effort to that level of detail. For instance, routers, switches, etc. are trusted given the UL mark. If USDOT says it conforms to the standard, the manufacturer certifies that it does, and there is evidence, then that would be sufficient. Uncertain but possible. Product Certification Mark would likely be sufficient. The detailed test data is probably not necessary and we likely do not have internal resources that the data

Category	Questions	Responses
		would make sense. We may require independent test results but would hope we would not have to pay for it. We require 3rd party test results for traffic signal controllers and LED signal indications, but we do not pay for it. Usually the manufacturer gets the testing done for a specific model of their device and uses the same test results for all the customers. Not known at this time. Yes, if appropriate. For instance, we contract with firms for security screenings. Seems to make fiscal sense that if a group had test data available for a fee that it could be purchased and reviewed rather than starting from scratch. Unlikely, though we typically require equipment manufacturers to provide such results as part of product evaluations for APL/QPL listing.
18.	What agreements would be required to allow other agencies with Connected Vehicle devices to interface with your organization's Connected Vehicle devices?	To be determined. Uncertain of exact agreement, but would likely necessitate some sort of MOU or equivalent to establish and understanding of need, use, etc. Our DOT does not have internal attorneys/general counsel. Attorney General's office provides legal services.

Category	Questions	Responses
		Leverage guidelines for agreements. We have an operations partnership that helps us establish regional partnerships and data exchange agreements, etc. Permits for encroachment, installation, etc. Data sharing agreements. Service level agreement. No particular model. Development and additional thought necessary for future. Uncertain at this point. There needs to be agreement on a number of points. National uniformity is critical and conformance to standards and certification is buy-in evidence of that agreement. The question is too general to give a specific answer. It would depend upon the specific application. Not known at this time Not applicable. Contribution agreements exist for certain things. Our organization would encourage/facilitate users, but most likely not actually execute agreements. Our organization commonly executes MOUs and other

Category	Questions	Responses
		agreements for data sharing, system connections, maintenance, etc. Suspect that Connected Vehicle systems and data could follow existing agreement models. Our organization has a legal department that would likely be involved with such.
19.	Does your organization produce or use a statewide Qualified Products List or equivalent?	QPL Yes. Yes. Yes. Yes. We do for certain items. Yes. Yes. Maintain a number of prequalified list, but probably not applicable to CV at this time. Provinces and municipalities. Yes.

Category	Questions	Responses
20.	What are your organization's processes and procedures for listing equipment on a Qualified Products List or equivalent?	See online. See VDOT QPL website, etc. See online. MAG standards in RFP and vendors are qualified per contract. See online. Lab under Traffic Operations, Electrical. Check website. n/a http://www.dot.state.mn.us/products/index.html n/a Would likely encourage groups of stakeholders to develop/agree upon such a list for CV, but it would most likely by implemented/executed by others. The process is documented online. For the APL, it involves a 3-step submittal process. http://www.dot.state.fl.us/trafficoperations/Traf_Sys/terl/apl2.shtm

Category	Questions	Responses
21.	Does your organization require vendors to pay a fee to have their product tested for the Qualified Products List?	No. See VDOT QPL website, etc. N/A Do not believe so. Check website. No. It depends, and we may expect the vendor to provide products for evaluation at no cost N/A No.
22.	How would a new technology (i.e., Connected Vehicle) become part of your organization's overall qualified products program?	Likely if there were dozens/hundreds TBD N/A

Category	Questions	Responses
		Hope that someone else is putting up RSEs, but uncertain that there is a business model that supports it. We should be SpaT info providers that provide access to controller information, but not necessarily own and operate the RSE. Perhaps a model similar to what is done with certain red-light enforcement systems. We give them access to determine signal state, but they handle everything else. Yes. It is another traffic management device and should be on QPLs that govern controllers, signals, etc. We would have to determine that it is an appropriate item to have on an approved products list versus specifying it in detail in construction project. Then we would need to develop a specification that vendors would need to meet to get on the list. We would post the specs and the process on our website. We would evaluate the products of vendors that request to get on the list. We sometimes grant provisional approval such that we allow the vendor to try to get contractors to use their device on our projects for some limited amount of time. Following provisional deployments we will determine if they are fully approved to be on the list. Not known at this time N/A

Category	Questions	Responses
		It is likely that Connected Vehicle equipment, particularly devices resident in roadside cabinets would be considered and evaluated for listing on the APL.
23.	If your organization plans to include Connected Vehicle devices as part of your organization's qualified products program, would your organization request additional budget or would this fall under your organization's current budget?	Falls under current process. TBD N/A If we did, we would likely ask for budget change and end up with unfunded mandate. It is unlikely we will get new money. Not known at this time N/A Uncertain, though additional budget to perform the additional work required would certainly be desirable and helpful with resource allocation. We currently have a full workload to evaluate APL products. If Connected Vehicle devices are to be added as a priority, then additional funding would be desired.

Category	Questions	Responses
24.	Does your organization plan to develop or already have requirements or specifications for Connected Vehicle devices? If not, what would your first Point of Contact be to develop your organization's requirements or specifications for CV devices?	Yes. Through following existing federal requirements and adoption. #1 requirement is interoperability. Project specifications done for existing projects. No current specifications. Desire is to use requirements established through pooled-fund study and AASHTO, etc. and then adopt those standards Procurements and specifications to date were more for research purposes. Future requirements would likely be included in a supplement. Depends on which way they go. If they are responsible for RSE then yes, would try and use National standards, but would likely write their own because that is what they traditionally do. Highly dependent on business model. No. Prefer that be nationally directed, promoted. Technology and products are not mature enough at this point to tell how things We do not currently have specifications for these devices. Because the devices are still basically in an experimental stage, we would only be developing specs as part of a pilot test project, and would probably have our contractor develop the specs.

Category	Questions	Responses
		No Yes. Our organization would work with local and regional operators to establish a minimum common functional specification for national use. A North American Specification, or perhaps global specification, makes sense in the CV context. We are currently in the preliminary stage of developing procurement documents for RSEs. If deployment and use of Connected Vehicle equipment expands, we would likely take action to develop statewide specifications for Connected Vehicle roadside equipment. Our office would almost certainly be the POC for requirements and specifications for Connected Vehicle devices use in our state.
25.	Would your organization consider becoming a third party certification house for Connected Vehicle devices?	Extremely unlikely. Unfunded. Probably not due to resources (staff/facilities). However, University partners may have interest. Do not believe that this is our role. No No

Category	Questions	Responses
		No Not known at this time Probably Not Yes. It would depend upon coordination with USDOT's existing effort, the business case, and cost/benefit.
26.	Would your organization consider and be able to perform in-house testing and pay fees (initial and recurring) to become an accredited Connected Vehicle test facility?	Extremely unlikely. Probably Not N/A No N/A No Not known at this time

Category	Questions	Responses
		Possibly on a very limited basis. We would likely consider and be able to perform in-house testing to some level. It is uncertain whether we would be willing to pay fees for accreditation. However, paying fees for accreditation is not unprecedented.
27.	What acceptance criteria does your organization generally consider for electronics (such as modems or Ethernet switches) used on roadway projects and signalized intersections?	Requirements developed through past projects or federal program requirements. Handful of types. Minimum specifications statewide would likely cover RSEs. Particularly about the ruggedness. To be determined. UL and internal testing. Case by case depending on product. NEMA. Typically manufacturer self certification. Often gravitate towards field proven. We do not have standard acceptance criteria. For traffic signal equipment we sometimes use an environmental chamber and test equipment to test samples of the equipment to verify it is good. This is not certification however. Varies depending on the device and its application

Category	Questions	Responses
		N/A We publish statewide specifications that contain minimum requirements for Ethernet switches and other electronics used on roadway projects. We consider a variety of acceptance criteria in order to evaluate and list such devices on the APL.
Legal Responsibilities		
28.	Are there concerns within your organization regarding liability issues that might be associated with CV? If so, please explain.	Same as other concerns nationally re: conceptual issues with data privacy, etc. Crash avoidance and other applications likely will elevate issues. To some degree, similar discussions re: CCTV and privacy Awareness is probably limited due to newness of technology. Early adoption and deployment will likely be focused on the "less controversial" applications. In-house fleets and other participants that are viewed "low-risk" likely. Start with own fleet and move toward public acceptance Yes. That is why it would be good to have MUTCD content or other national guidance. For example – accident at non-signalized intersection. Lawyer says sign was not good. Operators are protected by national standards for sign design, etc. to mitigate liability.

Category	Questions	Responses
		Yes. For instance, what happens if SPaT for warning/collision avoidance malfunctions and results in injury? We would ideally like to minimize liability. Just the lawyers. Anything of this nature will have legal and liability issues, but that alone is not the reason not to do something. Just need protection and appropriate legislation, etc. Certainly no more liability than a signal, stop sign, etc. Yes. Some of these are safety critical systems. Even though it is OK to have a traffic signal without an RSE, if we do have an RSE there may be expectation that we keep it functional. This may end up making this to be a very high priority maintenance item, delaying completion of other maintenance needs. Anything that connects to a traffic signal control cabinet is a potential liability concern. Yes, liability is always a concern particularly if we are deploying life/safety systems such as traffic signals Yes. Absolutely from a Road safety perspective. It needs to be explored. Involves regulatory mandate, like NHTSA – equipment in vehicles is often federally mandated. For instance, Feds mandate seatbelts in vehicles, States enforce use.

Category	Questions	Responses
		Yes, somewhat. Liability is always a concern for any DOT or system operator. That is why it is good to have national guidance on how enabling technologies or methods are implemented. For instance, the MUTCD has content for national guidance on many items. National standards often afford a degree of protection by helping define best practices.
29.	Is your organization interested in investigating liabilities associated with implementing, deploying, or certifying CV programs?	In due time. Somewhat in process. Watching Fed activities in this area closely. For instance, USDOT governance round table discussion with privacy and governance issues. More such activities would be beneficial. Federal guidelines, etc. may be helpful for consistency. Different levels of liabilities and acknowledgement required for different applications. Example: CVO has and needs private information. Would prefer to see USDOT champion these issues. Believes this is an appropriate role for the USDOT. Yes. Liability is important to any public agency. Very interested. Yes. Will be vetted through deployment, best practice, etc. and knowledge sharing from groups and agencies directly involved. For CV to become an operational system rather than

Category	Questions	Responses
		research, we would need to investigate liabilities. At this point it is all research. It is probably too early for this. Yes. Yes. Our organization likely has established protections for certain liability, but it would be good to know how it may be applied to Connected Vehicle and other new technologies, programs, etc.
30.	Does your organization have existing laws that apply to device certification?	No. To be determined. Mostly governed by standards. Uncertain. Check website. No. We are required to have a listing by a nationally recognized testing laboratory, such as UL, for electrical equipment. That is about it.

Category	Questions	Responses
		We do not have laws as an organization, the State has laws and we also follow federal laws. I do not know any current relationship to device certification. Yes, although specifics are uncertain. Yes.
31.	Will your organization be willing to accept responsibility for devices that are certified by your organization?	Do not plan to certify. Uncertain. N/A. Yes. N/A. In the near term, while the devices are experimental, we would probably need to have our contractor make sure everything works. In the long term, the industry should make sure everything works. We are routinely responsible for accepting traffic signal control equipment and other devices based upon our own inspection, etc. We would not call that certification,

Category	Questions	Responses
		but rather acceptance. Not known at this time. To be determined. Certification and listing on the APL does not relieve the manufacturer of responsibility. It is unlikely that our state would ever accept such responsibility.
32.	Has your organization been authorized by the FCC to operate 5.9 GHZ equipment associated with Connected Vehicle systems?	Yes Uncertain. No at this time. Yes; office of radio communications handles statewide. Uncertain. Assume that someone has coordinated and obtained this for the Federal test beds. Uncertain.

Category	Questions	Responses
		Yes. Yes. 5.9 has been set aside, but no licensees known at this time. Yes.
33.	Is your organization familiar with the process of obtaining authorization from the FCC to utilize the 5.9 GHZ band?	Yes. Uncertain. Somewhat. Yes. Have office of radio telecommunication that handles FCC licensure issues, etc. Not intimately familiar. We could figure it out. We have an internal office representative for granting use of spectrum for public safety. They would know how to obtain the necessary authority. We have license for the frequency.

Category	Questions	Responses
		Yes, but details to be determined. Yes.
34.	Would your organization require assistance in obtaining authorization from the FCC to utilize the 5.9 GHZ band?	No. Uncertain. Yes. Not necessary. Yes. No. N/A. Yes, particularly in border regions. No.
Connected Vehicle Network Design, Deployment, and		

Category	Questions	Responses
Security		
35.	What Security Certificate requirements has your organization implemented for IT networks?	Following best practice. All ITS networks are closed networks and require security. Security of networks is typically handled/ administered regionally. We generate our own. Uncertain. Uncertain. Uncertain. We have requirements, though I am not familiar with the details. IT group looks after this based upon best practice. Network security generally follows established best practices based on the specifics of the network and data in question.

Category	Questions	Responses
36.	What Security Certificate requirements is your organization planning for IT networks?	Following best practice. Uncertain. Following best practice. Uncertain. Uncertain. Uncertain. We have requirements, though I am not familiar with them. Uncertain. Uncertain.
37.	Does your organization currently operate IPv6 networks?	Ability, but not yet. Yes. Mostly in the core.

Category	Questions	Responses
		Uncertain. Uncertain. Uncertain. Uncertain. Few, if at all. Other than a handful of specialty applications, we primarily operate IPv4 networks.
38.	Has your organization determined who will be primarily responsible for architecting and designing CV data networks and access points (RSEs)?	Yes, follow typical ITS Program process same as any other ITS devices. Central Operations & Security Division plus installing contractors. In-house forces or contractors under the direction of the Traffic Management Division. No. Hopeful that there will be a business model that makes it attractive to others.

Category	Questions	Responses
		We want list or QPL that gives locals comfort in selecting equipment that has been certified and vetted. They will most likely be responsible and a list of such equipment would help product selection, etc. No. It is too early to consider this. To be determined. Deployment will likely be done by the Traffic Operations/ITS program through contractors, and potentially in-house personnel.
39.	Has your organization determined who will be primarily responsible for the deployment of DSRC RSE devices?	Yes, follow typical ITS Program process same as any other ITS devices. Central Operations & Security Division plus installing contractors. In-house forces or contractors under the direction of the Traffic Management Division. No. Hopeful that there will be a business model that makes it attractive to others.

Category	Questions	Responses
		No. It is too early to consider this. To be determined. Deployment will likely be done by the Traffic Operations/ITS program through contractors, and potentially in-house personnel.
40.	Has your organization considered how you plan to handle network and data security in DSRC systems?	Yes. Following best practice, but still work in progress given infancy of system. Plan established. Yes. Ongoing research to identify need, understand intricacies, and deployment ramifications. If we are responsible, then we will adopt best practice and established standards Too early to tell. Hopefully it will not require huge technical burden on the part of those responsible for deployment and operation.

Category	Questions	Responses
		My understanding is that how to do security with DSRC is still being debated. I assume we would follow whatever system is agreed upon at the national level. It is too early to consider this. To be determined. Yes, it has been considered but is not mature. Additional work in this area is necessary and it seems too early to tell exactly how this will be handled in mature deployments using stable products.
41.	As part of the device certification process, would your organization generate a security certificate or expect to obtain a certificate from a third party?	Yes. Global security certificate may be desirable. Expect 3rd party to verify. Uncertain. Depends on technical details and need. Testing should be done on closed system before coming on open system Uncertain. Uncertain. Prefer not to be in the business of generating certifications. We would expect 3rd parties to provide

Category	Questions	Responses
		Too early to tell. Hopefully it will not require huge technical burden . Too soon to know. Not known at this time. To be determined. Uncertain.
42.	If your organization has devices certified by a third party, would you organization expect to receive a security certificate as part of the certification process?	Yes. Uncertain. Security area needs work and vetting out realities. Uncertain. Uncertain. Security area needs work and vetting out realities. Too early to tell. Too soon to know.

Category	Questions	Responses
		Not known at this time. To be determined. Uncertain.
Technical		
43.	Does your organization consider Connected Vehicle devices and products that are used as part of a traffic control system to be traffic control devices?	Yes. To be determined. Yes. No, but it is difficult to say. However, the MUTCD would clearly establish things considered as traffic control devices. Absolutely part of our traffic control system, not necessarily a traffic control device. If they become part of a traffic control system they would be traffic control devices.

Category	Questions	Responses
		Probably. Yes. This is where we see the future of traffic control moving – integrated systems. Yes.
44.	Does your organization consider certifications or approvals when selecting products for use in your organization's communications systems such as UL, Wifi, etc.	Yes. Yes, certifications and approvals are important to ensure products operate as required. Helps establish that technology is proven and vetted. Yes. Yes. Yes. The law requires listing for electrical equipment by a nationally recognized testing lab, such as UL. This does not apply to plug-in devices, only to hardwired electrical equipment. For things like WiFi, we just assume the manufacture has it covered.

Category	Questions	Responses
		Yes. Not applicable. More likely the role of consultants, etc. Yes.
45.	If your organization has a testing laboratory/facility, how large is it? Is it indoor, outdoor or both?	Yes, but more associated with materials (concrete, asphalt, etc.). Yes. Local university has lab. University staff only. Also have a small lab (radio lab) as part of state maintenance office. Approximately 3 miles with 6 intersection. Yes. Both. 80 acre campus that does material testing, electronics testing, etc No. We have a testing facility for testing materials for road construction, such as concrete cores or rebar, etc. We also have a pavement testing facility with various pavement test sections and a bypass, as well as a 2 mile closed loop test track for testing pavement on low volume roads. We do not have a lab specifically

Category	Questions	Responses
		for testing electronic equipment. We test traffic signal control equipment at our signal maintenance shop. Yes, we do both indoor and outdoor testing, mostly focused on construction materials. We also do electronics testing in our regional Signal Shops Yes. Indoor and outdoor test facilities. Contractor operated, agency owned. Also have communication research center campus that specializes in military/commercial wireless, etc. Yes. Our state has multiple testing facilities, including indoor and outdoor areas including intersections, a test tracks, small roads, and outdoor fields.
46.	Does your testing facility include a test track or area that will accommodate vehicles drive tests?	N/A. Yes. It is an active roadway. Otherwise, mostly indoor facilities. We have a signalized intersection. N/A.

Category	Questions	Responses
		It could. No. Yes. Yes.
47.	Is your organization's facility capable of being certified to avoid interference with government and other proprietary frequencies?	N/A. Uncertain. Uncertain. Yes. N/A. Uncertain. Yes, but doing would depend on the level of effort required and the benefit of doing so.

Category	Questions	Responses
		Yes. Uncertain, but probably.
48.	Would your organization plan to purchase a Connected Vehicle device such as Roadside Equipment from a single vendor or multiple vendors?	Prefer multiple viable for competition, etc. Uncertain. Uncertain. Multiple preferred for competition. Would like to see one, but the reality will be multiple. It depends on if there are multiple vendors that provide what we need. If more than one vendor can provide what we need, multiple vendors is better. Uncertain. For long-term, competitive solicitation is likely preferred. However, for pilots and other preliminary deployments a single vendor may be preferable.

Category	Questions	Responses
		Our organization prefers competitive solicitations based on standard requirements. Therefore, it is likely that we will ultimately purchase RSEs from multiple vendors, though individual deployments may use devices from a single vendor.
49.	Does your organization plan to purchase in-vehicle devices such as Vehicle Awareness Devices and Onboard Equipment for use in fleet vehicles?	Possibly. Need additional information regarding value and benefits. Too early to tell. Traction control status for road conditions may be of future benefit, but may not be available due to proprietary aspects of vehicle OBD designs. Going to have to be a change in OEMs position on what data they will provide off the bus. Would purchase devices and install if the cost benefit ratio is there. Yes. Currently already have in certain fleet vehicles. Uncertain. Currently considering use in research vehicles (transit, commercial, and other test vehicles). Broader distribution uncertain. Have OBEs for testing. Have vehicles that were donated. Plan to install limited OBEs for research only. Yes – only if we ever buy another vehicle. Not at this time. There needs to be a reason to do so,

Category	Questions	Responses
		an application that will provide value immediately. We already have substantial deployment of some types of this equipment in our maintenance fleet. Possibly, particularly with pilot projects. For instance, a pilot Ecofleet has been done in the past for alternative fuel experimental fleets. Limited purchase of in-vehicle devices is likely to support Connected Vehicle pilot projects and operational evaluations.
50.	Would your organization purchase in-vehicle devices such as Vehicle Awareness Devices and Onboard Equipment for use by other agencies or for distribution to public volunteers?	Yes. Maybe for other Agencies. Uncertain for volunteers. Possibly. Prefer the other agency or entity purchase. Primarily for research and in limited quantity. Only as part of research or testing. As part of our IntelliDrive for Safety, Mobility and User Fees project, we have 150 volunteers with smart phones with special software, and will have a total of

Category	Questions	Responses
		500 when the project is complete. Only about 5 of these will have DSRC, which will work with the CICAS-SSA system which is already operational in the field. We purchased these through the contractor who is responsible for building the whole system for the test project. Unlikely unless it was part of a demonstration type of project. Absolutely yes. Very likely could be a component of various projects. Possibly, but unlikely. Would prefer the other agency or entity purchase.
51.	Would your organization plan to purchase Vehicle Awareness Devices and Onboard Equipment from a single vendor or multiple vendors for a statewide deployment?	Prefer multiple viable for competition. Statewide deployment unlikely. Single vs. multiple depends on project needs, etc. For instance, statewide backbone is single vendor, but other devices (such as layer2 switches, etc.) are typical multiple. Competitive solicitation. Multiple.

Category	Questions	Responses
		Multiple. If CV becomes an actual operational system rather than research, we would want multiple vendors if we were going to do a statewide deployment. Uncertain. If it is COTS equipment and claimed to be interoperable, then preference towards multiple. If it involves more customization and development, then a single vendor is likely preferred. Competitive solicitation.
52.	How would your organization verify interoperability of other agencies Connected Vehicle devices with your organization's Connected Vehicle devices? Would this even be an issue for your organization?	Hopeful that certification process to national standards will solve this issue. Definitely an issue. Uncertain of the "how", but interoperability is key. Ensuring standards and certification of devices is a large piece of the need. Everyone needs to be moving forward in the same path and working with the USDOT program to help mesh all participants. Great issue, but hope to test, exchange applications

Category	Questions	Responses
		Some degree of in-house verification. Certification would likely help address the concern. Everyone in the "system" needs to be consistent and interoperable. Certification would assist that. Whatever project installed devices requiring interoperability with another system would require the contractor to ensure it did interoperate. Uncertain. It is an issue, but we would likely facilitate. Actual inter-jurisdictional interoperability checks would likely be the responsibility of the owner/operator. 511 model, for instance. Operational testing (system acceptance testing) would likely be required on any project and would be a last step to ensure interoperability and proper function. However, steps along the way, such as an independent certification of interoperability or a successful APL evaluation, etc. would also establish confidence in device interoperability.

PART II – SUMMARY SURVEY QUESTIONS DERIVED FROM ORIGINAL QUESTIONNAIRE

The following table includes the survey questions that appeared to capture the essence of the wide variety of topics covered during the initial interviews. The project team feels that these questions are the most appropriate for creating a summary survey instrument that can be provided to additional agencies to gain further information about their needs and opinions on Cooperative System/Connected Vehicle Certification.

Question Number	Survey Question	Possible Responses
1	Does your organization have plans to deploy Connected Vehicle infrastructure or projects?	Yes/No
2	How important is it that Connected Vehicle devices be interoperable and conformant to established standards?	Scale from Not Important to Absolutely Critical
3	Would your organization prefer to perform in-house evaluation or certification of Connected Vehicle devices or would you prefer that they are certified interoperable and conformant to national standards by an independent 3rd party?	Pick from: In-house, 3rd Party, or Combination of Both.
4	Would a certification program based on national/international standards help establish your confidence that Connected Vehicle equipment from one vendor is interoperable and interchangeable with similar equipment from others?	Yes/No
5	Would you prefer that the USDOT establish a single certification program for Connected Vehicle technology or leave certification to others (such as States or Device Manufacturers)?	Pick from USDOT or Others
6	Does your organization produce or use a Qualified Products List or equivalent for products associated with your transportation systems?	Yes/No
7	Does your organization prefer to develop your own specifications for Connected Vehicle devices or adopt specifications for Connected Vehicle devices to use in contract documents for construction, procurement, etc.?	Scale from Prefer to develop specifications completely in-house to prefer to adopt specifications produced by others.
8	Is your organization interested in investigating liabilities associated with implementing, deploying, or certifying CV programs?	Yes/No

Question Number	Survey Question	Possible Responses
9	Has your organization been authorized by the FCC to operate 5.9 GHZ equipment associated with Connected Vehicle systems?	Yes/No
10	Has your organization determined who will be primarily responsible for architecting and designing CV data networks and access points (RSEs) within your jurisdiction?	Scale from in-house staff/consultants to outside 3rd parties.
11	Do product certifications or approvals such as WiFi, UL, FCC, CE, or others influence your selection of products?	Scale from “Has no influence” to “Has significant influence”

PART III – OBSERVATIONS AND PRELIMINARY ANALYSIS

During the course of interviewing and organizing the responses, some observations were made pertaining to how the agencies viewed certain areas of the connected vehicle program and device certification. In-depth analysis is the scope of Task 4 of this project, however, this task provided an opportunity for preliminary analysis. As the responses were being organized, some trends were identified. These trends were of two types; common and variability. On many items, the agencies were all in agreement while on other items the agencies had wide ranging opinions.

One of the strongest trends identified was that the agencies felt that the USDOT had to be directly involved in certain key areas of the certification process. The agencies felt that the USDOT had to provide leadership and guidance for interoperability testing. The USDOT did not have to perform the testing, but rather should provide (develop or endorse) the standards against which other entities would perform certification testing. The agencies felt that there did not need to be a single certification entity, but there had to be a single point of contact for overseeing the testing program. The majority of the agencies were not interested in developing standards, test procedures, or performing certification testing. The agencies felt that was the role of the USDOT and any certification bodies that the USDOT used. If a national rollout of connected vehicle technology is going to be successful, the USDOT must provide the foundation for certification testing such that a manufacturer's device will operate properly regardless of where it may be deployed in the US. Most agencies agreed that if they purchased connected vehicle devices from the USDOT preferred vendors that they would expect the devices to already be guaranteed interoperable. A few would perform additional testing by selecting random units from different vendors and performing their own in house tests. The agencies are expecting that a third party under USDOT direction will perform the interoperability testing.

Many agencies already have, or have plans to, deploy connected vehicle technology. Many agencies referred to having test beds either in-use or in development. Signal Phasing and Timing (SPaT), in vehicle device, and data gathering are examples of the types of technologies and applications that are being investigated. The agencies are using passenger vehicles and commercial vehicles in their testing and some are considering deploying the technology on fleets such as snowplows and other maintenance vehicles.

These agencies vary in their responsibilities for managing roadways. Some primarily manage expressways while others manage arterials and a few manage both. When looking at traffic management operations, the agencies area all involved in some level of traffic management ranging from signal systems to 511, tolling transit and commercial vehicles. These agencies plan to incorporate connected vehicle technology into mainstream traffic management

operations at some point. However, their adoption of connected vehicle technology depends greatly on how these systems mature and perform in the relatively near future. Interoperability of the in-vehicle devices is crucial to agencies being able collect, process, and use data from in vehicle devices. Agencies are looking at ways to use the data to improve operations and provide data to the vehicles so that drivers can make informed decisions regarding routing and environmental factors as well as other potential in vehicle applications. Again, interoperability is the key for traffic management centers to communicate information to all in vehicle devices no matter where the location of the device.

Many of the agencies had differing ideas on how interoperability among the in vehicle and roadside devices should be achieved. Some believed that had a single third party certification agency would be sufficient. Other agencies felt that continued research and testing of the devices through pilot programs and model deployments such as the ongoing Safety Pilot model deployment are necessary to ensure that long term viability of device interoperability. Agencies had concerns over devices being backwards compatible and continued interoperability as newer versions of the devices are released. This is a big concern because technology is turning over at a much faster rate than vehicle fleets. Therefore, it is reasonable to assume that multiple versions of a product could be deployed and then added complexity introduced by having multiple vendors providing those products. In such cases, backwards compatibility as well as interoperability is crucial to the long term success of such connected vehicle systems.