March 2, 2020

Ms. Marlene Dortch
Secretary, Federal Communications Commission
445 12th Street SW
Washington, DC 20554


Dear Ms. Dortch

The American Association of State Highway and Transportation Officials (AASHTO) is pleased to provide comments on the Federal Communication Commission’s (FCC) “Use of the 5.850-5.929 GHz Band” (ET Docket No. 19-138, FCC Docket No. 19-129), issued on February 6, 2020. Representing all 50 states, the District of Columbia, and Puerto Rico, AASHTO serves as a liaison between state Departments of Transportation and the federal government.

AASHTO and its members have been at the forefront of the development and deployment of connected and automated vehicles that have tremendous potential in significantly improving the safety of our surface transportation system as well as the mobility and accessibility for people. Paramount to the state DOTs is both eliminating the nearly 37,000 fatal vehicle crashes which occur on our roadways each year as well as the safe deployment of connected and automated vehicles. Without the full 5.9 GHz spectrum available to use for connected vehicle technologies it will be significantly more difficult to eliminate these fatal vehicle crashes.

In addition to the safety benefits of connected vehicle technologies, there are economic benefits as well. If the proposed reallocation occurs, the United States’ competitive edge in the development of connected vehicle technologies will be set back while Europe and Asia surge forward. Our goal as a nation should be to lead the world in advancing transportation technology for efficient and safe freight and passenger transportation. While depleting the spectrum for unlicensed purposes may have a short-term economic benefit for the telecom companies, it would absolutely set the US back by allowing other countries to bypass us and develop more advanced transportation technology systems, crippling our standing in the world economy.

To put it succinctly, AASHTO believes that the FCC proposal to permit unlicensed devices to operate in the lower 45-megahertz portion of the band at 5.850-5.895 GHz leaving ITS operations in the upper 30-megahertz portion of the band at 5.895-5.925 GHz is wrong and misguided. The FCC should continue to allocate the entire 5.850-5.925 GHz band for ITS
purposes in order to further enable the deployment of connected and automated vehicles that will ultimately save lives and improve mobility.

AASHTO echoes the letters sent by Secretary Elaine Chao to Chairman Pai and by House Transportation and Infrastructure Committee Chairman DeFazio and Ranking Member Graves to the FCC Commissioners stating their opposition to the FCC’s proposed reallocation of the 5.9 GHz spectrum as well as the Preliminary Technical Assessment prepared by the US Department of Transportation\(^1\). Both letters brought up serious concerns and issues and AASHTO agrees wholeheartedly that the NPRM will create a substantial shift in the direction of using the 5.9 GHz and is insufficiently grounded using limited and selected data and information.

AASHTO’s comments on specific aspects of the NPRM are provided in the following sections. First, we provide some overarching concerns and issues that have been raised by our members. Second, we provide examples and information on the impact to the State DOTs that will result if the NPRM were to move forward. Finally, we provide a detailed response to selected questions asked by the FCC in the NPRM.

AASHTO appreciates the opportunity to provide these comments on the flawed and misguided changes proposed in the notice published by the FCC. We look forward to working with our partners at the USDOT, other associations, and private sector on the further development and deployment of the life-saving technologies that will be enabled by keeping the 5.9 GHz spectrum dedicated for transportation purposes. If you would like to discuss the issues raised in this letter, please contact Matthew Hardy, Ph.D., AASHTO’s Program Director for Planning and Performance Management at (202) 624-3625.

Sincerely,

Patrick K. McKenna
President, American Association of State Highway and Transportation Officials
Director, Missouri Department of Transportation

SECTION 1: OVERARCHING CONCERNS AND ISSUES

1. Preservation of the Entire 5.850 to 5.925 GHz Band for Transportation Applications
AASHTO strongly recommends that the entire 5.850 to 5.925 GHz Safety Band allocated by the FCC in 2003 for Intelligent Transportation Systems (ITS) be preserved for that purpose with no reallocation. Our values and objectives have not changed since that original allocation. Applications and infrastructure using that band are now rapidly being deployed across the country. Any change to that ruling will create uncertainty, slow progress, and put future safety and mobility improvements at risk.

As expressed in the 2003 ruling, the 5.9 GHz band ITS allocation has always been intended to provide communications in support of transportation safety goals. Recent advances in vehicular safety features and transportation system management and operations have been successful only in keeping fatalities at a constant annual rate in the face of increasing travel demand. Further reductions in the Toward Zero Deaths efforts will require dedicated bandwidth for vehicle-to-everything (V2X) communications. These safety improvements also improve societal mobility by reducing the impact of crashes and other incidents on traffic flow. Advances in transportation system management and operations have demonstrated additional mobility improvements from availability of dedicated real-time communications between vehicles and roadside infrastructure.

Although not explicitly addressed in the allocating rule, AASHTO and the transportation industry also recognizes that the 5.9 GHz band and the technologies deployed could also mitigate many other costs associated with the transportation system:

- Mitigating the $250 billion in direct costs due to vehicles crashes and the $800 billion in societal costs associated with these crashes;
- Improving the $10 trillion value of goods shipped by truck each and every year;
- Reducing 8.8 billion hours of delay experienced by system users each year, representing a $166 billion cost; and
- Reducing the 3.3 billion gallons of fuel wasted each year in congestion resulting in more greenhouse gas emissions from vehicles.

2. Implications of Reducing Spectrum on Full Technology Deployment
The draft NPRM presents a dramatic shift in the current rules and the spectrum allocation for transportation use; a loss of 45 MHz of the existing 75 MHz allocation for transportation safety—limiting transportation to 20-30 MHz of spectrum that may or may not be useable based on known adjacent channel interference issues—a fact the FCC has failed to address. In fact, it may reasonably be expected that the shift defers accident reduction for another five to ten years, given time to develop, standardize, and deploy equipment—either existing concepts in different spectrum or new concepts in existing spectrum.
The implications are significant. First, the transportation industry has begun to focus on a more fully cooperative automated transportation (CAT) system which has advanced from the original understanding and frequency allocation of the existing spectrum allocation. This reduction in bandwidth will likely curtail these new connected autonomous applications, at the point in time when these and other important innovations—edge computing, machine-to-machine, and artificial intelligence are just beginning to emerge for transportation purposes. Reducing the bandwidth dedicated to transportation applications per the FCC proposal may indeed put the US at a competitive disadvantage relative to other nations in the race for AV/CAT development. As such, we believe that the burden of proof is on the FCC to demonstrate that transportation objectives are not negatively impacted by the reallocation of 45 MHz for unspecified applications in unlicensed spectrum.

Second, state DOTs who have actively pursued pilot and long-term deployments will be forced to reassess “what is possible” under a new environment. Agencies who may have already delayed plans because of the regulatory uncertainty, or were just getting ready to invest, will need to reexamine whether to move out of the starting blocks. And potential automotive and private sector partners may disappear in a constricted spectrum scenario, which could shift the burden of development costs more onto the state DOTs.

Finally, there are many different secondary impacts such as:

- **Jeopardizes Planned Funding**—Several states have programmed funds within the next five years for CV deployment, and others have been awarded federal money through congressionally supported grant programs. These allocations may not be able to be deferred, and an opportunity to advance deployment will be lost.
- **Taxpayer-Funded Projects Will Require Updates**—Many state DOTs have engaged in pilot projects and long-term deployment of CV technology based on the current rules governing the 5.9 GHz spectrum. While the lessons learned from these deployments can’t be taken away, and a portion of the infrastructure installed will remain useful, there likely would be changes required to hardware, software, and to the overall objectives of deployments - funding for which is not allocated anywhere.
- **Deployment Momentum Will Be Lost**—A decade of effort will need to be evaluated and possibly repeated as state DOTs and the private sector come to grips with channel realignment, new standards development, retooled device development, and re-launched proof of concept projects.

3. **Premature and Flawed Band Allocation**
   AASHTO fully recognizes that communications technology is ever evolving, and welcomes continuous improvement such as is underway with 5G services. We take exception, however, to the channel allocations within the proposed reduced 5.9 GHz band reserved for ITS. We note that the FCC has not provided any assessment of the sufficiency of 30 MHz for all the anticipated transportation applications. To the contrary, the USDOT’s preliminary assessment is that the reserved bandwidth will not be sufficient for the full scope of V2V and V2I applications.
Furthermore, we believe that the NPRM is premature in arbitrarily assigning channels to an application (C-V2X) that has not been fully tested and is without standards, squeezing an incumbent use that has been validated and has standards (DSRC). This will unnecessarily set back the progress made thus far on cooperative safety applications and delay benefits by forcing rework and retesting of applications into the proposed channelization scheme. AASHTO advocates forward and backward compatibility as technology evolves to protect the functionality of the installed base at any given time.

4. Lack of Understanding the Complexities of Developing and Deploying Connected Vehicle Technologies

Understanding the complexities of developing the transportation technologies that will eventually use the 5.9 GHz spectrum go hand-in-hand with understanding the overall cost and benefits of eventually deploying these technologies. The development and deployment of connected vehicle technologies is not even remotely comparable to that of faster and better Wi-Fi service. When Wi-Fi malfunctions, a video may load improperly or an email is delayed; when a safety device malfunctions, people are killed. There is rightfully a different standard for the two technology types, and transportation safety experts have spent the time necessary to develop this technology to the point where connected vehicle technologies can meet those high standards.

The FCC commissioners and others in the industry have expressed the misguided opinion that because there has not been wide-scale deployment of connected vehicle technologies that the spectrum has been unused and fallow since its allocation. AASHTO strongly rejects the notion and would argue that there has been a significant amount research, development and deployment of technologies using the spectrum given the complex nature of the environment in which the technologies will operate. Even though the band was allocated in 1999, the spectrum itself was not usable until an agreement with the incumbent satellite industry reached in 2008. Then, in 2018, FCC Commissioners O’Rielly and Rosenworcel contributed significant uncertainty to the industry when they sent a letter to Toyota North America suggesting they re-examine their intent to deploy DSRC technology in all its vehicles starting in 2021 by suggesting the commission could re-channelize the spectrum.

In the roughly ten years where there was some certainty about the future of deploying connected vehicle technologies using the 5.9 GHz spectrum, there has been significant development and deployment by both the private and public sector. Transportation infrastructure owner operators (IOOs) in 38 State and local agencies, supported by USDOT, have already made tens of millions of dollars of investment in DSRC deployments. Many more deployments are being held up by FCC’s licensing process with 11 states having pending license applications with the FCC representing 498 applications, with even more currently in planning and development². These deployments would face substantial costs of redeployment under the FCC’s proposal. The USDOT estimates the immediate direct cost of replacing even the existing deployments at $500 Million.

In the end, the benefits of deploying connected vehicle technologies—versus faster streaming of videos, downloading of files, and controlling your HVAC system in your home—are significant. In 2017, there were over 6 million police-reported vehicle crashes in the U.S. that resulted in 37,133 lives lost, as well as 2,746,000 injuries. These crashes also resulted in economic harm of approximately $250 billion in direct costs and over $800 billion when the loss of life, injuries, and other quality of life factors are put into dollars. Further, traffic congestion costs are estimated at over $140 billion annually and continue to increase. If connected vehicle technologies could mitigate only ten percent of the annual transportation cost—$110 billion—this is still more than the benefits estimated to be generated by opening up the spectrum to unlicensed use which is $100 billion annually.

5. Lack of Out-of-Band Interference and Channel Buffering
Ever since the cable industry and Wi-Fi advocates began aggressively seeking use of the 5.9 GHz band for their business the transportation community has supported the potential for band sharing between unlicensed devices and transportation users. In fact, AASHTO was supportive of a three-phased approach to testing this concept. Unfortunately, the FCC appears to unilaterally abandon testing with USDOT on the middle of Phase 2 of this testing. Work to date on sharing the 5.9 GHz band between transportation-specific and unlicensed applications has demonstrated significant, if not insurmountable interference issues.

Although the proposal purports to channelize the technologies to reduce interference, no provision has been made to deal with known out-of-band interference, or to provide buffering between the channel allocations. Research published by the USDOT assessing the proposed realignment has indicated signal interference “will occur, raising the question of the reliability of V2X communications in this configuration3.” And given the laws of physics that will limit the amount of traffic within the primary safety channel, a reduced number of use-case scenarios for safety applications will be induced, thus transportation safety will be negatively impacted.

SECTION 2: IMPACT OF REALLOCATION ON STATE DOT DEPLOYMENTS

As infrastructure owners and operators, AASHTO’s member DOTs believe that establishing a strong foundation for ADS requires ensuring robust connectedness for vehicle-to-vehicle (V2V) and vehicle-to-infrastructure (V2I) communication. The overwhelming support for the development and deployment of connected vehicle technologies is evident in the significant commitment that the states and local agencies have made to leading, supporting, and fostering the deployment and testing of connected and automated vehicle (CAV) systems. Currently, 34 states hold active statewide DSRC licenses with four additional states having DSRC licenses at the local level. As seen in the figure below, these licenses represent 57 operational projects with 15,506 vehicles equipped with DSRC radios and 6,182 roadside units. Additionally, 66 projects are being planned representing an addition 3,371 vehicles and 1,916 roadside units.

![Figure 1 5.9 GHz Deployments in the US](image)

At the state level, there are many efforts underway. In Utah, the Utah DOT (UDOT) has invested effort and resources to plan, develop and deploy connected vehicle technology. Over the past four years, Utah has invested $2.3 million in the deployment of DSRC in the 5.9 GHz band. Importantly, these systems are producing measured, positive results. In addition UDOT has existing contracts underway, valued at $11.459 million, to develop and deploy additional

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5 The table does not include a total of 14 applications pending with the FCC within the State of Tennessee: 10 with the Tennessee DOT and 4 with the City of Memphis.
connected vehicle systems and technologies. Funding is in place for further system expansions; $1.35 million in the current fiscal year, and $1.07 million in the following year. They currently have 137 intersections and 81 fleet vehicles with DSRC equipment installed and operating, and another 165 intersections and 90 vehicles slated for operation this year. These installations represent over 25% of all state-owned traffic signals in Utah. These are not pilot deployments, but are in a fully operational, permanent environment. They will also install dual-band DSRC / C-V2X roadside units in 69 non-intersection locations in late Spring 2020, accompanied by 35 fleet vehicles with either DSRC or C-V2X technology. Safety applications are being developed for these locations. More deployments, and additional applications are planned. Connected vehicle systems are a solution for UDOT, not an experiment. Saving lives with these systems is their goal.

In addition to the numerous state planning and deployment efforts, AASHTO is also working and supporting the states in many different ways. For example, AASHTO is supporting a national traffic signal phasing and timing (SPaT) program that heavily leverages V2V and similar technologies to improve traffic flow and reduce crashes. Through the SPaT Challenge, AASHTO is hoping to achieve the deployment of V2I infrastructure with SPaT broadcasts at roadway intersections in at least one corridor or network in each of the 50 states and Washington, DC by January 2020.

At both the national, state and local level, reallocating the 5.9 GHz spectrum will have a significant impact on all existing and planned 5.9 GHz deployments in terms of time and resources already spent that would potentially be wasted. AASHTO encourages the FCC to review all of the individual state DOT comments being submitted as part of this NPRM to better understand the broad impacts reallocation will have. It is important the 5.9 GHz spectrum be preserved for transportation purposes in order to improve safety and ensure the precious resources (federal, state and local) already spent are efficiently used.
SECTION 3: RESPONSE TO NPRM QUESTIONS

P7 “The Commission requests comment on its proposal to designate the 45 megahertz of spectrum at 5.850-5.895 MHz for unlicensed operations.”

AASHTO believes that the FCC proposal to reduce the spectrum dedicated to transportation safety in the 5.9 GHz band is premature. The FCC has not provided any analysis of the impact demonstrating that 30 MHz is sufficient for transportation safety applications, has not provided any analysis of potential interference from adjacent unlicensed operations, and has not made any provision for buffering or a guard band between the unlicensed bands and the transportation safety band.

P8 “The Commission seeks comment on how easily existing U-NII equipment could be modified to take advantage of the additional 45 megahertz of spectrum proposed for unlicensed operations.”

No comment from AASHTO.

P9 “The Commission seeks comment on the state of DSRC-based deployment and the extent to which existing licensees currently operate on some or all of the existing channels in the 5.9 GHz band. The Commission also seeks comment on the transportation and vehicular safety-related applications that are particularly well-suited for the 5.9 GHz band as compared to spectrum outside of the 5.9 GHz band, and how spectrum outside the 5.9 GHz band can be used efficiently and effectively to provide transportation and vehicular safety-related applications.”

Existing DSRC applications operate in all channels of the 5.850-5.925 GHz band. The efficacy of applications within or outside that band is based on latency and bandwidth, and not directly on the particular frequency to be allocated for transportation purposes. Transportation safety applications need direct access in both vehicle-to-vehicle and vehicle-to-infrastructure modes, which was the entire basis for the IEEE 802.11 specification for DSRC in opposition to other Wi-Fi technologies.

P10 “To ensure the most efficient and effective use of the 5.9 GHz band, the Commission proposes to continue dedicating 30 megahertz of spectrum in the upper portion of the 5.9 GHz band at 5.895-5.925 GHz to support ITS operations in the band. The Commission proposes that designating 30 megahertz of spectrum will be sufficient to support ITS-related functions in the 5.9 GHz band—public safety applications involving safety of life and property—which will be part of a larger wireless ecosystem that advances national transportation and vehicular safety-related goals. The Commission seeks comment on these proposals. Additionally, it seeks comment on whether there are actions it should take, or requirements that it should adopt, to promote rapid and effective deployment of ITS (e.g., establishing appropriate benchmarks for infrastructure deployment or in-vehicle installation).”
The FCC proposes, but has not provided any evidence that, designating only 30 MHz in the 5.9 GHz band will be sufficient to support ITS-related functions. As the ITS industry has been working toward deployment in the previously-allocated 75 MHz and has designated particular channels within that band toward transportation safety applications, it is incumbent on the FCC to demonstrate the basis for its belief that the bandwidth reduction will nonetheless be sufficient. There is no evidence that other non-dedicated bands can provide equivalent safety benefits with the same degree of reliability as has been demonstrated with the incumbent DSRC operating in the 5.9 GHz band.

P11 “The Commission proposes to authorize C-V2X operations in the upper 20 megahertz of the 5.9 GHz band (5.905-5.925 GHz) as a means of authorizing the ITS technology that is most capable of ensuring the rapid development and deployment of continually improving transportation and vehicular safety-related applications now and into the future, that is robust, secure, and spectrally efficient, and that is able to integrate spectrum resources from other bands as part of its transportation and vehicular safety-related system. The Commission seeks specific and detailed comment on this proposal and views.

While C-V2X as a technology is projected to be of some utility for transportation-related applications, it has failed to demonstrate any particular advantages over the incumbent DSRC technology for safety applications. As noted previously, non-dedicated bands have not been proven adequate for safety applications. The FCC has not provided any substantiation for its claims.

P12 “The Commission seeks comment on whether authorizing C-V2X in this spectrum would be the best means for promoting effective use of this spectrum for ITS, both in terms of maximizing the potential benefits of using 5.9 GHz spectrum for vehicular-related systems (including safety features) and promoting rapid deployment of ITS in the band. The Commission also seeks comment on available technical studies on C-V2X that could inform its consideration of C-V2X, including any recent studies that provide information about how C-V2X would operate in the 5.9 GHz band. The Commission requests that commenters provide detailed information on precisely how C-V2X communications would employ use of 5.9 GHz band frequencies, and how it would integrate and make use of the commercial mobile network infrastructure as part of C-V2X.”

The FCC’s seeking comment on how C-V2X would operate in the band currently occupied by successful DSRC-based applications is evidence that the FCC’s proposal is premature. If the FCC does not already have evidence of the purported operations and benefits of C-V2X, on what is its proposal based?

P13 “The Commission also seeks comment on how C-V2X would promote synergies with evolving technologies that use other spectrum resources and that will advance vehicular safety and other intelligent transportation capabilities of today and those anticipated in the coming years. The Commission requests comments from motor vehicle manufacturers, the associated automotive industry, and communications companies regarding authorization of C-V2X.
operations in this spectrum, including the extent to which their views on ITS development deployment issues have evolved. If C-V2X is best suited to achieve U.S. goals for ITS, how can the Commission best promote C-V2X use consistent with the goals and objectives of ITS, including safety and other vehicular ITS applications, connectivity, rapid development, and deployment?

State and local transportation agencies have already been deploying DSRC applications in the 5.9 GHz band without any promotional assistance from the FCC. Automakers have been similarly ready for DSRC deployments in their vehicles to take advantage of those infrastructure-side deployments. In point of fact, FCC commissioners are on record as having discouraged at least one automaker from deploying DSRC-based safety applications, and the FCC has been holding up hundreds of agency licensing requests for roadside DSRC deployments.

P14 “The Commission seeks comment on whether the remaining 10 megahertz (5.895-5.905 GHz) of the 5.9 GHz band should also be designated for C-V2X. The Commission seeks comment on how to best optimize the spectrum so that this portion of the 5.9 GHz band can effectively enable the rapid and ongoing development and deployment of transportation and vehicular safety-related functionalities and applications today and in the future.”

AASHTO’s position remains that there should be no reallocation of the full 75 MHz in the 5.850-5.925 band for purposes other than ITS applications.

P15 “The Commission seeks comment on whether making additional spectrum available for C-V2X beyond 20 megahertz is necessary and appropriate for enabling the development and deployment of advanced C-V2X applications in the band. What additional C-V2X features potentially would be enabled? Commenters that support this approach should explain how C-V2X would make use of the entire 30 megahertz for ITS services and applications, and the potential benefits of this approach.

Additional spectrum beyond 20 MHz is absolutely necessary and appropriate for ITS applications to be effective. Bandwidth analysis shows that the full 75 MHz of the 2003 allocation is required to support of the applications currently deployed and under development. 6

P16 “Alternatively, the Commission seeks comment on whether it should continue to set aside the 10 megahertz of spectrum at 5.895-5.905 GHz for DSRC. The Commission requests comment on the kinds of DSRC-based services that would be possible using 10 megahertz of spectrum. What effect would the Commission’s proposals have on any applications delivered using Channel 172 and Channel 184, the two DSRC channels that the Commission previously designated for safety of life applications? Can any such services be provided in the 10-megahertz at 5.895-5.905 GHz? What would be necessary to ensure that DSRC operations

adjacent to C-V2X would be compatible? Are there any ITS services that DSRC would provide that cannot effectively be provided using C-V2X? Is dividing the 30 megahertz of ITS spectrum between C-V2X (20 megahertz) and DSRC (10 megahertz) useful and spectrally efficient when it comes to making use of the upper 30-megahertz portion of the band at 5.895-5.925 GHz for ITS services? The Commission asks that commenters supporting DSRC in the 10 megahertz of spectrum at 5.895-5.905 GHz discuss the benefits and costs of their preferred approach. The Commission also seeks comment on whether there is a more appropriate division of the upper 30-megahertz portion of the band at 5.895-5.925 GHz between C-V2X and DSRC.”

P17 “5GAA indicates that in addition to the 20-megahertz channel requested in its waiver request, it also desires a 40-megahertz channel (i.e., 60-megahertz total) so that the technology it has planned for the band can evolve to include 5G systems and subsequent wireless generations that will amplify and expand upon the safety and other driving applications. Given that the Commission is already on the path to make substantial mid-band spectrum available for 5G in the 2.5 GHz and 3.5 GHz bands, and is proposing to do so in the 3.7 GHz band, allocating a larger spectrum designation in the 5.9 GHz as a path to 5G appears unnecessary. The Commission nonetheless seeks comment on 5GAA’s assertions that 60 megahertz is needed for C-V2X so that the technology planned for the band can evolve to include 5G systems. Is it necessary to plan for such systems in the 5.9 GHz band? If so, can 20 or 30 megahertz of spectrum support 5G automotive applications? What advanced safety applications would be offered on a future 5G system? The Commission seeks comment on whether other 5G spectrum the Commission has made and is making available could be used to support additional C-V2X applications rather than the 5.9 GHz band. Commenters should address how 5G systems might fit into the overall connected vehicle ecosystem.”

Independent of the eventual evolution to 5G systems, a band of more than 30 MHz is needed to support the deployed and developing ITS applications, as previously identified. Any development of future applications for the 5G spectrum would entail bandwidth beyond the current allocation of 75 MHz. Those new 5G applications need not be planned for the 5.9 GHz band.

P18 “Incumbent DSRC operations in the 5.9 GHz band fall into two categories: DSRC roadside units, which are licensed on a non-exclusive, shared basis pursuant to the Commission’s part 90 rules, and on-board units, which are licensed-by-rule under part 95. Since the proposals in the NPRM may require DSRC incumbents to transition their operations from currently-designated frequencies, the Commission seeks comment on possible transition paths. To assess the potential effects of such a transition, the Commission seeks up-to-date information on actual DSRC operations under existing licenses, as well as the various uses of ITS that have been implemented through DSRC technology in this band. Do the locations of roadside units registered in the Commission’s licensing database provide a complete and accurate representation of the deployments under these licenses? To what extent are DSRC operations concentrated in certain parts of the 5.9 GHz band, and how does use of the band vary between
on-board and roadside units? Commenters are invited to submit information about the scope of deployment of such on-board units including, if available, the number of units deployed in consumer vehicles versus the number deployed in state, local, Tribal, or other governmental vehicles.”

Existing DSRC roadside deployments and spectrum usage are summarized by the USDOT on its Safety Band website. Roadside (and public agency on-board unit) deployments are shown below.7

![The Safety Band at Work: Current Deployments](image)

Applications are using all of the currently allocation 75 MHz in the 5.9 band, as shown below.10

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7 Source: USDOT, [https://www.transportation.gov/research-and-technology/operational-connected-vehicle-deployments-us?fbclid=IwAR2JBiJY-wCoM4m6vYkT77go7d8ycwX_jEycbfiwW5KkC8ADWwVXL9x1VhjM](https://www.transportation.gov/research-and-technology/operational-connected-vehicle-deployments-us?fbclid=IwAR2JBiJY-wCoM4m6vYkT77go7d8ycwX_jEycbfiwW5KkC8ADWwVXL9x1VhjM), accessed 2/12/2020.


9 The table does not include a total of 14 applications pending with the FCC within the State of Tennessee: 10 with the Tennessee DOT and 4 with the City of Memphis.

To what extent are existing DSRC deployments anticipated to be used on a long-term (versus demonstration) basis, and what is the lifespan of existing DSRC pilot projects? To the extent the Commission adopts the proposals detailed in this NPRM, would operators of existing DSRC deployments be likely to pursue C-V2X-based solutions, re-channelize to the remaining DSRC channel (if it adopts such a plan), or simply wind-down operations? To the extent the Commission grants new or renews existing DSRC authorizations, should it only prescribe such authorizations for a relatively short period of time?

The intent of DSRC deployments has always been to maintain, update, and deploy additional capabilities as applications and technology advance. Agencies that have deployed DSRC have been doing this throughout the development life of their projects and will continue to do so to the extent that the equipment and applications continue to be supported by the manufacturers and developers. The safety applications are essential to the future of cooperative transportation and will eventually be deployed across the nation using the best available communications media available to those applications. There would be no incentive to seek short-term authorization assuming that the FCC would convert licenses from DSRC to C-V2X if and when needed.

The Commission proposes to modify existing DSRC licenses to allow operation in only the 5.895-5.925 GHz sub-band to the extent that licensees want to operate a C-V2X system or only in 5.895-5.905 GHz to the extent this sub-band is retained for DSRC systems and the licensees want to continue their DSRC operations. The Commission seeks comment on these proposals and appropriate transition paths. How would the proposed modifications affect current licensees with operational sites? How might statutory limitations or Commission policy inform

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**Figure 3  5.9 GHz Spectrum Channel Use**

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<thead>
<tr>
<th>CH175</th>
<th>CH176</th>
<th>CH180</th>
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<tr>
<td>5850-5855 MHz</td>
<td>5890-5905 MHz</td>
<td>5895-5905 MHz</td>
</tr>
<tr>
<td>CH172 service 10 MHz</td>
<td>CH174 service 10 MHz</td>
<td>CH182 service 10 MHz</td>
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<tr>
<td>CH176 control 10 MHz</td>
<td>CH180 service 10 MHz</td>
<td>CH184 service 10 MHz</td>
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- **Basic Safety Message**
- **Pedestrian**
- **Personal Safety Message**
- **Public Safety Preemption**
the actions that the Commission should take as part of any transition plan? The Commission notes that section 316 of the Communications Act of 1934, as amended, gives the Commission authority to modify entire classes of licenses by a rulemaking or adjudication, though this authority has been interpreted not to extend to any “fundamental change” to the terms of a license. What obligations does section 316 of the Communications Act (or any other provision of the Act) impose on the Commission with respect to incumbent DSRC operations if the Commission were to reallocate the band under any of the proposals on which it seeks comment in this NPRM?”

AASHTO believes that the FCC proposal does represent a fundamental change to the terms of the licenses issued, and generally to licensing for ITS applications in the 5.9 GHz band. The FCC proposal in this NPRM would leave insufficient bandwidth for effective deployment of the planned safety applications, even if those applications could be restructured to the channels being proposed, using either DSRC or C-V2X. The FCC has not provided any evidence that its proposed reallocation would provide an equivalent level of service as provided by the current rule and allocation.

p21 “Are there any transition considerations for on-board units that are different than considerations for roadside units? Considering the potential inability of DSRC on-board units to communicate with non-DSRC on-board units and infrastructure, should the Commission take any actions to remove them from service or require other suitable modifications consistent with any ultimately adopted revisions to the 5.9 GHz band? Would such units remaining in vehicles impact unlicensed operations assuming the proposals in this NPRM are adopted? If on-board units remain in vehicles and DSRC licensees remain permitted to operate only in the 5.895-5.905 GHz sub-band, what effect, if any, would unlicensed operations have on these DSRC units?”

Any change to the allocation and licensing in the 5.9 GHz band will require that DSRC OBU’s on which applications have been deployed be updated (if appropriate to a new DSRC channel configuration) or replaced (if the remaining 10 MHz channel were reallocated to C-V2X). The impact of the expanded unlicensed operations in the 5.9 GHz band is discussed in another comment.

P22 “Should the Commission allow existing DSRC roadside infrastructure to continue to operate under the licenses they hold until the end of their license term without renewal expectation? The Commission seeks comment on whether such an approach would adversely affect the introduction of unlicensed operations and C-V2X applications. In addition, the Commission requests comment on an appropriate transition timeline for all DSRC operations under any of the approaches it discusses above. Finally, to the extent that the Commission adopts revisions requiring a transition of DSRC operations, the Commission requests comment on any other considerations or approaches that it should take to effectuate an appropriate transition.”

The nature of the FCC’s proposal is so disruptive of existing deployments that no particular transition plan will be more effective or efficient. It will result in a period of no significant V2X deployments until applications can be redesigned to the new media
configurations and equipment complying with the new rule has been designed, developed, tested, and made available to deployers. For roadside deployments, AASHTO estimates that the result of the FCC’s proposed action will delay operational deployments by a minimum of two years but likely much longer.

_P23-26 Under the Heading E. Technical Rules_

This section of the NPRM is concerned with U-NII bands and equipment and do not require specific AASHTO comments.

_P27 Rules for C-V2X based on the 3GPP LTE Standard_

This does not require specific AASHTO comments.

_P28 “The Commission’s current DSRC rules incorporate by reference the American Society for Testing and Materials (ASTM) EE2213-03ASTM E223313-03 standard. However, that standard has been superseded by a different standard, the IEEE 802.11p. If DSRC operations remain in the band, the Commission seeks comment on whether it should incorporate by reference IEEE 802.11 standards for DSRC operations. Similarly, the Commission seeks comment on whether 3GPP standard(s) for C-V2X operations should be incorporated by reference in the Commission’s rules. What are the trade-offs in terms of deployment speed, safety and cost between mandating a particular standard for devices and leaving the choice of equipment to each manufacturer or automotive company? Commenters that advocate for mandating a particular standard should address how the Commission or industry could ensure that devices could be upgraded as the standard is upgraded to incorporate new capabilities and applications.”_

AASHTO believes that the need to ensure interoperability of V2V and V2I communications across the U.S. vehicle fleet requires that the FCC specify standards for both DSRC and C-V2X operations in the 5.9 GHz band. Substantial effort has already been expended to specify standards for DSRC, and similarly in designing and testing of DSRC systems to assure compliance to those standards. Any retreat from those standards risks a failure of interoperability of V2V and V2I applications across manufacturers or vehicle manufacturers. The same concern and reasoning should apply to C-V2X systems, and standards need to be specified so as to assure interoperability. Devices developed to those standards should then include appropriate configuration management and upgrade capabilities so as to enable and assure that new capabilities and applications can be deployed interoperably across the vehicle fleet.

_P29_

Asks for comment on the specific language for C-V2X rules and does not require specific AASHTO comments.
P30-31 concern emission and radiative power limits for C-V2X. “The Commission proposes that the transmit power limit for C-V2X operation be defined over its channel bandwidth. The Commission seeks comment on this proposal and asks whether a different channel bandwidth for compliance purposes would be more appropriate. The Commission also seeks comment on any alternative technical rules to the existing DSRC regulatory framework. Commenters should address how any technical rules they support ensures the ability of C-V2X operations to deliver services while also ensuring compatibility among different nearby spectrum users (i.e., how the potential for causing interference to other services is minimized). Commenters should specifically address any differences between these proposals, especially with respect to the OOBE limits, and the existing DSRC rules.

A major issue with the FCC’s proposal for reallocating the 5.9 GHz band is that it makes no provisions for channel separation and limiting interference from the unlicensed band to the single 10 MHz DSRC band or from the 20 MHz C-V2X band into the DSRC band. Out of band emissions (OOBE) with no buffer or guard bands are likely to create significant interference in each of the bands. Although definitive testing is yet to be done for this configuration, preliminary analysis and bench tests indicate that the arrangement is unlikely to prove satisfactory. Although alternative rules may somewhat reduce the interference, there may then be consequential reductions in channel performance.

P32-33

These sections concern potentially higher power C-V2X operations for government entities, as allowed by current DSRC rules. Some AASHTO Communications stakeholders may have opinions that need to be addressed in the response. TBD

P34-40

concern incumbent non-transportation application uses of the 5.9 GHz band and do not require specific AASHTO comments.
Concerns changes to the U.S. Table of Frequencies based on the proposed changes to the 5.9 GHz band and does not require specific AASHTO comment.

“The Commission seeks comment on the extent to which the needs for transportation and vehicular safety related communications and other ITS applications originally identified for the 5.9 GHz band are already being met through spectrum use outside of the 5.9 GHz band. Is the requirement in the Intelligent Transportation Systems Act of 1998 to consider designating spectrum for ITS still relevant today? Because the Commission’s general policy has been to move away from specific spectrum designations in favor of more flexible use, is there still a need to designate spectrum for ITS? Commenters that advocate for a specific designation should provide details regarding the benefits of such a designation including those to the public as well as on equipment designers and manufacturers.”

Dedicated spectrum allocation to assure low latency, high availability, and sufficient bandwidth in the exchange of safety-relevant vehicle operations data is essential to the success of V2V and V2I safety applications. Direct peer-to-peer connections without network mediation are essential to assuring the low-latency data exchanges needed, for example, in collision warning and avoidance applications. Public safety benefits of those applications are present only if communications supporting them can assure delivery of messages within the 100-millisecond timeframes needed for vehicular control decisions. Bandwidth shared with other non-ITS application, or mediated over networks, has not been demonstrated to provide equivalent efficacy to direct connections in a dedicated band.

Commenters also should consider whether there are other spectrum bands that might be better suited for supporting ITS applications. If so, which ones? What would be the benefit of doing so, e.g., would this lead to more rapid take-up of valuable automotive safety applications? Commenters should address the extent to which some of the 5.9 GHz band might remain critical to the realization of ITS applications. Commenters that support maintaining some 5.9 GHz band spectrum for ITS applications should specify the specific transportation and vehicular safety-related functions to be accommodated in the band and how much bandwidth in this particular band is necessary to achieve those respective functional capabilities. Are all of these applications equally critical to ensure automotive safety and improve the vehicular transportation environment? The Commission seeks comment on how the Commission can ensure that ITS is used for safety of life applications. What are the trade-offs associated with other options, such as the use of different spectrum to provide ITS services? Do the potential safety benefits vary by band or service and, if so, in what way?”

The 5.9 GHz band as allocated by the FCC in 2003 is wholly appropriate for ITS applications. Its range at the power levels currently licensed for DSRC (and similarly proposed by the FCC for C-V2X) is well suited to vehicle operation and decision horizons. The information density available in that frequency band comports well with safety and operations needs for ITS.
Bandwidth needed to support potential ITS applications in the 5.9 GHz band have been estimated at 80 MHz\textsuperscript{11}, beyond even the original 75 MHz band allocated by the FCC.

p44 “Could the Commission modify its rules to make it easier to provide for automotive safety applications in other bands or through other radio services? What are the implications of retaining spectrum for ITS in the 5.9 GHz band relative to autonomous vehicles, especially given that autonomous vehicles are already being tested and deployed using applications and technologies other than DSRC for vehicle-to-vehicle communications or other transportation or vehicular-safety related operations?”

First, the FCC does not offer any basis for the assertion that “…autonomous vehicles are already being tested and deployed using applications and technologies other than DSRC for vehicle-to-vehicle communication…”. Current AV testing do not use direct V2V communication between or among vehicles operating on the public roadway network. In fact, typical “autonomous” vehicles do not require any vehicle-to-vehicle communications.

Second, AASHTO believes that the current state of autonomous vehicle development and demonstration is not representative of the full complexity of operations in a Cooperative Automated Transportation (CAT) ecosystem. Autonomous vehicle operations on the public infrastructure will need to transition to cooperative automation that recognizes the infrastructure owner-operators’ responsibility to assure safety, mobility, equity, and efficiency of transportation for all users—not just for autonomous vehicles.

p45-47 “The Commission’s goal in this proceeding is to revise the current 5.9 GHz band plan to optimize the efficient and effective use of the band by making the band available both for unlicensed use and ITS services. The Commission seeks to evaluate the benefits and costs of its proposed approach as well as alternatives, and requests comment on how to best calculate these benefits and costs. To date, the band has been underused for ITS services. Designating the 5.850-5.895 GHz band for unlicensed operations is likely to generate quantifiable benefits for consumers, stakeholders, and the American economy. Similarly, the Commission believes removing uncertainty pertaining to the future of ITS services in the band, including the type(s) of technologies that are authorized, would promote more rapid and effective deployment of these services in the band. At the same time, the Commission recognizes that reducing the spectrum available for ITS, depending on the approach taken, potentially could lead to social costs if deployments of ITS would ever occur at wide-scale. The Commission seeks comment on how to best calculate these benefits and costs.”

“The Commission believes that its proposals have the potential to create economic value by resolving uncertainty concerning the future designation of the 5.9 GHz band for both unlicensed

\textsuperscript{11} Road Safety and Road Efficiency Spectrum Needs in the 5.9 GHz for C-ITS and Automation Applications, Car 2 Car Communications Consortium, 2018.
uses and ITS services. Specifically, does the economic value of removing this uncertainty and providing a clear direction for use of the band under the proposed new band plan exceed the benefits that might be achieved by continuing on the path set out by the Commission in 2013, when it sought to explore sharing of the band between unlicensed and DSRC devices (and the extensive further testing that this would entail)? Insofar as the Commission’s proposal provides certainty that part of the 5.9 GHz band would continue to be reserved for ITS services, and would have the effect of promoting development and deployment of ITS services that make use of this band, how should the Commission evaluate the benefits of such a determination today and into the future?”

“The Commission seeks comment on the benefits and costs of designating a significant portion of this band for unlicensed operations. The Commission notes that other studies have sought to quantify the benefits of unlicensed spectrum, but most have focused on existing allocations rather than on the 5.9 GHz band specifically. The Commission requests comment on the extent to which available studies may provide an appropriate approach for quantifying the benefits associated with proposing to designate 45 megahertz at 5.850-5.895 GHz for unlicensed operations. The Commission also seeks comment on other potential benefits, including benefits to other licensed or unlicensed users (including ITS users) that may be able to use unlicensed devices in providing services.”

AASHTO believes that the “uncertainty” cited by the FCC was not an issue until the FCC first suggested the sharing of the 5.9 GHz band with unlicensed uses. Prior to that time, USDOT, the AASHTO member State DOTs, automakers, standards organizations, and communications technology providers were working in synch to develop and deploy transportation safety applications using DSRC in the FCC-designated 75 MHz in the 5.9 GHz band. Progress at that time was paced by the complexity of the applications, not by uncertainty in direction. The FCC itself introduced uncertainty and additional cycles of analysis and testing with its plan to share the band with unlicensed uses.

As discussed elsewhere in these comments, AASHTO does not believe that the proposed reduction in bandwidth dedicated to ITS applications will in fact be sufficient for the anticipated needs. The reduction in fact puts at risk the potential safety and economic gains of those applications. Secretary of Transportation Elaine Chao, in a November 20, 2019 letter to FCC Chairman Ajit Pai cites the relevant safety and mobility costs to the U.S. that are put at risk by the proposed reduction in 5.9 GHz bandwidth dedicated for ITS applications:

“During 2017, over 6 million U.S. police-reported vehicle crashes resulted in 37,133 lives lost, as well as 2,746,000 injuries. These crashes resulted in economic harm of approximately $250 billion in direct costs and over $800 billion when accounting for the loss of life, injuries, and other quality of life
factors. Further, traffic congestion costs are estimated at over $140 billion annually and continue to increase.”

The societal costs described by Secretary Chao are precisely those that are intended to be addressed by ITS applications using the 5.850-5.925 GHz band allocated by the FCC in 2003. The efficacy of those applications under the new restrictions and bandwidth proposed by the FCC in this NPRM have not been evaluated and are seriously in question, independent of whether the FCC decides to specify the use of C-V2X or DSRC. The FCC proposal puts potential benefits of over $1 trillion annually in safety and an additional $140 billion in congestion costs at risk.

By comparison, the value of the unlicensed 5.9 GHz spectrum to be opened by reallocation, as provided in a docketed letter to the FCC commissioners in December 2019 is only “up to $100 billion to GDP.”

“In particular, the proposal will create the country’s first widely usable, contiguous 160 MHz Wi-Fi channel, which can deliver multi-gigabit low latency connections to support 5G services in dense indoor environments. As a November 29, 2018 RAND study has detailed, opening the 5.9 GHz spectrum for unlicensed use will contribute up to $100 billion to GDP.”

The benefits to the U.S. economy by a significant margin favor retaining the 5.9 GHz band for ITS applications affecting safety and mobility.

P48 “The Commission also proposes to measure the benefits and costs of reserving 30 megahertz of spectrum in the 5.9 GHz band for ITS and seeks specific comment on how best to evaluate these benefits and costs. In proposing to reserve 30 megahertz of spectrum in the 5.9 GHz band for ITS, the Commission recognizes that many of the technologies that will make use of 5.9 GHz band spectrum are evolving and will continue to evolve in the future. The Commission seeks comment on how to evaluate the benefits and costs of its proposal given the evolving nature of transportation and vehicular safety-related technologies, both within and outside of the 5.9 GHz band. The Commission seeks comment on the extent to which its proposals would make ITS based technologies either more or less effective. To what extent are or will the types of ITS services that would be available through use of the 5.9 GHz band going to be offered using spectrum outside of the 5.9 GHz band? How should the Commission evaluate the benefits and costs of ITS services in the 5.9 GHz band (whether for vehicular safety or other transportation-related applications) using 30 megahertz of spectrum in the band as compared with other

amounts of spectrum in the band? The Commission also asks that commenters quantify how the vehicular safety and transportation-related benefits and costs may be affected based on the authorization of C-V2X technologies in the entire 5.895-5.925 GHz sub-band, or alternatively authorizing C-V2X in the upper 20 megahertz and DSRC in the other 10 megahertz. Are there technologies presently being or likely to be developed outside of the 5.9 GHz band that would substantially substitute for benefits of ITS in the 5.9 GHz band?"

As related in a prior comment, AASHTO believes that the potential benefits of retaining the 5.850-5.926 GHz band solely for dedicated ITS applications far exceed any potential benefits of unlicensed spectrum use in that band. This is especially relevant given the other bands already or soon to be available for unlicensed and general consumer 5G uses. While the need for high-bandwidth low-latency direct communications among vehicles and between vehicles and the roadside might be accommodated by other spectrum or technologies, those benefits are currently available with continued deployment in the 5.9 band. Any other allocation to be considered would delay or diminish the potential benefits.

As described in response to other comments, AASHTO believes that any reduction in the band available for ITS applications puts the benefits of ITS applications in that band at risk. Given an appropriate emphasis on safety applications, benefits in congestion relief, vehicle emissions reduction, and fuel savings would be the most likely to be diminished by the reduction in bandwidth for applications.

P50-51 “Are there spectrum band approaches other than those discussed above that may better maximize the effective and efficient use of the 5.9 GHz band? Would creating differently sized subbands be a better approach than the Commission’s proposed band plan? Are there any additional emerging vehicle safety technologies the Commission should consider for the 5.9 GHz band? Should the Commission provide automakers and the transportation industry with broad flexibility to introduce additional vehicular safety communications technologies into the band, and permit any and all technologies so long as they can co-exist? This could include DSRC, C-V2X, or future spectrum use protocols that might be developed. If so, how should the Commission define successful co-existence and interoperability, and are there ways to ensure that a technology-neutral approach to any future such developments would provide ready
access to the band and enable critical safety services without causing harmful interference to incumbent technologies?“

“Commenters should provide detailed justification to support specific band plan options, including the types of services that could or could not be delivered by unlicensed use or by vehicular-related services under each option. Likewise, in each case, commenters should seek to quantify the costs and benefits as well as the risks and opportunities, of the discussed alternatives relative to the Commission’s proposed band plan.”

AASHTO is not proposing a specific band plan option, other than to retain the existing 75 MHz allocation for ITS applications.

P52-77

Concern the “Regulatory Flexibility Analysis” and do not require any AASHTO response to requests for comment.