

August 15, 2016

Gregory G. Nadeau  
Administrator, Federal Highway Administration  
U.S. Department of Transportation  
1200 New Jersey Avenue S.E.  
Washington, DC 20590

Re: Docket No. FHWA-2013-0054

Dear Administrator Nadeau:

The American Association of State Highway and Transportation Officials (AASHTO) is pleased to provide comments on the Federal Highway Administration's (FHWA) "National Performance Management Measures; Assessing the Performance of the National Highway System, Freight Movement on the Interstate System, and Congestion Mitigation and Air Quality Improvement Program" proposed rule (Docket Number FHWA-2013-0054), published in the Federal Register on April 29, 2016. 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 the State DOTs are supportive of MAP-21's performance management provisions and believe that they can be implemented in a manner that advances a safer and more efficient transportation system without imposing undue regulatory burdens on States. There are some recognized challenges ahead in the effort to achieve those goals and AASHTO and the State DOTs will continue to engage with U.S. DOT to address these challenges and work together.

We have a number of important concerns with the provisions proposed in this docket. FHWA has set forth a proposal for data and measurement requirements that would represent a major departure from current practice, with major features that are new to the State DOTs, and would require states to report on millions of data points—resulting in significant burden and cost. Given the extent of change proposed, it is not surprising that we have concerns. While AASHTO is supportive of some aspects of the proposed regulations, we recommend that FHWA take action to address our concerns in finalizing this regulation—without adding any measures to those that are expressly required by statute. Also, FHWA must take the time needed to get this rule right, as it will impact states for many years.

AASHTO comments are organized as follows in the attachment to this letter:

- **Principal Comments**—There are fifteen principal comments for which AASHTO provides an in-depth analysis and discussion.
- **Section-by-Section Comments**—AASHTO comments on each major section and sub-section of the NPRM.
- **AASHTO Response to FHWA Requests**—AASHTO response to the questions specifically asked by FHWA in the NPRM.
- **Appendix A**—AASHTO Recommendations on Improving the NPMRDS.
- **Appendix B**—AASHTO Recommendations on Simplifying the Measures Used for Performance of the NHS, Freight Movement and Delay to the Extent They are Applicable.
- **Appendix C**—Results of Peak Hour Travel Time Ratio (PHTTR) Gap Filling Analysis Results

These comments represent a substantial effort among State departments of transportation to thoroughly review and comment on the System Performance NPRM. AASHTO has in place a process to provide coordinated comments representing the different disciplines of the various standing committees on all of the performance management NPRMs being developed by USDOT. This included a coordinated effort to gather input from the AASHTO Standing Committees on Performance Management, Planning and Environment, Subcommittee on Transportation Systems Management and Operations, and listening to our partner associations such as the Association of Metropolitan Planning Organizations (AMPO). These comments are but one set of more than ten that AASHTO will have provided to U.S. DOT regarding the performance-related provisions of MAP-21. AASHTO continues to recommend that U.S. DOT provide an opportunity for States and others to offer any additional comments after all of the performance management related NPRMs have been issued to provide any further input on implementation and coordination of the final rules.

We appreciate the opportunity to provide these comments and look forward to working with FHWA in the implementation of the final rules. 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,



Paul Trombino III, President  
Director, Iowa Department of Transportation

## PRINCIPAL COMMENTS

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### **1) WHAT MATTERS IS GETTING THIS RULE RIGHT, NOT FINALIZING IT QUICKLY**

As set forth more fully below, aspects of the NPRM would overwhelm states with requirements to use new and unfamiliar data sets and would require each state to report with respect to literally millions of data points. These data requirements, even if they can be met, which is far from clear, will require State DOTs to spend funds on software, hardware, consultants and/or personnel, shortchanging other vital functions so that they can pursue compliance with burdensome requirements. The proposed rule is burdensome at a time when Congress and the public want efficiency in the delivery of projects and programs.

We also note at the outset that AASHTO is providing substantive comments that have been developed by seasoned professionals who understand both the breadth and depth of the issues surrounding performance measures. Simply put, the comments provided by AASHTO and the State DOTs should be given more weight than web-based “check the box” comments generated by advocacy organizations that do not have experience delivering transportation programs and projects.

Finally, AASHTO is very concerned that USDOT may be rushing to issue a final rule in this docket even though aspects of the proposal are highly problematic and require careful review of our comments and subsequent revision of the proposal. Moreover, we note that USDOT took nearly four years from passage of MAP-21 by the Congress in June 2012 to publish this NPRM. Without question this NPRM is complex and has raised many issues about the proposed measures, their usage as well as the data that is to be used for their calculation. Accordingly, it is important to the success of this effort that FHWA not rush to finalize the rule. We would expect FHWA to utilize the same levels of resources and time that were accorded to each of the two other NPRMs in this series of rulemakings for this rulemaking.

AASHTO believes that the public will be better served by having no rule rather than this proposed rule. State DOTs already have good knowledge regarding congested portions of the highways within their borders. This rule is not essential to provide a working understanding of congestion. As proposed, it will add burdens and costs to hard-pressed State DOTs and MPOs. FHWA needs to make major changes in the proposal to adopt the substance of these comments to better serve the public. If FHWA can do that quickly, we have no complaint about fast action. But FHWA must take whatever time is needed to make changes to the proposal in accord with these comments.

### **2) CALCULATION METHODS AND DATA REQUIREMENTS ARE OVERLY COMPLEX, BURDENSOME AND COSTLY, DO NOT PROVIDE MEANINGFUL BENEFIT AND DO NOT ALIGN WITH NATIONALLY ACCEPTED PRACTICES**

AASHTO believes that the data requirements and calculation methods proposed by FHWA are both overly complex and do not align with nationally accepted practices. Overall, the metrics and

calculation methods proposed by this rule are considered to be overly complex even by those states that have been viewed as leaders in developing performance measures and related tools, such as the Washington State DOT, Missouri DOT, and Texas DOT. The measures proposed by FHWA are completely new to the industry and are very different from the industry-accepted methods published through various national system performance publications. While elements and concepts of the proposed performance measures have been used elsewhere, the performance measures as proposed have simply never been used in their entirety as a reporting mechanism and, at the statewide “roll up” level, offer states no clear guidance on improving the performance of the NHS. All of this goes against one of AASHTO’s fundamental performance management principals, which is to use and apply performance measures that have already been developed by the transportation industry for performance measure reporting.

AASHTO believes that the final rule in this docket would be improved if the proposal is modified to use a simpler approach consistent with approaches that have been used historically. That is a key element of our comments. To that end, AASHTO believes that the overall complexity of the proposed measures could be mitigated if FHWA were to adopt the measures proposed by the AASHTO Standing Committee on Performance Management in its report *SCOPM Task Force Findings on National-Level Performance Measures*. This report provides detailed recommendations on both delay and reliability measures for NHS and freight performance.

If FHWA does not use the measures proposed SCOPM for national-level reporting, then AASHTO strongly encourages FHWA to simplify both the performance measures themselves as well as the calculations processes and adopt, or allow states the flexibility to adopt, other methodologies consistent with those discussed in national reports such as the Urban Mobility Scorecard (in publication since 1984), Urban Congestion Report published by the FHWA Office of Operations and practices used by states (such as WSDOT’s annual Corridor Capacity Report in publication since 2001). Appendix B to these comments, *AASHTO Recommendations on Simplifying the Performance of the NHS, Freight Movement and Delay Measures*, outlines recommendations on how to improve the proposed performance measures based upon current industry practices but does not differ greatly from the proposed measures.

In addition to simplifying measures used, as explained in these comments AASHTO also strongly supports a narrower focus for the use of measures. We explain below, for example, that the proposed rule would apply measures (whether complex or simplified) to too many roads or areas, such as to uncongested non-urbanized areas.

### **3) TAKE A STRAIGHTFORWARD APPROACH TO IMPLEMENTATION OF THE PERFORMANCE MEASURES**

AASHTO has a number of concerns about the proposed rule’s complexity and lack of consistency. First and foremost, the proposed rule would require different data preparation for each measure, ranging from handling null and outlier values differently, to using different percentiles for general traffic and freight. Simply put, AASHTO recommends that FHWA reevaluate the overall approach to the proposed performance measures such that it is simpler in nature, more understandable to both transportation professionals and decision makers, and less

burdensome and costly for both State DOTs and MPOs to implement. Below are specific suggestions that we believe will make implementation of the rule less burdensome on the State DOTs. The result will be states being better able to focus on delivering benefits to the public and spending less time and money on regulatory compliance.

- **Allow State DOTs and MPOs to designate reporting segments that are more applicable to prevailing practice**—The mandated maximum lengths for reporting segments (1/2-mile in urbanized areas, 10 miles in non-urbanized areas) for a reliability measure are not consistent with prevailing practices (i.e., SHRP 2 Reliability Program) in calculating travel time reliability measures. The main principal behind travel time reliability is to measure travelers' experience with consistency of trip travel times, which translates to longer reporting segments that are more comparable to typical traveler trip lengths. For example, TxDOT uses reporting segments that are typically about 5 miles in urbanized areas and about 10-20 miles in length in non-urbanized areas. Further, it has been shown that reporting segment length can make a significant difference when computing the percentiles used in reliability measures. That is, even though travel times on short congested road segments can be highly unreliable, other parts of a traveler's trip tends to normalize (reduce) this high unreliability for the short segment. Therefore, a reliability measure that uses very short reporting segments is more likely to inflate the level of unreliability beyond that experienced by travelers or shippers.

*AASHTO recommends that FHWA allow State DOTs and MPOs flexibility to establish reporting segments that best reflect the needs of an individual state, which may be longer than the proposed limit of one-half mile for urban areas and ten miles for rural areas. The segments could be based upon logical termini such as intersecting NHS facilities or the start or end of an urbanized area.*

- **Provide State DOTs the flexibility to use measurement and target setting approaches that mitigate the effects of weather events that would adversely affect the system performance measures**—All states will encounter some type of non-recurring weather-related events, be it: significant amounts of rain in Vermont, Texas, or Colorado; snowfall in Michigan, Minnesota, or Wyoming; or hurricanes in Florida, South Carolina, or Louisiana. The impact of weather-related delays makes establishing targets very problematic. In Michigan, for example, there are areas that average more than 70 days of measurable snowfall resulting in a fifty percent variance in delay from one year to another with most of the change attributed to weather. In Michigan and a number of other states, many stretches of the NHS located in areas traditionally hard hit by winter weather will likely always appear to be unreliable or congested under many of the measures in the proposed rule, even though slower speeds are normal and even to be encouraged during winter in those states.

While state and local transportation agencies can take steps to implement solutions that address problems that cause recurring congestion, and can be prepared to respond efficiently to issues that cause non-recurring congestion, in the case of weather delays, agencies are at the mercy of circumstances that are beyond their control. From the

perspective of the system users, the idea of reliable travel times adjusts according to significant weather events. Performance measures that fail to account for weather-related delays will likely yield results that are unhelpful and misleading. The rule would do well to allow a State or MPO the flexibility, but not the requirement, to present data and targets in terms of performance on days other than those where, in the sole opinion of the State, weather has impacted performance.

*AASHTO recommends that FHWA allow State DOTs and MPOs the flexibility, but not the requirement, to exclude from calculation (and targets) roadway segments for the periods during which they were adversely affected by weather conditions using a consistent approach and data (e.g., National Weather Service reports and data archives).*

- **Allow State DOTs the flexibility to use measurement approaches that mitigate the effects of construction projects that will ultimately improve system performance**—at any given time there are thousands of construction projects occurring on the NHS. AASHTO is concerned with how these construction projects will affect the performance measures. Many construction projects on the NHS attempt to maintain capacity in work zones. However, it is inevitable that some sort of congestion and delay will occur in the work zones. In some instances, the construction projects are significant, resulting in a complete shutdown of the roadway or significant reduction in roadway capacity resulting in a detour route. In this situation, data collected (or missing) from the roadway may indicate slower travel times than is normal.

For target setting purposes, it would be extremely time consuming to analyze all the impacts to all potential detour routes, especially in future years with limited information on the full impacts of every project. Further, at the end of a performance period, if a state/MPO did not meet their target, it would be equally as time consuming to analyze construction impacts on performance in an effort to explain why targets were not attained.

*AASHTO recommends that State DOTs and MPOs be allowed to exclude certain roadway segments from analysis if a major construction project will adversely affect travel time speeds. In addition, FHWA needs to develop guidance on how State DOTs and MPOs will develop targets and how they are expected to maintain or improve conditions in these situations when construction will cause these temporary setbacks.*

- **Allow State DOTs the flexibility to better address the significant role that managed lanes play in the operation of the transportation system**—many regions in the US have implemented some aspect of management lanes. As written, the measures in the proposed rule will likely mask benefits from HOV, HOT, toll roads, and other operational enhancements and could discourage investment in these best practice procedures. It is very important that FHWA allow a State to differentiate the data with the data provider, or account for HOV, HOT, toll roads, and other managed lanes in the system performance measures.

*AASHTO recommends that FHWA develop an approach in final rule that allows, but does not require, State DOTs and MPOs to specifically address managed lanes on their roadway network either through an improved NPMRDS that distinguishes between general purpose and management lanes or through supplementary analysis that takes into account the benefits of the managed lanes.*

#### **4) DO NOT OVERREGULATE BY IMPOSING CONGESTION MEASUREMENT AND MANAGEMENT REQUIREMENTS FOR RURAL UNCONGESTED AREAS**

As described elsewhere in these comments, the NPMRDS approach set forth in the proposed rule will require states to develop computerized applications and report on millions, in some cases hundreds of millions of data points, principally in order to identify areas where traffic is congested. While, candidly, states and MPOs are already quite knowledgeable as to where routes are congested, the apparent theory of the proposed rule is that more detailed information could result in an improvement in already excellent state and MPO decisions regarding ways of addressing congestion. AASHTO submits that this added increment of work for states, in organizing and reporting data, is particularly not needed as to the non-Interstate NHS outside of urbanized areas. The final rule should be made inapplicable to such mileage or, at most, FHWA should allow alternate compliance by means of a simple state certification that, in the view of the State, those segments are not subject to congestion except in unusual circumstances.

This straightforward approach would greatly reduce the reporting and cost burden associated with the proposed rule. Requiring States to include the non-Interstate, non-urbanized NHS miles in the data reporting and targeting regime proposed in this docket would be a mistake, similar to that made when the HSIP NPRM proposed that States be forced to collect 37 different data points on unpaved roads – a flawed and burdensome proposal that FHWA commendably reduced to a *de minimis* requirement in the final HSIP rule. A similarly massive reduction in regulation is warranted here as to non-urbanized non-Interstate NHS highways. Those roads are not congested and have reliable travel times. A simple certification that such roads are not congested except in unusual circumstances will more than suffice.

- **Do not force States to report on or collect traffic data on the non-Interstate NHS outside of urbanized areas**—AASHTO recommends that State DOTs and MPOs be allowed to exclude from data reporting (and any other requirements) under this rule (whether the final rule uses NPMRDS or some other method) data on traffic on non-Interstate NHS routes outside of urbanized areas. If FHWA considers it necessary, such exclusion could be combined with a state certification that, in the view of the state, the non-reported non-Interstate NHS route is not in an urbanized areas and not subject to congestion except in unusual circumstances. Proposed 490.503(a)(1) and .507(a)(2) should be revised accordingly.

#### **5) FHWA SHOULD NOT DEVELOP NEW NATIONAL PERFORMANCE MEASURES BEYOND THOSE SPECIFICALLY REQUIRED BY STATUTE**

AASHTO and the State DOTs are supportive of the MAP-21 performance provisions and believe that with effective implementation of Federal performance management requirements that are

not unduly burdensome or costly, there is the potential for a more effective Federal transportation program to complement ongoing state efforts to achieve a safer and more efficient transportation system. However, there will be implementation challenges ahead with this new national program.

AASHTO strongly recommends that FHWA not establish additional national-level measures beyond those explicitly required by Federal statute. State DOTs, MPOs, and USDOT need time and experience with the new national-level measures that are explicitly required by law (including those required by NHTSA and FTA) before even more measures are added, implementation of which will require additional resources and data to analyze and implement. Also, some State DOTs have chosen and may expand their efforts to adopt their own state level performance measures in a variety of areas. For example, some states are establishing state-wide GHG measures. However, the measure(s) vary greatly from state to state, and that experience will continue to inform this process going forward.

Just as importantly AASHTO does not believe that USDOT has the legislative authority to establish any new performance measure. 23 USC 150(c), which provides the statutory authority for performance management requirements, states in 150(c)(2)(C) that USDOT shall “limit performance measures only to those described in this subsection.” The statutorily described list is specific and explicit.

If, notwithstanding the lack of authority, USDOT chooses to advance any new performance measure, we strongly believe USDOT must first go through a separate rulemaking process to propose and receive public comments on that specific performance measure. Any new measure should be subject to public comment prior to being adopted as only in the context of a specific proposal can States and other interested and affected parties provide input and comments on potential issues and challenges. Without an open and transparent public dialog about a specific performance measure(s) proposed by USDOT, useful input regarding the details of the performance measures including data requirements, calculations, and targets, will not be included in USDOT’s deliberations in developing the measure.

## **6) THE PROPOSED RULE RESTS ON A FOUNDATION THAT GREATLY OVERESTIMATES ITS BENEFITS AND GREATLY UNDERSTATES ITS COSTS**

FHWA conducted an analysis of the benefits and costs of this rulemaking and determined that the benefits outweigh the costs. In general, AASHTO agrees that the benefits of implementing an effective transportation performance management program are significant and will likely outweigh the costs. However, AASHTO believes that the benefits will be derived not solely from a national-level program but also from state and local performance measures and related actions. As proposed, the national-level performance measures proposed by FHWA will not be sufficient for making program and project-level investment decisions. FHWA has stated that the purpose of these performance measures is to support better decision making as the country works to provide a safe and effective transportation system within a limited budget. The measures proposed by FHWA, however, while providing a general sense of the function of the transportation system, do not lead directly to better decision making by states, which already have knowledge of the issues.

Below, AASHTO discusses a number of the significant costs that a State DOT will have to incur if it is required to implement the performance measures as proposed in the NPRM. In nearly each case, AASHTO has identified an alternative and more cost-effective solution that would significantly reduce the overall cost burden on the State DOTs. AASHTO strongly recommends that FHWA implement these recommendations when finalizing the NPRM, as well as use the significant amount of transportation research and development funding made available to FHWA as part of the FAST Act.

- **Provide technical support to State DOTs**—Standard software and hardware is proving to be not powerful enough to handle the huge (NPMRDS) datasets from which the measures would be derived, and states would need to create or use a conflated roadway network dataset before beginning to calculate the proposed measures. Navigating the technical complexities of the rule will translate to an enormous burden on State DOT and MPO resources. For example in Washington State, the excessive delay measure would require working with approximately 1,100 of Washington's 6,100 TMC segments—that's more than 115 million travel times to be evaluated, which will require powerful software, hardware and technical expertise. State DOTs are looking at having to create relationships with groups of Ph.D.'s at universities and the elite hardware and software they may have in an effort to be capable of implementing the requirements proposed in this docket. And success is not guaranteed.

*AASHTO requests that FHWA make it a requirement for itself to provide technical assistance resources, including providing the conflated roadway network (including updates needed to accommodate industry changes to individual TMC segments every 2-4 months), to State DOTs as soon as possible, in an effort to assist with the calculations required by the final rule in this docket. This will be particularly important if the final rule retains the complexity and vast data requirements of the proposed rule.*

- **Provide State DOTs and MPOs with a web-based tool to calculate the performance measures**— To implement this proposed rule and meet its obligations, State DOTs and MPOs must find additional resources (both in employees and funding) to complete the extensive workload that is necessary to accomplish the large-scale cross-agency collaboration the proposed rule requires. States will have to develop their own processes and tools for conflating roadway network, processing NPMRDS data and calculating those metrics. Unfortunately, many State DOTs and MPOs simply do not have the additional resources (funding) to hire additional staff and, in some instances, State DOTs are not able to secure technical staff with skillsets needed to manage the implementation of these data and metric requirements.

As proposed in this rule, each State DOT and MPO will need to develop its own analytical tool to calculate the proposed performance measures. Already, consulting companies and research organizations have offered the ability to calculate the measures on behalf of States and MPOs. However, this will cost each State DOT and MPO a significant amount of money for software, hardware, consultants, and/or personnel and

likely lead to multiple, potentially proprietary approaches to data analytics. This makes national consistency even more challenging. AASHTO is exploring the cost of a pooled fund project to calculate the performance measures as a potentially less expensive alternative. Either way, the proposal would be costly and states would have to find a way, perhaps by abandoning other important transportation projects and tasks, to spend what is necessary to meet a federal requirement that will not significantly alter the overall decision-making process.

*AASHTO requests that, because the NPMRDS is a national data set and it is inefficient for each state to develop its own process and tool, FHWA develop and fund a national level tool for calculating proposed metrics and measures for all states to minimize burden and ensure consistency in the process. This would lend itself to ensuring a consistent approach to the calculations and, thus, a consistent way to draw national trends/conclusions.*

- **FHWA should offer to process data and calculate all metrics and measures:** For better decision making, most State DOTs already use localized information and detailed analysis determined by states' needs and priorities to fully understand the nature of and potential remedies for transportation needs. If FHWA requires national level indicators of the transportation system, those should be produced, or at least funded, at the national level by FHWA and in no way be funded by drawing on funds that are allocated to the States or MPOs. The NPMRDS is national in scope, and all but Subpart H of the proposed measures could be calculated directly in conjunction with AADT data through HPMS already reported to FHWA. This would ensure consistent process and accomplish the same nation-wide representation of our transportation system in a more efficient manner. Requiring State DOTs to establish segments, hourly volumes, aggregate delay, use different thresholds for each calculation, etc., introduces many places for error and inconsistencies that are difficult to track. Looking at differences in performance measures from year to year, State DOTs would have difficulty determining whether these differences were caused by error or changes in travel patterns, rendering an outcome without any added value.

*AASHTO recommends that FHWA offer to State DOTs and MPOs that so choose the option for FHWA to use the NPMRDS to calculate the national transportation system performance measures internally for use by the State DOT or an MPO.*

- **Revise the proposal to greatly reduce the significant effort it will take under the proposal to coordinate between State DOTs and MPOs**—As written, the proposed rule would require extensive collaboration between State DOTs and MPOs (especially around large urbanized areas that cross state borders) to develop roadway segmentation, desired peak hour travel times and 2- and 4-year targets for each applicable urbanized area. In Washington State alone there would be approximately 1,100 urban (1M+) reporting segments that would be subjected to these tasks.

Setting these various standards could become a lengthy and politically sensitive process

within an MPO as the governance structure consists of multiple jurisdictions and agencies. The negotiation process between all partner agencies for determining how or whether the roadway segments should be grouped in an applicable urbanized area could take an extended period of time while placing an enormous strain on both State DOT and MPO resources.

*AASHTO requests that, first, FHWA establish a default solution if agreement within an MPO or between an MPO and a State DOT is not achieved, so that the risk of endless coordination will not bog down efforts to implement whatever is in the final rule<sup>1</sup>.*

*Second, AASHTO recommends that FHWA study the added value of requiring agreement between State DOTs and MPOs on the various pieces of the rule and reconsider the short amount of time allowed to conduct this process. Finally, AASHTO requests that FHWA provide resources to conduct peer exchanges and workshops for those State DOTs and MPOs having to address multi-state MPOs.*

## **7) CONFIRM STATE DISCRETION IN TARGET SETTING AND REPORTING**

There are a number of concerns that State DOTs have regarding target setting. First and foremost, target setting is a significantly data-driven and multidisciplinary process that is practiced by all states. MAP-21 was clear in saying that each State shall set performance targets that use the measures developed by U.S. DOT. Furthermore, it is AASHTO's position that every state and political subdivision faces different constraints and opportunities affecting their transportation system. Available funding is a particularly important variable for States in planning and target setting, but there are other factors, including economic conditions, environmental conditions, population growth trends, legislative and gubernatorial mandates and priorities, and issues identified in the public involvement process. Consequently it is essential that States and MPOs have the flexibility to set targets, including targets that have performance holding steady or, in some situations, declining.

Regulations pertaining to performance reporting should focus on providing the public and interested parties clear, concise and easily available information on transportation system performance in the State as determined by the State. States should have flexibility in determining the need for consolidation of information regarding MAP-21 performance measures and the nature of the performance reporting. Options include but are not limited to stand-alone periodic performance reports, reporting within the context of the statewide plan, summary discussions with appropriate references in the STIP, etc. States are in the best position to know "what works" in the State regarding communications with the public, interested parties, and their partners.

The final rule should also be clear that State DOTs would have the discretion to voluntarily set long term targets (such as 10 years or more), not just 2 and 4 year targets, and to do so completely outside of the Federal regulatory framework. While AASHTO does not support adding mandatory long term target and management provisions to the requirements proposed in the NPRM, the proposed performance management structure should accommodate voluntary decisions by the individual States to also establish, for their own use, target and reporting

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<sup>1</sup> See further discussion in these comments under Section-by-Section Comments, 490.103.

timeframes that the individual State considers to be realistic and appropriate for the measures being used. The proposed rule should give State DOTs (and MPOs) the flexibility to establish long-term targets, outside of a Federal regulatory requirement. State DOTs can still report on a biennial basis (as required by MAP-21) on performance results and progress while also fashioning, voluntarily, their own longer term targets.

With regard to the performance measures proposed in this docket, identifying realistic and achievable targets related to performance of the NHS, freight movement, and CMAQ will be very difficult since the lack of long-term historical data makes it difficult to identify trends that can be projected into the future. This data problem is particularly acute for non-Interstate NHS routes, where a robust collection of reliable data may not exist for several more years. At least three to five years of good data with proper analysis and training is necessary before we can reasonably be expected to establish meaningful targets. Establishing targets for measures where good data does not exist may essentially be nothing more than a shot in the dark. Moreover, as discussed above under the principal comment *Do Not Overregulate By Imposing Congestion Measurement and Management Requirements For Rural Uncongested Areas*, the burden on and cost to States would be greatly reduced and the objectives of the NPRM not adversely affected if non-Interstate NHS data obligations were limited to urbanized areas, which AASHTO proposes.

It is also important for states/MPOs to have more of an ability to understand and predict the impact that specific projects, or project types, can have on congestion and reliability. If a clear link could be established between the program of projects for a state/MPO and the end result of that program of projects on congestion and reliability, investments could be better focused and states/MPOs could have better information upon which to base their targeted level of performance. Unfortunately, when it comes to these measures, there are a number of external factors that can greatly impact congestion and reliability that are not acknowledged or controlled for within the proposed performance measures. These include construction, weather, and the health of the economy. In order to be able to establish targets that are meaningful, realistic, and perhaps most importantly, attainable, agencies need more information about how these factors can be reflected in the targets.

AASHTO recommends the following as it relates to target setting and reporting requirements:

- **The proposed rule should include specific language stating that target levels may call for improving, constant, or declining condition.** FHWA's recognition that targets can indicate a decline in performance (whether due to inadequate funding or otherwise) is set forth only in the preamble of the NPRM (Page 23866) but not in the proposed rule itself. AASHTO recommends that specific language be included in the rule itself to confirm this essential point
- **State DOTs should have the flexibility to be able to adjust targets annually if critical assumptions underlying performance targets have changed sufficiently to affect target values.** Currently, the NPRM would allow a State DOT to modify targets on a biennial basis. In some cases, the need to adjust targets may occur more often and State DOTs should be allowed to adjust targets annually after providing documentation to its FHWA Division for information, not for approval.

- **Specify that the state transportation agency is responsible for setting the statewide targets.** Only the State DOTs are held accountable if targets are not met. Thus, only the State DOT should be allowed to establish statewide targets and not another agency of the state.
- **Provide State DOTs maximum flexibility to establish, revise and, when and to the extent necessary, explain targets.** The performance measures in this NPRM are new for all State DOTs and flexibility is appropriate.
- **Be mindful of the unintended consequences on target setting of dictating minimum speeds to congestion thresholds.** The proposed rule, by proposing “thresholds” for vehicle speeds, may be perceived by many state DOTs as impinging on state prerogatives to set targets. It may be true that, under FHWA’s proposed formulation, States would set targets as to the percentage of highway segments meeting or exceeding the specified vehicle speed thresholds. However, to the extent that a state considers different vehicle speeds to be more relevant for its planning purposes, and wants to pursue that planning, it would have to engage in an additional layer of planning rather than an alternate layer of planning (as it would still have to take the steps required by the proposed rule). AASHTO strongly recommends that FHWA work and discuss with the State DOTs and MPOs alternative approaches to establishing the minimum speed congestion thresholds such as using a percent of posted speed limit.
- AASHTO does not agree with the FHWA proposal that a state that chooses to develop certain measures and targets in addition to or beyond those that are required, such as separate urban and rural targets, must report them to FHWA in the approved format. This is a needless, costly, and burdensome requirement. States should have flexibility in going beyond what is required. Otherwise, they are discouraged from doing so - or forced to say that what they are doing is not a performance measure, so that it would not be subject to Federal regulation.

## 8) ALLOW FLEXIBILITY FOR THE USE OF A FULLY-POPULATED TRAVEL TIME DATASET OTHER THAN THE NPMRDS

The proposed rule requires the use of the NPMRDS travel time data set, or an equivalent data set, which contains only actual measured travel times, and “shall not be populated with travel times derived from imputed (historic travel times or other estimates) methods.” The proposed rule does allow an expedient alternative method when directly measured travel times are not available in the NPMRDS – assuming that traffic is moving at the posted speed limit. Analysis conducted for FHWA (Docket ID # FHWA-2013-0054-0103) documents the substantial amounts of missing data in the NPMRDS (pages 6-8), as well as undesirable impacts of this missing data and proposed an expedient alternative method on calculated measure values (pages 10-11). The method of using posted speed limit is not applied consistently among all of the proposed performance measures. See Appendix B and C for additional discussion and analysis.

AASHTO believes the rule should allow the option of a different approach to filling in gaps in the NPMRDS. That would be to use a fully-populated travel time data set, such as those that are commercially available through multiple data providers. The traveler information companies producing these fully-populated travel time data sets use much more sophisticated imputation

methods than the speed limit-based imputation prescribed in the proposed rule. Using a fully populated travel time dataset has been the preferred approach by numerous State DOTs that have been conducting this type of analysis and are implementing performance reporting and management. Further, the I-95 Corridor Coalition has undertaken substantial accuracy validations of the fully-populated travel time datasets since 2009 (<http://i95coalition.org/projects/vehicle-probe-project/>) and has demonstrated the accuracy of these fully-populated travel time data sets that include more sophisticated imputation methods.

Finally, changing the proposed rule to permit as another alternate approach to gaps in the NPMRDS the use of a fully-populated travel time dataset, would allow states that have already implemented performance reporting processes based on fully-populated travel time datasets to meet the “equivalent data set” requirement, which reduces time and resources required of these states to learn how to use a “Federal-only” dataset. In addition, see Appendix A for AASHTO’s recommendations for how FHWA could work with the data provider to fix these issues in the NPMRDS, thereby saving State DOTs and MPOs a significant amount of resources.

AASHTO recommends the following related to the use of alternative travel time data set:

- **Provide State DOTs additional options in using a national data set:**
  1. *Allow State DOTs to use an alternative data set that meets the same minimum standards as provided in the NPMRDS, pursuant to the final rule.*
  2. *Allow State DOTs to use the NPMRDS as provided by FHWA, pursuant to the final rule.*
  3. *Allow for alternative approaches to filling gaps as proposed by individual State DOTs, such as using the posted speed limit or other approach, to fill gaps in data in the NPMRDS or equivalent data sets.*

## **9) SIGNIFICANT CHALLENGES REMAIN IF THE NPMRDS IS TO BE USED FOR NATIONAL-LEVEL REPORTING**

AASHTO appreciates that FHWA is funding the purchase of the NPMRDS and providing it to the State DOTs and MPOs for their use in calculating the proposed performance measures identified in this NPRM. AASHTO has prepared a supplemental appendix to these comments, *AASHTO Recommendations on Improving the NPMRDS*, which provides specific recommendations for FHWA to improve the NPMRDS as part of its next re-compete of the NPMRDS contract. In addition to those specific and detailed recommendations, AASHTO has three significant concerns about the use and application of the NPMRDS that must be addressed in order for the data set to be useful as part of the national-level reporting.

First, various studies by State DOTs, comparing NPMRDS to agency loop detector data, have shown significant data gaps occurring during peak periods. The proposed rule would require a State DOT to replace missing data with posted speed limit travel times. The result of FHWA’s White Paper on NPMRDS Missing Data and Outlier Analysis showed that doing nothing with missing data resulted in closer to ground truth outcomes than imputation with speed limit travel times. This indicates that missing data is not limited to lower traffic density but also concerns congested periods. Even if this completeness issue improves over time with better reception

rates, etc., replacing missing data with travel time at posted speeds will make the initial true congestion condition look better than it is, which will then artificially affect trends, with the calculated measure declining over time even if actual roadway performance improves. There are other issues with using travel time at the posted speed limit as well, such as that the travel time at posted speed limits on signalized arterials will return relatively faster speeds than free flow, and that shorter TMC segments are prone to greater shifts than other null/outlier procedures. Many State DOTs, research institutions and consultants have completed research, finding that replacing missing data with median historical travel speeds was the option closest to ground truth data. On the other hand, the proposal to allow filling in with the posted speed limit is one of the only aspects of the proposed rule that is not unduly burdensome, and it should continue to be an option for states, even though other options should be allowed.

Second, the measure calculation procedures in the proposed rule require several highway classification attributes that are not integrated into the existing NPMRDS Travel Time Data Set and will require substantial effort by State DOTs to integrate. Specifically, the proposed measures require reporting of “Interstate” or “Non-Interstate NHS” measures, yet there is not a clearly defined attribute in the NPMRDS that designates which TMC paths are classified as Interstate or Non-Interstate. States have found classification errors when using the ROUTE\_TYPE attribute as well as the ROUTE\_NAME attribute to determine Interstate or non-Interstate classification. A similar problem exists with the freeway/expressway or principal arterial classifications required to determine the speed threshold for calculating Excessive Delay. The proposed rule refers to HPMS Functional Class codes that are not included in the NPMRDS. A similar problem also exists with urbanized area boundaries. Some State DOTs maintain these in a linear road referencing system, but urbanized area boundaries are not clearly indicated in the NPMRDS, and will require substantial integration effort by State DOTs.

Finally, the most difficult requirement for system performance measures is related to agencies needing to conflate both the HPMS volume data and their Speed Limit data over to the TMC segments. If FHWA allows agencies to use imputed data directly from the data vendor (as suggested above), then the need for speed limit data conflation goes away. However, the HPMS volumes will still need to be conflated for use in some of the measures. Conflation of the HPMS network to the TMC network is quite difficult (and costly) for each State DOT and MPO to conduct. In addition, the TMC network changes on a regular basis which would require conflation of the HPMS and NPMRDS networks several times a year. It would be significantly more cost effective for FHWA to either require the data provider to do this volume conflation or for FHWA to hire a third party to perform the conflation services on behalf of all State DOTs and MPOs.

AASHTO recommends the following as it relates to the NPMRDS Data Set:

- **Allow States the option to use a historical data replacement methodology, speed limit data or some other methodology, to impute incomplete or missing data.**
- **As part of the next NPMRDS contract, require the data provider to utilize recognized, industry-accepted methods to impute incomplete or missing data to the NPMRDS.**

- **Require the data provider to include the following attributes for each TMC segment:**
  - Posted speed limits
  - Metadata stating the HPMS-defined functional class for each TMC segment.
  - Urban area identifier for each TMC segment.
- **Include the highway classification attribute as part of the next NPMRDS contract and provide to State DOTs these attributes in a current database.** The measure calculation procedures in the proposed rule require several highway classification attributes that are not integrated into the existing NPMRDS Travel Time Data Set and will require substantial effort by DOTs to integrate. Specifically, the proposed measures require reporting of “Interstate” or “Non-Interstate NHS” measures, yet there is not a clearly defined attribute in the NPMRDS that designates whether TMC (Traffic Message Channel) paths are classified as Interstate or Non-Interstate. We have found classification errors when using the ROUTE\_TYPE attribute as well as the ROUTE\_NAME attribute to determine Interstate or non-Interstate classification.
- **Make available to the State DOTs and MPOs a conflated dataset that combines HPMS segments with TMC segments so that volumes are readily available and datasets that would likewise be updated to accommodate changes to TMCs 2-4 times per year if other AASHTO comments regarding “locking down” a network are not incorporated.**
- **The rule should not apply except with respect to years for which FHWA has provided the NPMRDS in a usable format with “no assembly required.”** If FHWA is unable to provide an improved presentation of the NPMRDS to the State DOTs, so that there is no “assembly required”, then the State DOT should be excused from compliance with the applicable requirement that uses the NPMRDS.

## **10) HPMS IS IMPORTANT TO THE PROPOSED REGULATION BUT WAS NOT DEVELOPED TO BE A REGULATORY DOCUMENT**

It is clear in the NPRM that FHWA intends to make the HPMS the primary mechanism with which to report performance data. In so doing, FHWA is using HPMS for much more than what HPMS was intended to achieve. AASHTO generally supports the concept of using the HPMS as a central repository for State DOTs to report data; for FHWA to store and archive the data; and for FHWA to use the data to assess whether significant progress is being made. In this case, however, adjustments are appropriate and needed to reflect the new use of these documents. AASHTO has a number of concerns that need to be addressed if the HPMS system becomes part of larger regulatory requirements.

First, there needs to be a stronger partnership between FHWA and the State DOTs to ensure that appropriate changes to HPMS are made and to protect against any undesirable changes to these data collection tools. Currently, there is no mechanism whereby comments on the referenced documents such as HPMS are formally filed with FHWA or clearly considered by FHWA. AASHTO has provided numerous comments on changes to the HPMS in the past but has not seen many of these comments incorporated into revisions or updates (see Docket FHWA-2006-23638). What the State DOTs have seen is that recent changes to the HPMS have greatly

increased the burdens on the states, but many of the increased workloads have been made in a directive manner rather than in full cooperation with the primary user, the states represented by AASHTO.

Given the importance of data collection to the proposed performance management regime, changes in how data is collected, or changes that increase the amount or types of data to be collected, clearly are potentially important to a state's results for purposes of the rule and simply cannot continue to be handled informally. Accordingly, AASHTO strongly recommends that there be discussion in the final rule that will ensure that future changes to the current items incorporated by reference do not circumvent the rulemaking process and avoid a chance for State DOT input. Second, FHWA needs to preclude itself by rule from making any further changes to HPMS without first providing notice and opportunity for comment.

In addition, concern has been expressed regarding current Chapter 7 of the HPMS Manual. It appears that the requirements proposed, if adopted, will result in changes in how data is submitted, including the separate submission of data for different classes of highway. This does not appear to be captured in the HPMS at this time. FHWA should promptly develop any needed changes to the HPMS manual and issue them for notice and comment.

AASHTO recommends the following as it relates to use of the HPMS:

- **Establish a mechanism for comments, and preferably active consultation with State DOT, before making future changes to the HPMS requirements.** Any changes to the Highway Performance Monitoring System (HPMS) Field Manual or other documents incorporated by reference in the rule should be subject to notice and opportunity to comment and due legal process before directly or indirectly becoming parts of the regulation.
- **FHWA should preclude itself by rule from making changes to the HPMS without first providing notice and opportunity for comment.**
- **Revise the HPMS guide to all English units of measure to eliminate the Metric/English units of measure rounding issues that result in changes to performance levels.**
- **Ensure that all data submission templates are made available to State DOTs with sufficient time to conform state databases to updated templates that are required for performance measure reporting.**

## **11) ENSURE CONSISTENCY IN ADDRESSING THE PERFORMANCE OF THE NHS, CMAQ CONGESTION AND FREIGHT MOVEMENT PERFORMANCE MEASURES**

While one of the emphasis areas in this NPRM is consistency, the proposed rule itself lacks that in several matters. For example, there are significant differences among how the three performance measure areas handle different aspects of the calculations including missing data, speed thresholds, and reliability thresholds. AASHTO believes that if there is more consistency

among the measures this will result in an easier understanding of the performance measures by the general public and reduce the likelihood of making calculation errors.

- **Missing Data and Outliers**—FHWA needs to ensure consistency in addressing both the missing data and the travel time outliers among the performance measures. AASHTO is concerned about the proposed method that would be used to address missing. While some measures need to be replaced with speed-limit-equivalent travel times, other measures require no action. The proposed rule acknowledges that travel time outliers (i.e., speeds less than 2 mph or greater than 100 mph) may be present in the NPMRDS, but does not address these travel time outliers consistently among the calculation procedures. For example, §490.511 requires that travel time outliers be removed for the Peak Hour Travel Time Ratio, yet does not require this outlier removal for the Level of Travel Time Reliability. Similarly, the Truck Travel Time Reliability and Average Truck Speed metrics do not require the removal of travel time outliers. These issues could be mitigated if AASHTO's recommendation concerning improvements to the NPMRDS and use of alternative data sets are addressed. FHWA should also consider the possible unanticipated impacts to performance measures applied to non-Interstate NHS roadways in dense urban areas where actual travel speeds may be exceptionally slow, especially as measured by current NPMRDS data collection methods.
- **Reliability Percentiles**—AASHTO is concerned about the use of either the 80th or 95th percentile travel times for system performance and freight. As proposed, there is significant confusion about the need to manage the same roadway asset to different reliability levels. If freight and cars occupy the same roadway, AASHTO does not understand the goal of holding the freight reliability measure to a higher standard as they are all using the same Interstate System. Additionally, unique operating characteristics for trucks (larger, heavier, slower acceleration/deceleration characteristics, etc.) make achieving this higher standard more difficult. A SHRP 2 research project indicated that the 95th percentile travel times usually involve non-routine events that are difficult to predict and are well outside of an agency's ability to control (for example: extreme weather, law enforcement criminal investigations, and similar events). Research conducted by WSDOT found that the reported average truck speeds in NPMRDS data are more variable than those collected by traditional fixed sensors due to the relatively small sample size of the vehicle probe fleet, biasing the data toward slower moving vehicles. These data limitations cause the travel time distribution curve to be heavily skewed toward longer travel times compared to actual roadway performance. Using the 95th percentile would most likely capture the outliers in the NPMRDS, and overestimate the longest travel times of trucks. AASHTO recommends that FHWA use a single reliability percentile for both the system performance and freight performance measures. Further, AASHTO recommends that the 80<sup>th</sup> percentile be used for both performance of the NHS and freight movement since it is a target that many State DOTs already manage to. Finally, AASHTO recommends that the reliability measures for system performance and freight be calculated the same way for “all vehicles” and “freight” data, with the same thresholds, as the vehicle groups use the same roadway lanes and are part of the same traffic flow.

- **Peak Hour Travel Time**—There are currently six time periods of analyses from which to choose the longest average annual peak hour travel time (6-7 am, 7-8 am, 8-9am, 4-5 pm, 5-6 pm, and 6-7 pm). This means that different reporting segments will have different hours for this metric (even if they are adjacent to one another), and means that the same reporting segment could be based on a different time period from year to year. To avoid the confusing information that might result, AASHTO recommends that there be only three periods of analysis: (1) AM peak (6-10 am), (2) PM peak (4-7 pm), and (3) daily.
- **Days of Analysis**—Days should be grouped similarly (non-holiday weekdays, weekends, and holidays). In addition, FHWA needs to be clear on which days to exclude related to Federal holidays regarding which day the holiday is celebrated versus observed. For example, Christmas is celebrated on December 25 but observed on a Monday or Friday if the date falls on a Sunday or Saturday, respectively.
- **Consistency in Boundaries**—In some instances the NPRM calls for measures based on “FHWA smoothed” urbanized boundaries (or census boundaries if no agreed upon smoothed boundaries exist) and in others for measures on metropolitan planning area boundaries. Further, the urbanized area geography is not well understood and the specific use of it in calculating the proposed measures involves a significant learning curve that will take time to better understand. In addition, FHWA has proposed significant changes to the definition of a Metropolitan Planning Area under the Metropolitan Planning Organization Coordination NPRM. At this time, it is difficult, if nearly impossible, to understand what the consequences of the urbanized areas and MPA definitions will have on target setting and measure calculation. AASHTO urges FHWA to work with the State DOTs and MPOs to better understand the implications one approach will have over another.

## 12) MITIGATE THE RISK OF UNINTENDED CONSEQUENCES SHOULD EPA MAKE CHANGES IN THE ADMINISTRATION OF THE CLEAN AIR ACT

AASHTO is concerned about the potential for unintended consequences should EPA make changes in the administration of the Clean Air Act. The definitions should be revised so that any changes made by EPA in administering the Clean Air Act that would designate additional pollutants would not automatically increase state responsibilities under this rule. Any expansion of requirements should occur only if permissible under statute and if there is new FHWA rulemaking that would be subject to notice and opportunity for comment.

The proposed rule does recognize, in the definition of “criteria pollutant,” that the CMAQ related pollutants are “carbon monoxide, nitrogen dioxide, ozone, and particulate matter (PM10 and PM 2.5).” However, as worded “criteria pollutant” is broader than just the transportation related criteria pollutants. The rule should be crafted to limit defined pollutants to those identified CMAQ related pollutants and not include broader definitions that have the potential to expand burdens under this rule due to actions by another agency (EPA) finding some other source to be a pollutant.

AASHTO recommends the following as it relates to the definitions associated with the EPA and Clean Air Act:

- **The definition of “criteria pollutant” should be revised so that it is limited to the specified transportation related criteria pollutants. Specifically, delete all words after “means” until the words “carbon monoxide”.**
- **The definitions of “attainment area,” “maintenance area,” and “nonattainment area” should be revised.** Add a phrase at the end of each definition such as “provided, for purposes of this part, the term applies only with respect to the pollutants listed in this part as ‘criteria pollutants.’” This would assume that the definition of criteria pollutants is revised as suggested above so that it is limited to the transportation related criteria pollutants.
- 490.105(e)(9)(ii) should be modified by striking “precursors” at the end and substituting “precursors specified in 490.803”. The preceding clause, 490.105(e)(9)(i), limits target-setting for applicable criteria pollutants to those specified in 490.803 and precursors. Without this change there is risk that the provision would require target setting on a larger group of pollutants than specified CMAQ pollutants and precursors.

### **13) MAKE REPORTING AREAS CONSISTENT BETWEEN CMAQ CONGESTION AND ON-ROAD MOBILE SOURCE EMISSIONS PERFORMANCE MEASURES**

As proposed, this provision (Subpart H, see proposed 490.803) concerns the relationship between expenditures from apportionments for the CMAQ program and certain emissions reduction. In the CMAQ section, 23 USC 149, Congress clearly provided a number of states (formerly known as CMAQ minimum apportionment states) with the ability to spend at least some CMAQ apportionments on projects eligible under the STP program. The CMAQ performance measure requirement, 23 USC 150(c)(5), is “for the purpose of carrying out section 149.” So, to better reflect the terms of section 149, the rule should not require data reporting as to flexible CMAQ funds, as part of an effort to measure emissions reduction. This could easily lead to informal pressure on states to choose to forego the flexibility provided by Congress and, instead, dedicate flexible CMAQ funds to projects as if the funds were not flexible. However, FHWA cannot undo in this rule or elsewhere flexibility in the use of CMAQ funds provided to States by Congress. Accordingly, 490.803 and any other relevant portion of Subpart H should be modified to limit its application only to the use of non-flexible CMAQ funds.

Further, the requirement in subpart H should be limited, like the congestion measure (see proposed 490.703), to urbanized areas with a population of over one million that are in nonattainment or maintenance status for listed pollutants. Proposed section 490.803 and any other relevant portion of Subpart H should be modified accordingly. Such a modification would be consistent with congressional intent, where the requirement to prepare a CMAQ performance plan is limited to MPOs serving areas of over one million in population. See 49 USC 149(l). Moreover, the authorization of Federal performance management requirements for on road mobile source emissions in 23 USC 150(c) is described as “for the purpose of carrying out section 149.” See 23 USC 150(c)(5). Within 23 USC 149 Congress specifically limited CMAQ performance plan requirements to the areas of over one million in population, amending earlier

versions that would have extended the requirements to additional areas<sup>2</sup>. Further, outside of large metropolitan areas, non-attainment is far less likely to result from “on-road” emissions than from dust or combinations of emissions with geographic features (e.g., valleys) that cannot be changed.

AASHTO recommends the following as it relates to the applicability of the CMAQ On-Road Mobile Source Emissions Measure:

- **Limit the CMAQ On-Road Mobile Source Emissions Measure to urbanized areas with a population of over one million that are in nonattainment or maintenance status for CMAQ related criteria pollutants.** This would make consistent between the CMAQ measures which areas have to establish targets for all of the CMAQ measures.
- **23 CFR 490 Subpart H should be modified to limit its application only to the use of non-flexible CMAQ funds.**

#### **14) MAKE IMPROVEMENTS TO THE CMAQ PUBLIC ACCESS SYSTEM**

As mentioned in the NPRM, FHWA has acknowledged that the quality of the data and the quantitative emission estimates need to be improved in the Public Access System (PAS) system to meet the performance plan requirements included in this rulemaking; however, the specific improvements and the tool kit to assist in quantifying emissions has yet to be released. Since the PAS system is essentially a “read-only” version of the User Profile and Access Control System (UPACS) that MPOs use to enter CMAQ project and emissions data, it is assumed the same issues in UPACS are present in PAS. Although the UPACS system has evolved to what it is today, and is sufficient to report general trends, with this NPRM putting more reliance on information within the UPACS/PAS, the UPACS/PAS needs significant improvements prior to any use national or state-level decision-making. Current deficiencies in the UPACS to meet the requirements of this rulemaking include:

- Emissions estimates are based on funding expenditures, not when a project is operational.
- Intention of UPACS is to track if a CMAQ project demonstrates emission benefits, not whether or not those benefits meet a certain target in the future.
- Current protocol retains initial emissions estimates and is not changed over time with updated emission factors.

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<sup>2</sup> When MAP-21 was first introduced in the 112<sup>th</sup> Congress as S. 1813, it called for all States to prepare CMAQ performance plans. In S. 1813 as introduced, the planning section included material requiring all states to prepare CMAQ performance plans in accord with 23 USC 149(k) (which became 149(l) in the final legislation). See page 309, line 16 of S. 1813 as introduced. During markup of the legislation by the Environment and Public Works Committee, the requirement that States prepare performance plans in accord with section 149(k) of title 23 was dropped. Similarly, in S. 1813 as introduced, by means of a reference to 23 USC 149(k), all MPOs were required to prepare CMAQ performance plans. See page 273, lines 8 and 22 of S. 1813 as introduced. That requirement was modified during committee markup by inserting the phrase “where applicable”, thereby limiting the requirement to prepare CMAQ performance plans to those MPOs serving areas with a population of over one million and also representing a nonattainment or maintenance area.

- For the first performance report will the emissions reduction assigned at the time the project was entered be the target value, or will the projects need to be recalculated using current emissions modeling, emission factors, etc. to determine if the target was met?
- Inconsistent per project category emissions estimates from region to region. Emissions estimates computed based on different methodologies across the country.
- Current protocol requires a daily emissions estimate in kg and this NPRM suggests tons per year. Suggest changing current protocol from the metric system (kg/day) to Standard (lbs./day) for consistency to life of the project cost effectiveness.
- Inability to de-obligate an entry.

Further, the CMAQ measure should be aligned to current CMAQ reporting requirements, practices, and data systems until FHWA can develop better reporting tools and metrics to determine the effectiveness of CMAQ funds at reducing emissions and track which projects offer the most benefits. As proposed, however, the rule would require extracting the relevant projects from the database and summing emissions reductions. AASHTO would be concerned should the database systems be consolidated to reduce redundancy and unnecessary workload on State DOTs staff. This viewpoint is consistent with the Consistency with Current CMAQ Reporting Requirements and Practices viewpoint discussed on p. 23817 of the preamble, and the first measure discussed as an option on p. 23829. Further, AASHTO requests that State DOTs be given discretion to determine if quantitative CMAQ reporting be required. The proposed rule seeks ideas on dealing with missing data—having the opportunity to update information is good, but the State DOTs do not want to have to update if it is determined that it is not a good use of resources.

## **15) INCLUDE WAIVER AUTHORITY IN THE RULE**

Given that it took FHWA nearly four years from passage of MAP-21 to develop this proposed rule, and given the scope of AASHTO's comments, there is no question that new 23 CFR part 490, National Performance Management Measures, is a complex and multi-faceted rule. Moreover, it will be applied across the country, in all states, impacting a vast array of factual conditions.

The rule should recognize that its drafters, even after consideration of comments from AASHTO, States, and others, are unlikely to have taken into account all the circumstances that may emerge as States and MPOs work to implement this complex and multi-faceted rule.

Because it is foreseeable that there will be unanticipated or unusually difficult circumstances in the implementation of this new part of the CFR, FHWA should build a waiver provision into the rule itself, probably in subpart A.

It could simply provide along the following lines:

*“490.13. Waivers and Extensions.*

*To the extent not prohibited by statute, FHWA may waive provisions of part 490, in whole or part, with or without time limits or other conditions, and/or extend deadlines, for good cause shown.”*

FHWA could decide not to grant waivers. But establishing the authority would be a prudent step to avert unanticipated or harsh outcomes that may not be readily anticipated at the rule drafting stage, particularly if the context is a solid effort at compliance by an MPO or state that is seeking the waiver or extension, perhaps only for a modest time period or with respect to a small aspect of the rule.

## SECTION-BY-SECTION COMMENTS

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### **490.101 DEFINITIONS**

Unless otherwise stated below, AASHTO generally agrees with the definitions included in this section.

#### *FREIGHT BOTTLENECK*

AASHTO recommends the term be changed to "truck freight bottleneck" for clarification since it only applies to truck traffic, and not to other modes such as rail or waterway. Further, AASHTO recommends that the final rule delete the proposed binding bottleneck threshold set forth by FHWA (50 mph) and, instead, provide for State DOTs to define and identify truck freight bottleneck locations, after considering any non-binding bottleneck threshold suggested by FHWA as well as applicable local conditions. AASHTO notes that segments of the Interstate System not meeting thresholds for truck freight congestion specified by FHWA might not actually be bottlenecks.

#### *HIGHWAY PERFORMANCE MONITORING SYSTEM (HPMS)*

The definition of "Highway Performance Monitoring System (HPMS)" should be revised to refer to the HPMS system as it is in effect on the date of the issuance of the NPRM. Since HPMS has, in effect, become a factor in the application of the rule, it should be more precisely defined and its meaning not allowed to change absent further rulemaking with a notice and opportunity for states and others to comment.

#### *MAINLINE HIGHWAYS*

AASHTO supports the definition of "Mainline Highways" and the exclusions set forth in the definition of "mainline highways," so that highways are addressed in the rule as travel lanes only, not as including off ramps, etc. AASHTO would like to see this definition retained in the final rule.

AASHTO is concerned that states will need to do significant work conflating the NPMRDS in order to exclude the ramps, shoulders, turn lanes, etc. The NPMRDS is sometimes accurate in correctly using "I-" to begin route number designations, but this is not always the case. Thus, there is no systemic method for excluding these segments, and to ensure accuracy the data set would have to be conflated or each State DOT would need to manually check every TMC segment to make sure a non-mainline segment has not been included. As discussed in the principal comments, *The NPMRDS Is a Good Resource But Significant Challenges Remain if it is to be Used for National-level Reporting* and Appendix A, AASHTO has made a number of recommendations to improve the overall usability of the NPMRDS.

#### *NON-URBANIZED AREA*

AASHTO supports the definition of "Non-Urbanized Area". AASHTO would like to see this definition retained in the final rule.

#### *REPORTING SEGMENT*

The definition of “reporting segment” assumes that States and MPOs will agree on such segments. Likely they will in most cases. However, the implementation of the rule would be simplified if there is a default solution in the absence of agreement. Thus, the definition could be revised to say that a reporting segment is the segment set forth in the NPMRDS data set provided by FHWA (or an alternate data set used by the State) unless the state and any applicable MPO determine otherwise. Inserting the concept of an “applicable” MPO is also important as an MPO should not have authority to play a role in deciding segment size for areas outside of the geographic area served by the MPO. This is consistent with the use of the term “applicable” in proposed 490.103(e). The definition should also be clear that, outside of an urbanized area, a state could establish a reporting segment greater than 10 miles in length.

Furthermore, the mandated maximum length of reporting segments (1/2-mile in urbanized areas, 10 miles in non-urbanized areas) for a reliability measure are not consistent with prevailing practices (i.e., SHRP 2 Reliability Program) in calculating travel time reliability measures. The main principal behind travel time reliability is to measure the travelers’ experience with consistency of trip travel times, which translates to longer reporting segments that are more comparable to typical traveler trip lengths. For example, TxDOT uses reporting segments that typically are about 5 miles in urbanized areas and about 10-20 miles in length in non-urbanized areas. Further, it has been shown that reporting segment length can make a significant difference when computing the percentiles used in reliability measures. That is, even though travel times on short congested road segments can be highly reliable, other parts of a traveler’s trip tends to normalize (reduce) this high unreliability for the short segment. Therefore, a reliability measure that uses very short reporting segments is more likely to inflate the level of unreliability beyond that experienced by travelers or shippers.

#### **490.103 DATA REQUIREMENTS**

(c) The proposed rule requires that targets be established for the CMAQ measures for non-attainment or maintenance areas designated as of the date for submitting the baseline performance report. With new ozone standards in the process of being implemented, this could prove problematic in a number of cases. The rule should build in a later deadline for such cases and also specific authority for a waiver to be granted to affected states and MPOs in terms of deadlines—when an area is newly designated as nonattainment, so that it can have more time in setting targets relevant to the affected area.

(e) AASHTO supports FHWA’s intent to use the NPMRDS and make it available to State DOTs and MPOs to use to calculate the performance measures. However, AASHTO has provided a number of suggestions to improve the overall usability of the NPMRDS. See the principal comments section: *The NPMRDS Is a Good Resource But Significant Challenges Remain if it is to be Used for National-level Reporting*. AASHTO also supports allowing a state to use an alternate data set and not requiring reporting on non-Interstate NHS routes in non-urbanized areas.

(f) AASHTO is concerned about the requirement that State DOTs and MPOs must agree on the identification of a single set of reporting segments on the Interstate System and non-Interstate

NHS. This is an issue in 490.103(e), (f) and (g). While AASHTO believes that agreement will likely occur, absent agreement, there should be a default solution applying the NPMRDS data set and segments provided by FHWA. This wording should be addressed throughout the rule, notably in 490.509(a)(1), 490.609(b) and 490.709(b). Without a practical default solution standing behind efforts to coordinate, there is a risk of endless coordination bogging down efforts to implement whatever is in the final rule.

#### ***490.105 ESTABLISHMENT OF PERFORMANCE TARGETS***

(e)(1) There seems to be a typo in 490.105(e)(1); accordingly, strike “1 year of” and substitute “1 year after”. Beyond that correction, the time frame of the requirement for target setting should be extended beyond one year after the effectiveness of the rule, effectively providing states more time to become facile with the new NPMRDS data set.

(e)(3) FHWA has asserted that if states engage in setting non-required targets, they must report to FHWA in FHWA approved formats. As a result of this approach, in order to avoid needless FHWA regulation, states that desire to undertake such additional planning are left with having to find a way to engage in the additional planning without using the word “target” (or perhaps even the words “measure” or “performance management”) to describe the work in order to be able to take other steps that are relevant for its own needs without being subject to FHWA recordkeeping and other regulatory requirements with respect to this self-initiated work. Thus, AASHTO recommends that FHWA strike (i), (ii), (iii), (iv), and (v) and make any other needed modifications so that the regulations do not discourage a State DOT from establishing additional targets or undertaking additional performance management.

(e)(4)(i) AASHTO supports the requirement to provide performance analysis for system performance, freight, and excessive delay measures based on calendar years and the on-road mobile source emissions measures based on federal fiscal years. The CMAQ on-road mobile source emissions measure would not involve the NPMRDS, and the separate analysis timeline aligns with current CMAQ reporting.

(e)(7) AASHTO supports the phasing in of the non-Interstate NHS reliability measures due to missing NPMRDS data. This approach will allow FHWA or State DOTs to absorb the workload to complete analyses for biennial reports and understand the implications of the data issues during the first reporting cycle. However, AASHTO suggests that all measures proposed in this rule be considered for phase-in until the dataset’s coverage issues are resolved. Further, as noted above, AASHTO supports limiting the non-Interstate NHS data requirements to urbanized areas. That would greatly ease the data burden on states and not detract from the heart of the effort, which is congestion related.

(e)(9)(ii) This section should be modified by striking “precursors” at the end and substituting “precursors specified in 490.803”. The preceding clause, 490.105(e)(9)(i), limits target-setting for applicable criteria pollutants to those specified in 490.803 and precursors. Without this change there is risk that the provision would require target setting on a larger group of pollutants than specified CMAQ pollutants and precursors.

(e)(9)(iii) By requiring the targets for mobile emissions to “reflect” the anticipated reductions, the NPRM inappropriately and impractically limits the flexibility it provides to state DOTs in establishing targets. The final rule should be revised to clearly provide for flexibility in establishing targets for mobile emissions, which may include but should not be restricted to reflect the anticipated reductions. Without this flexibility, targets based on modeled estimates would be subject to change whenever EPA updates its emission model (as the emission estimates tend to change with each estimate, including to lower values), modeling inputs such as regional fleet registration distributions change (even if the project scope and schedule do not change), and/or there are unavoidable changes to the project.

#### **490.107 REPORTING ON PERFORMANCE TARGETS**

(a)(3) AASHTO is very concerned about the overall design/usability of the electronic template that will be provided by FHWA. AASHTO recommends that FHWA establish a formal review panel comprised of State DOTs and MPOs (those agencies that will be using the reporting template) to provide input and advice on the overall usefulness and usability of the electronic reporting template. The template should be provided to states with sufficient time for coordinating changes to state data bases and data management functions to assure the timely submission of required performance measure reports.

(a)(4) AASHTO recommends that FHWA delay the date of the Initial State Performance Report until at least October 1, 2018. AASHTO believes that the intent of Congress on writing MAP-21 was to have a baseline report soon after the national-level performance measure rules had been finalized. A date of October 1, 2016 is too early in the process for any type of substantive reporting by the State DOTs or USDOT in implementing the MAP-21 performance management requirements.

(a)(4)(iv) This section carries forward requirements from MAP-21 that states include the ways in which they are “addressing congestion at freight bottlenecks, including those identified in the National Freight Strategic Plan.” Section 490.101 proposes to define freight bottlenecks as segments of the Interstate System that do not meet thresholds for freight congestion and reliability specified by FHWA – a definition that AASHTO seeks to modify (see comments, above). However, the NFSP includes a much different definition of bottleneck, which is far broader, and actually re-defines bottlenecks to include not only infrastructure bottlenecks, but also institutional bottlenecks, and financial bottlenecks. Including a discussion of these types of bottleneck in the required performance reports seem inappropriate and overly burdensome. The final rule should much more clearly articulate that the only bottlenecks to be addressed in performance reports are those to which the specific performance measures apply.

(b)(1)(ii)(C) AASHTO disagrees with the proposal to require that State DOTs discuss how established targets in paragraph 490.107(b)(1)(ii)(A) support expectations documented in longer range plans. In many instances, there may be states that do not have an asset management plan or a long-range statewide plan updated by October 1, 2018, especially because the FHWA rules for these plans have not been finalized. AASHTO suggests deleting 490.107(b)(1)(ii)(C) as 23 Sec 135 already requires the asset management plan and long-range statewide plans to include a description of the performance measures and targets used and to include a report.

(b)(1)(ii)(F) AASHTO supports the concept that multimodal freight performance should be considered in transportation planning and programming efforts and submits that the issue is addressed satisfactorily in planning rules, warranting deletion of this provision. Freight bottlenecks can be multimodal and multifaceted, and each state may use a different approach to define, identify and classify freight bottlenecks and consider them in planning. Moreover, State DOTs should not be required to address freight bottlenecks as part of the National Strategic Freight Plan since the draft National Strategic Freight Plan did not identify specific locations of freight bottlenecks nationwide. Again, there is no need to add this provision to FHWA's already voluminous regulations; this issue is satisfactorily addressed in the planning process.

(b)(1)(ii)(H) AASHTO recommends that individual MPOs that are required to develop the CMAQ performance measures submit their MPO CMAQ Performance Plan directly to FHWA.

***490.109 ASSESSING SIGNIFICANT PROGRESS TOWARD ACHIEVING THE PERFORMANCE TARGETS FOR THE NATIONAL HIGHWAY PERFORMANCE PROGRAM AND THE NATIONAL HIGHWAY FREIGHT PROGRAM***

(b) The FHWA requested comment on whether it should require State DOTs to more frequently (e.g., annually) evaluate and report the progress they have made. AASHTO opposes a higher frequency for national-level mandatory reporting since much of the data will show no significant difference year-to-year. Many state DOTs already conduct their own annual system performance analysis, and the additional federal reporting requirement would require additional state resources.

(e)(5) AASHTO supports the concept of allowing State DOTs to give weight to extenuating circumstances in their assessment of progress towards the achievement of targets. AASHTO suggests that a fourth reason be added, related specifically to insufficient funding at the federal, state or local level.

(f) This section specifies the requirements state DOTs must satisfy should their performance report show that significant progress has not been made for the established targets. For several performance targets (as specified in 490.109 (f)(1)(i), (ii), and (iii)) if significant progress is not made, the state DOT is to document the actions they will take to "improve" the Interstate pavement conditions, non-Interstate pavement conditions, and NHS bridge conditions. State DOTs should only be required to document actions to "achieve targets", not to "improve" conditions, since they may not have the resources necessary to invest enough to actually improve conditions. Additionally, AASHTO emphasizes that there should be no penalty associated with not meeting targets beyond what is required by law.

***490.111 INCORPORATION BY REFERENCE***

AASHTO has no comments on this section.

## **SUBPART E—NATIONAL PERFORMANCE MANAGEMENT MEASURES TO ASSESS PERFORMANCE OF THE NATIONAL HIGHWAY SYSTEM**

### **490.501 PURPOSE.**

In the preamble of the NPRM, FHWA suggests that the development and implementation of these Federal performance measures will result in a significant reduction in congestion.

AASHTO disagrees; Federal performance measures and management alone will not result in a reduction in congestion. Addressing congestion (whether to reduce it or to mitigate increases) requires a certain level of funding to build new capacity, provide alternative modes, or implement demand management approaches and not simply measuring performance via a select few national-level performance measures. Moreover, states are already aware of congestion within their borders. FHWA should not presume that there is no strategic effort to address congestion (or any other issue) just because there is not a Federal rule in place.

### **490.503 APPLICABILITY.**

(a)(1) As explained at length above in the principal comment, *Do Not Overregulate By Imposing Congestion Measurement and Management Requirements For Rural Uncongested Areas*, AASHTO recommends that 490.503(a)(1), regarding the reliability measure, be revised to apply only to the Interstate System and to that portion of the non-Interstate NHS that is in urbanized areas. As a conforming change, in section 490.507(a)(2), the reliability measure should be revised so that it does not apply to the entire non-Interstate NHS but only to the “non-Interstate NHS in urbanized areas”. An acceptable variation on this proposal would specify that the reliability measure would not apply to the non-Interstate NHS in non-urbanized areas to the extent that the State, in its discretion, certifies that the non-urbanized, non-Interstate NHS (or segments of it) in the State are not subject to congestion except under unusual circumstances. Simply, those roads are not congested, making all the data collection and other work associated with imposing the reliable travel times requirements with respect to those roads highly burdensome and essentially without benefit. The rule must be more focused.

(a)(2) AASHTO recommends that the final rule continue to limit the applicability of the PHTTR (if the measure is retained) to urbanized areas of over one million, as proposed in the NPRM. This limits the peak hour travel time measure to NHS mainline highways within the boundary of an urbanized area with a population of over one million. This is consistent with congressional intent, where the requirement to prepare a CMAQ performance plan is limited to MPOs serving areas of over one million in population (see 49 USC 149(l)). It also properly limits the burden of compliance to those areas most likely to experience reduced travel times in peak hour travel periods.

### **490.505 DEFINITIONS.**

#### *Desired Peak Period Travel Time*

AASHTO supports the concept of State DOTs and MPOs working together to establish a desired peak period travel time that may be unique to an individual community or roadway segment. However, AASHTO has concerns about the significant work that will be required to coordinate with, potentially, multiple MPOs and State DOTs in certain regions. See the principal comments section: *The Proposed Rule Rests on a Foundation that Greatly Overestimates Its Benefits and Greatly Understates Its Costs* and comments under 490.103(f).

#### *Level of Travel Time Reliability*

AASHTO supports the 80<sup>th</sup> percentile travel time as a way to gauge operational strategies compared to that for the normal travel time-- as the agency can make more of an impact with operational strategies at the 80th percentile travel time. AASHTO also agrees with the 50th percentile travel time as a normal travel time measure for this analysis if missing data is consistently replaced with historic data.

### **490.507 NATIONAL PERFORMANCE MANAGEMENT MEASURES FOR SYSTEM PERFORMANCE.**

AASHTO has two significant concerns with this section. First, and as explained at length in principal comment (4), and noted above regarding section 490.503, the reliability measure should not apply to the non-Interstate, non-urbanized NHS. Simply, those roads are not congested, making all the data collection and other work associated with imposing the reliable travel time requirements with respect to those roads highly burdensome and essentially without benefit. Second, AASHTO has concerns about the performance metrics used to calculate the reliability and PHTT measures (see discussion below regarding proposed 490.511).

### **490.509 DATA REQUIREMENTS.**

(b) Allow States the option to use an historical data replacement methodology, as well as the option to use the speed limit, to impute incomplete or missing data. See the principal comments section: *Significant Challenges Remain if the NPMRDS is to be used for National-level Reporting.*

### **490.511 CALCULATION OF SYSTEM PERFORMANCE METRICS.**

AASHTO has significant concerns and recommendations on how to improve the system performance metrics identified in this section. See the principal comments section: *Calculation Methods and Data Requirements Are Overly Complex, Burdensome and Costly; Do Not Provide Meaningful Benefit; and Do Not Align with Nationally Accepted Practices.*

### **490.513 CALCULATION OF SYSTEM PERFORMANCE MANAGEMENT MEASURES.**

AASHTO has significant concerns and recommendations on how to improve the system performance management measures identified in this section. See the principal comments section: *Calculation Methods and Data Requirements Are Overly Complex, Burdensome and Costly; Do Not Provide Meaningful Benefit; and Do Not Align with Nationally Accepted Practices.*

## **SUBPART F—NATIONAL PERFORMANCE MANAGEMENT MEASURES TO ASSESS FREIGHT MOVEMENT ON THE INTERSTATE SYSTEM**

### **490.601 PURPOSE.**

AASHTO notes that the proposed metrics reflect only a small portion of the multimodal freight system. While the measure can provide some baseline information about truck movement on the interstates, it is not a comprehensive measure of freight movement, which is multimodal, and even for trucks, uses a network that extends well beyond the interstates. For example, congestion and reliability on the first and last mile of a trip and on intermodal connections with freight facilities such as seaports, airports, inland ports, land Ports of Entry, are not reflected in these measures. AASHTO is NOT recommending that additional freight measures be added to account for the multimodal nature of freight. However, it should be recognized that the measures in this subpart will only tell a small portion of the story.

### **490.603 APPLICABILITY.**

AASHTO supports this section. Requiring application of the requirements of this subpart beyond the Interstate System would extend beyond what is required in law and would be burdensome. In addition, it would be challenging to consider multimodal freight performance measures in the transportation planning process since rail, waterways, and airway modes are privately owned and generally performance information is proprietary. This approach would put undue burden on State DOTs.

### **490.605 DEFINITIONS.**

Clarification of “freight” and “truck” definitions is needed. It appears that the NPRM refers to freight and trucks as those vehicles which are defined as trucks by the NPMRDS dataset. However, there is uncertainty about what exact mix of vehicles is in the NPMRDS and how it could change over time. It is recommended that FHWA determine exactly what type of vehicle classes it wants classified as freight or trucks. This could be heavy vehicles (FHWA classes 4-13), trucks (FHWA classes 5-13), or combination trucks (FHWA classes 8-13). It is recommended that FHWA define freight as combination trucks (FHWA classes 8-13), as that group of vehicles is representative of most significant freight activity along the Interstate System. FHWA could then require that the NPMRDS dataset include only those freight or truck vehicles that fit FHWA’s precise definition.

### **490.607 NATIONAL PERFORMANCE MANAGEMENT MEASURES TO ASSESS FREIGHT MOVEMENT ON THE INTERSTATE SYSTEM.**

(a) AASHTO does not agree with the proposal to use the 95th percentile travel time for freight in place of the 80th percentile travel time for the calculation of the Percent of the Interstate System Mileage providing for Reliable Truck Travel Times (see 490.611(b)(2)). AASHTO agrees with FHWA in their discussion of using the 80<sup>th</sup> percentile for passenger cars and believes the same reasoning applies to the freight reliability threshold as well. See the principal comments section: *Ensure Consistency in Addressing the Performance of the NHS, CMAQ Congestion and Freight Movement Performance Measures.*

#### **490.609 DATA REQUIREMENTS**

(a) AASHTO has specific concerns about the NPMRDS as discussed in the principal comment: *The NPMRDS is a Good Resource but Significant Challenges Remain if it is to be Used for National-Level Reporting.*

(b) AASHTO has specific concerns about defining reporting segments as discussed in the principal comment: *Take a Straightforward Approach to Implementation of the Performance Measures.*

(c)(1) AASHTO agrees with FHWA in that when truck travel times are missing from the Travel Time Data Set, they should be replaced with an observed travel time that represents all traffic on the roadway during the same 5-minute bin. Because trucks are moving in the same traffic flow as cars, the observed travel time for all traffic is a reasonable estimate for truck travel time for the same 5-minute bin. However, there are occasions when oversize/overweight (OSOW) truck traffic does not operate the same as regular freight traffic. OSOW loads typically travel at lower speeds due to load size, permit conditions, much more constrained routes/turning radius, etc. Furthermore they are often required to slow to 5MPH when crossing many structures. FHWA should provide flexibility to the State DOTs to address situations like this when they are evident in the data.

(c)(2) Allow States the option to use a historical data replacement methodology, as well as the option to use the speed limit, to impute incomplete or missing data. See the principal comments section: *Significant Challenges Remain if the NPMRDS is to be Used for National-level Reporting.*

#### **490.611 CALCULATION OF FREIGHT MOVEMENT METRICS.**

(a) AASHTO supports FHWA's focus on both truck travel speeds and the travel time reliability for truck travel as Interstate System freight performance measures. Alone, truck travel speeds do not necessarily tell us how well the system is performing for trucks, other than to tell us they are moving slowly in urban areas. Reliability for truck travel is frequently a more important metric.

(b)(2) AASHTO agrees with FHWA in using the 50<sup>th</sup> percentile travel time as the normal truck travel time for the reliability metric calculation. The 50<sup>th</sup> percentile provides a better measure of central tendency of the typical travel time compared to average travel time once missing data is replaced. AASHTO does not agree with FHWA in the use of the 95<sup>th</sup> percentile truck travel time for the truck reliability measure. See the principal comments section: *Ensure Consistency in Addressing the Performance of the NHS, CMAQ Congestion and Freight Movement Performance Measures.*

#### **490.613 CALCULATION OF FREIGHT MOVEMENT MEASURES.**

(a) AASHTO supports FHWA's proposed freight measures being calculated based on the length of roadway segments, and not factor in truck volume. The proposed measures, percent of the Interstate system mileage providing for reliable truck travel times and percent of the Interstate system uncongested, are calculated based on the length of roadway segments, and do not capture the weight of truck volumes in the results. AASHTO supports using this simple and straightforward mileage-based approach, which would make it easier for states to compute the

freight measures and comply with reporting requirements. Introducing truck volumes into the freight measures would create significant additional work for states to interpolate and estimate truck volume data for every TMC segment and every 5-minute bin.

(c) AASHTO does not support the 50mph speed threshold to define congested conditions for freight movement. First, the threshold infringes on the authority of State DOTs to establish targets since the minimum threshold could be perceived as a minimum “target” that State DOTs must meet. Second, considering freight characteristics, 50mph for this definition is unrealistically high. The speed of freight vehicles can be affected by a number of external factors: congestion (too much traffic), geography (hills/mountains), roadway geometry, and technology or regulatory requirements (e.g., variable speed limits). States need to be able to account for these factors when determining whether or not a roadway segment is congested. Finally, the 50 mph threshold appears arbitrary and does not account for any of these external factors. For example, due to design limitations some portions of the Interstate system in urban areas have a posted speed limit of 55 mph or less, meaning a slowdown of approximately 5mph will be considered congested. AASHTO recommends that FHWA give State DOTs flexibility in defining the congestion threshold for freight.

AASHTO believes that states should have the flexibility to have locational thresholds. The rule should allow flexibility for stretches of the NHS that slow truck traffic. A lower speed doesn't necessarily equate to a less reliable or congested section of NHS. This should take into account both horizontal and vertical alignments and geometric constraints. Examples would be mountain passes and canyon stretches of NHS. The threshold could be a function of population density, lanes, ADT, posted speed limit, or something similar to reflect conditions within individual states. Further, freight performance metrics and measures should be identical with the system performance measures, as all vehicle share the same roadway and experience similar traffic conditions. Reporting the freight movement differently from all vehicle movement could be as confusing.

## **SUBPART G—NATIONAL PERFORMANCE MANAGEMENT MEASURES FOR ASSESSING THE CONGESTION MITIGATION AND AIR QUALITY IMPROVEMENT PROGRAM—TRAFFIC CONGESTION**

### **490.701 PURPOSE.**

AASHTO has no comments on this section.

### **490.703 APPLICABILITY.**

AASHTO would like to see the final rule continue to limit the applicability of the excessive delay measures to urbanized areas of over one million that are in nonattainment or maintenance, as proposed in the NPRM. This limits the congestion measure to urbanized areas with a population of over one million, which are in nonattainment or maintenance status for pollutants expressly listed in 23 USC 149 and proposed 490.101 definition of “criteria pollutant.” This is consistent with congressional intent, where the requirement to prepare a CMAQ performance plan is limited to MPOs serving areas of over one million in population (See 49 USC 149(l)). It also properly limits the burden of compliance to those areas most likely to experience traffic congestion. Further, AASHTO would recommend limiting the traffic congestion measure to only large urban areas with maintenance or nonattainment areas that have on-road mobile sources as a major contributor. For example, an urbanized area should not have to implement this measure because of a PM2.5 problem in one area that is primarily caused by wood smoke or desert dust.

### **490.705 DEFINITIONS.**

#### *Excessive Delay*

AASHTO disagrees with the 35mph and 15mph speed thresholds for the excessive delay measure calculation. Not all roadways are built to handle traffic in the same manner. When establishing and enforcing minimum speed thresholds in the final rule, AASHTO strongly recommends that FHWA take into consideration the need to adopt minimum speed thresholds based on a variety of factors and not just a flat minimum threshold. The variety of factors includes issues such as urban vs. rural areas, functional class, geometry, seasonality, terrain, major construction zones, etc. Across states and even within states, Interstate and non-Interstate roadways often have different speed limits or varying number of traffic controls and pedestrian crossings on rural arterials, for example. Aggregation of total excessive delays nationwide would not have reasonable meaning using these thresholds.

Further, AASHTO disagrees with splitting out the speed thresholds by different functional class split than other measures in this proposed rule. Splitting out the subpart G delay calculation by Interstate/freeway/expressway (functional classes 1 and 2) is inconsistent with the Interstate-only (functional class 1) split for subpart E and subpart F. The method proposed in this rule would require functional classes to be identified and assigned or joined to the links in order to apply the volume thresholds, which would require conflation by each state and would be a monumental task. AASHTO requests that FHWA use consistent categories for performance measures so that data preparation can be standardized.

## **490.707 NATIONAL PERFORMANCE MANAGEMENT MEASURE FOR TRAFFIC CONGESTION.**

In the preamble, FHWA states that “Use of an excessive delay measure relates to the widespread use of delay-related metrics to justify congestion-related CMAQ projects, an important consideration when looking at what projects will help meet targets...” AASHTO believes linking the measure to funding too closely could negatively change how states and municipalities fund or prioritize projects. An example would be focusing a project on a reporting segment that is just slightly over the set thresholds instead of the areas that need it the most in order to impact the final number of hours of excessive delay. Further, the CMAQ Congestion performance measure is not focused solely on CMAQ projects but on the performance of the entire NHS, which is supported by the states with investments principally from aspects of the highway program other than the CMAQ program (e.g., NHPP and STP block grant).

## **490.709 DATA REQUIREMENTS**

AASHTO has significant concerns and recommendations on how to improve the ability of State DOTs and MPOs to calculate the system performance metric and measure identified in this section. See principal comments section: *Calculation Methods and Data Requirements Are Overly Complex, Burdensome and Costly; Do Not Provide Meaningful Benefit; and Do Not Align with Nationally Accepted Practices.*

## **490.711 CALCULATION OF CONGESTION METRIC.**

AASHTO has significant concerns and recommendations on how to improve the ability of State DOTs and MPOs to calculate the system performance metric and measure identified in this section. See principal comments section: *Calculation Methods and Data Requirements Are Overly Complex, Burdensome and Costly; Do Not Provide Meaningful Benefit; and Do Not Align with Nationally Accepted Practices.*

(a)(3) AASHTO recommends that FHWA improve upon the hourly volume estimation as proposed. The estimated data will not be entirely sufficient in determining delay. Currently volumes are only estimated at specific points on the roadways, and reported as a daily figure. Applying these volumes at a granular level as the NPRM proposes—to other nearby TMCs and attempting to distribute it among the 5-minute bins—could produce inaccurate results. AASHTO suggests FHWA take the AADT information from each state’s HPMS submittal and develop traffic volume profiles by time of the day and day of the year at a 5-minute bin level for each reporting segment. This would greatly reduce the analytical resource burden in imputing the traffic volumes from AADT (which are estimates to begin with) and would provide consistent methodology and confidence for FHWA in the metric calculation due to different levels of states’ technical expertise. This task would also help FHWA to generate the conflation process between NPMRDS and HPMS volume datasets that would provide computational capabilities at a 5-minute bin level. Because there is no coordination required for State and MPOs to decide upon a threshold for baseline calculation purposes, this is a measure that FHWA can take upon itself to calculate nationwide in a consistent manner.

## **490.713 CALCULATION OF CONGESTION MEASURE.**

AASHTO has significant concerns and recommendations on how to improve the ability of State DOTs and MPOs to calculate the system performance metric and measure identified in this

section. Please see principal comments section: *Calculation Methods and Data Requirements Are Overly Complex, Burdensome and Costly; Do Not Provide Meaningful Benefit; and Do Not Align with Nationally Accepted Practices.*

(b) The “per Capita” denominator of the Excessive Delay per Capita measure inaccurately assigns Excessive Delay to all people in an urbanized area, rather than just the highway drivers that are affected. This produces misleading measure values when comparing urbanized areas that have much different mode splits (say New York City or Washington DC as compared to Houston or Dallas). Further, urbanized areas with high levels of interstate through traffic will have misleading high values because the delay is being experienced by travelers from outside of that urbanized area that are only passing through on the congested highways. AASHTO believes that if FHWA desires to normalize the delay measure by total population, then the denominator for the Annual Hours of Excessive Delay per Capita should not be based upon *Total Population* but rather limited to commuters using a personal vehicle on the roadway network. Since the *Total Excessive Delay* is only measuring delay on the NHS roadway network, the measure should be normalized by those who are using the NHS roadway network during the time periods it is being measured which are morning and evening peak periods which are predominantly commuters.

In addition, the Excessive Delay measure can produce misleading measure trends when using incomplete data and when no imputation is used. The proposed rule does not require imputation for travel time data used in the Excessive Delay measure. As the data become more complete, the measure trend values could be more influenced by the changes in data completeness, rather than in the congestion trends. AASHTO believes that a fully populated travel time dataset would significantly reduce this issue, providing more complete input data and minimizing measure trend changes that are due to changes in data completeness.

## **SUBPART H—NATIONAL PERFORMANCE MANAGEMENT MEASURES FOR ASSESSING THE CONGESTION MITIGATION AND AIR QUALITY IMPROVEMENT PROGRAM—ON-ROAD MOBILE SOURCE EMISSIONS**

The CMAQ NPRM references use of recent Cost Effectiveness Tables Summary released by FHWA. However, upon review of this material, there seems to be misleading information regarding NOx emissions, VOC emissions, cost effectiveness, diesel vs. natural gas technology, etc. FHWA has apparently concluded what is documented is not necessarily what is intended. The concern is what is documented does not align with real world proven or historical knowledge. For example, a strategy in the Pacific North West will have significantly different cost effectiveness than that same strategy in the South.

Furthermore, in the interests of streamlining, FHWA should implement the programmatic eligibility provision from MAP-21 to create a simple and reliable way for state DOTs and MPOs to estimate emission reductions for typical project types, configurations and operating conditions. For example, FHWA should create a look-up table that it updates periodically that lists emission reductions that may be expected for a range of smaller projects. Such a table would eliminate the need for state DOTs and MPOs to conduct project-specific modeling for smaller projects such as intersection improvements that typically receive CMAQ funding, as they could simply use the reference value(s) from the FHWA look-up table for CMAQ reporting purposes. Separate estimates for emission reductions would be needed by project type, configuration and year. Under this approach, project-specific modeling would still be conducted for projects that have a larger scope or impact but would be eliminated for smaller projects, thus streamlining the CMAQ modeling and compliance process for state DOTs. As FHWA would be responsible for creating and maintaining the table, it would be able to maintain rigorous quality assurance and control practices and therefore have confidence in the results.

### **490.801 PURPOSE.**

AASHTO has no comments on this section.

### **490.803 APPLICABILITY.**

(a) AASHTO recommends limiting applicability of this measure to non-attainment/maintenance areas with a population of over 1 million, as these regulations are onerous and require significant resources and staffing, as noted in the NPRM. Not all TMAs that serve populations of 200,000 or more have the necessary capacity to address these two performance measures, though most are likely to be working to address the concerns of excessive delay and vehicle emissions. This is also consistent with congressional intent. This is discussed more fully above under principal comment, *Make Reporting Areas Consistent Between CMAQ Congestion and On-Road Mobile Source Emissions Performance Measures*.

(b) AASHTO supports this section which clarifies that the performance measure does not apply to States and MPOs that do not contain any portions of a nonattainment or maintenance area.

### **490.805 DEFINITIONS.**

AASHTO has no comments on this section.

**490.807 NATIONAL PERFORMANCE MANAGEMENT MEASURE FOR ASSESSING ON-ROAD MOBILE SOURCE EMISSIONS FOR THE PURPOSE OF THE CONGESTION MITIGATION AND AIR QUALITY IMPROVEMENT PROGRAM.**

AASHTO supports FHWA's definition of the performance measure. AASHTO would like to see retained in the final rule that this performance measure is limited to each criteria pollutant and applicable precursors (PM2.5, PM10, CO, VOC, and NOx). No other non-CMAQ pollutants should be added.

**490.809 DATA REQUIREMENTS**

(a) Please see comments under the principal comment: *Make Improvements to the CMAQ Public Access System.*

(b) Please see comments under the principal comment: *Make Improvements to the CMAQ Public Access System.*

(c) Please see comments under the principal comment: *Mitigate the Unintended Consequences of EPA Making Changes in the Administration of the Clean Air Act.*

**490.811 CALCULATION OF EMISSIONS METRIC.**

AASHTO recommends continuing current practices.

**490.813 CALCULATION OF EMISSIONS MEASURE.**

(a) AASHTO is concerned about the proposed Total Emissions Reductions methodology. AASHTO believes that research/review is necessary to evaluate regional emissions benefits methodologies. An assessment would determine an array of methodologies, range of results, and methodology recommendation or guidance that when used, will ensure results are statistically equal. For example, in Texas, this issue was realized and remedied through the Technical Working Group for Mobile Source Emissions (TWG). The TWG created The Texas Guide to Accepted Mobile Source Emission Reduction Strategies which "attempt to equalize strategy analysis between regions<sup>3</sup>."

(b) The 2-4 year milestones for proposed on-road mobile source emissions performance measures are not possible for projects with a design life of less than four years; FHWA regional offices in Texas have agreed upon project life periods that are inconsistent with what is recommended in the CMAQ NPRM. AASHTO requests national guidance on project life for specific projects to ensure reporting consistency.

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<sup>3</sup> See [http://moser.tamu.edu/docs/Texas.Guide.to.Accepted.Mobile.Source.Emission.Reduction.Strategies\\_August.2007.pdf](http://moser.tamu.edu/docs/Texas.Guide.to.Accepted.Mobile.Source.Emission.Reduction.Strategies_August.2007.pdf)

## **AASHTO RESPONSE TO FHWA REQUESTS**

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**1. FHWA seeks comment from the public on what an appropriate effective date(s) could be.**

AASHTO has been consistent in recommending that FHWA use a single effective date for implementation of all performance-management related NPRMS. AASHTO believes that it will become burdensome and confusing to State DOTs, MPOs, and the public as various requirements are phased-in over a multi-year period. However, FHWA has decided to implement the various NPRM rules as they are finalized with multiple effective dates. For this NPRM, AASHTO is recommending that FHWA consider a phased approach which includes a two-year testing period following the effective date of the final rule to allow State DOTs and MPOs to develop non-binding targets in order to more fully understand the use of the data and the implications of those targets.

**2. FHWA encourages comments on how it can help maximize opportunities for successful implementation.**

FHWA can maximize the prospects for successful implementation by significantly reducing the reach and complexity of the proposed requirements. We particularly note the following portions of the principal comments, which note ways of easing the regulatory burden and increasing the chances of successful implementation:

- #3 *Take a Straightforward Approach to Implementation of the Performance Measures*
- #4 *Do Not Overregulate By Imposing Congestion Measurement and Management Requirements For Rural Uncongested Areas*
- #6 *The Proposed Rule Rests on a Foundation that Greatly Overestimates Its Benefits and Greatly Understates Its Costs*

**3. FHWA seeks comment on the use and availability of performance throughput data (e.g., Traffic Throughput Data).**

Many comments have been posted to docket requesting FHWA to develop a person throughput measure as part of the final rule. AASHTO believes that the data and methodologies to calculate such a measure do not currently exist. There have been numerous research projects conducted by research organizations and State DOTs that have attempted to establish a throughput measure but these are primarily focused on roadway throughput. Comprehensive data to measure person throughput on particular corridors and routes does not exist nor have the methodologies to calculate any proposed measure been developed. Through the AASHTO Standing Committee on Performance Management, we have funded research to further look into these types of measures. However, AASHTO opposes adoption of such measures for the purpose of national-level reporting but does support their use by state and local agencies for their purposes as they see fit.

**4. FHWA recognizes limitations in the availability of data could be resolved in the future with technology advancement. The FHWA seeks comments on potential**

***data sources and technologies related to system performance and traffic congestion measures, including:***

- a) *Trip Information Data: The FHWA is seeking comments on approaches for gathering travel, trip origin and destination, transportation mode, or occupancy rates information on a routine and system-wide basis.*
- b) *Throughput Data: The FHWA is seeking comment on approaches for gathering throughput data for traffic congestion that would capture the total number of travelers passing through segments that make up a full system on a regular basis.*
- c) *Survey Data: The FHWA recognizes that survey data available today offers only limited application to the development of performance measures; technologies available to capture large volumes of data on the movement of people could provide the potential to capture trip-related information that could be useful in managing transportation performance. The FHWA is seeking comment for informational purposes only on approaches that can be used to capture trip-related information on a more routine and system-wide basis.*

AASHTO has no specific comments on this topic at this time beyond not supporting additional rules in such areas. There has been significant research into all of these areas with both public agencies and private companies developing new and innovative approaches. AASHTO would encourage FHWA to discuss this in more detail with State DOTs and MPOs.

**5. *The FHWA is seeking comment on this process and other processes that FHWA should consider to improve missing data and outlier impacts in terms of dealing with missing data when assessing the performance of the NHS, freight movement on the interstate, and traffic congestion***

Please see principal comment: *Significant Challenges Remain if the NPMRDS is to be Used for National-level Reporting*

**6. *Impact of Traffic Volumes on Travel Time Derived Measures—The FHWA is seeking comments on this approach and encourages comments suggesting alternative methods that may more effectively capture the impact of performance changes on differing levels of system use.***

Please see AASHTO comments on the instability in calculating the volume-based measure and the value of a volume-limiting function within the proposed performance measure in Appendix B, *AASHTO Recommendations on Simplifying the Performance of the NHS, Freight Movement and Delay Measures*.

**7. *Focus on Large Urbanized Areas for Assessing the Performance of the NHS and Traffic Congestion—The FHWA is requesting comment on: whether a population threshold should be used for determining the measure applicability; and if so then whether 1 million is the appropriate threshold, or whether another threshold (e.g., population over 200,000) would be more appropriate.***

AASHTO supports the 1 million population threshold and strongly encourages FHWA to adopt the threshold for the calculation of both CMAQ measures. Please see principal comments:

- *#4: Do Not Overregulate By Imposing Congestion Measurement and Management Requirements For Rural Uncongested Areas*
- *#13: Make Reporting Areas Consistent Between CMAQ Congestion and On-Road Mobile Source Emissions Performance Measures*

8. ***Starting with Highways and Expanding to other Surface Transportation Modes for Assessing Traffic Congestion***—FHWA would like to move to a measure in the future that would consider the mobility of travelers using all surface modes of transportation and is seeking comment on feasible approaches that can be taken to move toward the development of such as measure.

AASHTO believes first and foremost that FHWA must focus on developing measures that are explicitly required in current statute and doing so in a manner that is not unduly burdensome. Thus, FHWA should not focus limited resources on the development of future national-level measures. Please see principal comment: *What Matters is Getting This Rule Right, Not Finalizing it Quickly*.

Currently, AASHTO is helping to sponsor a number of research activities aimed at developing different type of measures that go beyond vehicle speeds and reliability. A pooled fund study sponsored by Minnesota DOT is developing an accessibility measurement tool that could be used by State DOTs and MPOs to measure various aspects of accessibility including passenger and freight movement. Also, the long-standing Mobility Measurement in Urban Transportation Pooled Fund Study continues to look at new and innovative methods to measure congestion on the transportation system. Further, the AASHTO Standing Committee on Performance Management has funded an NCHRP research project that will look into developing future measures pertaining to non-motorized and environmental performance measures.

9. ***Dealing with Missing Data when Assessing On-Road Mobile Source Emissions***—State DOTs and/or MPOs would not be required to amend their project information, but we are also soliciting comments on other ways State DOTs and/or MPOs may update or amend their project information with quantitative emissions estimates for use in implementing this performance measure.

Please see principal comment: *Make Improvements to the CMAQ Public Access System*.

10. ***The FHWA is seeking comments on this approach for establishing optional additional targets for urbanized areas and the non-urbanized area.***

Please see Section-by-Section comments 490.105(e)(3) which states the following:

FHWA has asserted that if states engage in setting non-required targets, they must report to FHWA in FHWA approved formats. As a result of this approach, in order to avoid needless

FHWA regulation, states that desire to undertake such additional planning are left with having to find a way to engage in the additional planning without using the word “target” (or perhaps even the words “measure” or “performance management”) to describe the work in order to be able to take other steps that are relevant for its own needs without being subject to FHWA recordkeeping and other regulatory requirements with respect to this self-initiated work. Thus, AASHTO recommends that FHWA strike (i), (ii), (iii), (iv), and (v) and make any other needed modifications so that the regulations do not discourage a State DOT from establishing additional targets or undertaking additional performance management.

***11. The FHWA would also like comments on any other flexibility it could provide to or identify for State DOTs related to the voluntary establishment of additional targets. Some examples include:***

- a. Providing options for establishing different additional targets throughout the State, particularly for the States’ non-urbanized area; and*
- b. Expanding the boundaries that can be used in establishing additional targets (e.g., metropolitan planning area boundaries, city limit boundaries).*

Please see Section-by-Section comments 490.105(e)(3) which states the following:

FHWA has asserted that if states engage in setting non-required targets, they must report to FHWA in FHWA approved formats. As a result of this approach, in order to avoid needless FHWA regulation, states that desire to undertake such additional planning are left with having to find a way to engage in the additional planning without using the word “target” (or perhaps even the words “measure” or “performance management”) to describe the work in order to be able to take other steps that are relevant for its own needs without being subject to FHWA recordkeeping and other regulatory requirements with respect to this self-initiated work. Thus, AASHTO recommends that FHWA strike (i), (ii), (iii), (iv), and (v) and make any other needed modifications so that the regulations do not discourage a State DOT from establishing additional targets or undertaking additional performance management.

***12. The FHWA seeks comments on target establishment options and coordination methods that could be used by MPOs and State DOTs in areas where the MPO metropolitan planning area crosses multiple States.***

Currently, there are significant unknowns about the process MPOs and State DOTs will undertake to coordinate on target setting. Until the process actually occurs, it is difficult to suggest options that would be useful. However, AASHTO has made a number of recommendations under the principal comment: *The Proposed Rule Rests on a Foundation that Greatly Overestimates Its Benefits and Greatly Understates Its Costs* that we believe would significantly help State DOTs and MPOs in this process.

***13. FHWA is specifically requesting comment on the following questions related to State DOT and MPO coordination in light of the proposed performance management requirements in this rule:***

- a. *What obstacles do States and MPOs foresee to joint coordination in order to comply with the proposed requirements?*
- b. *What mechanisms currently exist or could be created to facilitate coordination?*
- c. *What role should FHWA play in assisting States and MPOs in complying with these proposed new requirements?*
- d. *What mechanisms exist or could be created to share data effectively between States and MPOs?*
- e. *Are there opportunities for States and MPOs to share analytical tools and processes?*
- f. *For those States and MPOs that already utilize some type of performance management framework, what are best practices that they can share?*

AASHTO has made a number of recommendations under the principal comment: *The Proposed Rule Rests on a Foundation that Greatly Overestimates Its Benefits and Greatly Understates Its Cost.*

**14. The FHWA is seeking comment on alternative approaches that could be considered to effectively implement 23 U.S.C. 134(h)(2)(B)(i)(I) and 23 U.S.C. 150(d)(2) considering the need for coordination required under 23 U.S.C. 134(h)(2)(B)(i)(II) and 23 U.S.C. 135(d)(2)(B)(i)(II).**

In general we tend to prefer less specificity and prescription from U.S. DOT and greater flexibility for states. AASHTO has made a number of recommendations under the principal comments: *The Proposed Rule Rests on a Foundation that Greatly Overestimates Its Benefits and Greatly Understates Its Cost and Confirm State Discretion in Target Setting and Reporting.*

**15. The FHWA is also requesting comment on whether the regulations should include more information or specificity about how the MPOs and States should coordinate on target establishment. For some measures proposed in this NPRM, MPOs could establish targets up to 180 days after the State DOT establishes its targets.**

AASHTO has made a number of recommendations under the principal comments: *The Proposed Rule Rests on a Foundation that Greatly Overestimates Its Benefits and Greatly Understates Its Cost and Confirm State Discretion in Target Setting and Reporting.*

**16. FHWA seeks comment on whether the description of the MPA in place when establishing targets should be included in the system performance report and apply to the entire performance period.**

The urbanized area geography is not well understood and the specific use of it in calculating the congestion metric involves a significant learning curve that will take time to better understand. Furthermore, FHWA has proposed significant changes to the definition of a Metropolitan Planning Area under the Metropolitan Planning Organization Coordination NPRM. At this time, it is difficult, if nearly impossible, to understand what the consequences of the urbanized areas and MPA definitions will have on target setting.

**17. The FHWA encourages public comment on the following issues related to the measure approach and methods that can be used to realize a “future” measure of traffic congestion.**

AASHTO believes first and foremost that FHWA must focus on developing measures that are explicitly required in current statute and to do so in a manner that is not unduly burdensome. Thus, FHWA should not focus limited resources on the development of future national-level measures. Please see principal comment: *What Matters is Getting This Rule Right, Not Finalizing it Quickly*.

Currently, AASHTO is helping to sponsor a number of research activities aimed at developing different type of measures that go beyond vehicle speeds and reliability. A pooled fund study sponsored by Minnesota DOT is developing an accessibility measurement tool that could be used by State DOTs and MPOs to measure various aspects of accessibility including passenger and freight movement. Also, the long-standing Urban Mobility Pooled Fund Study continues to look at new and innovative methods to measure congestion on the transportation system. Further, the AASHTO Standing Committee on Performance Management has funded an NCHRP research project that will look into developing future measures pertaining to non-motorized and environmental performance measures.

- a. Are there existing methods that can be used reliably to weigh the highway delay metric by “total vehicle occupants” rather than “total number of vehicles”? Are there technologies or methods that could be advanced in the next 3-5 years to capture vehicle occupancy data?*

AASHTO proposes two different thoughts on this topic. First, Average vehicle occupancy data has declined over the past thirty years. According to National Household Travel Survey (NHTS) data, work-trip vehicle occupancy (carpooling) is approximately 1.13—only 13 passengers ride with every 100 vehicle drivers. Approximately half of these 13 passengers are fellow commuters; the other half are persons sharing the ride for other trip purposes such as being dropped off at school. For all trips, vehicle occupancy rates range from 1.06 (New Hampshire) to 1.14 (Washington, DC). Thus, using these types of estimated and volume data will be a good representation of actual vehicle occupancy.

Second, the State DOTs have funded the development of the Census Transportation Planning Products (CTPP) Program that develops robust work-based trip data. One important piece of data that is available from these calculations is total number of workers commuting by car (either alone or as part of a carpool). Thus, the highway delay metric could be easily normalized by the number of workers commuting by car.

- b. Which surface modes of transportation, other than highways, have readily available data that could be used to support a measure to assess traffic congestion? To what extent is this information available in the urbanized areas applicable to the measure proposed in this subpart?*

Traffic congestion is caused by demand for a highway exceeding its capacity. Simply put, the current travel time data sets that are publically and commercially available should suffice in developing the necessary national-related traffic congestion performance measures.

- c. *What would be the appropriate surface transportation network to use to measure traffic congestion in the future? Is data available off the NHS that can be used to assess traffic congestion that can be made available to all State DOTs and MPOs?*

AASHTO believes that limiting the national-level measures to the NHS is appropriate given the considerable focus given to the NHS by Congress in 23 USC 150(c). AASHTO also notes that expanding the reach of a measure adds cost and burden and does not currently envision a need to expand the reach of the requirement. Also, states and MPOs can develop additional measurement and management programs as they deem appropriate without a Federal requirement. AASHTO further believes that when measuring and managing congestion, the national interest dictates that FHWA should limit requirements to congested areas (over one million in population) and not regulate with respect to uncongested rural areas.

Appendix A:  
*AASHTO Recommendations on Improving the NPMRDS*

To the extent the NPMRDS will be a requirement for Federal performance management reporting, and/or to simply improve the usefulness of the NPMRDS for other purposes, then the following changes are highly recommended:

## **1. SMOOTHING & IMPUTING**

The two largest issues with the current NPMRDS are 1) data gaps, and 2) lack of smoothing and filtering. The gaps in data (of which there are many) produce numerous challenges with respect to computing performance measures. Perhaps even more problematic, however, is the fact that the current NPMRDS is non-filtered, non-smoothed data. This results in significant, non-accurate speed representations on the roadway.

All data providers (HERE, INRIX, and TomTom) have been shown through numerous University, agency, and private sector evaluation studies to provide consistently high quality data with minimal latency on virtually all classes of roadway requested by the current FHWA procurement. Even when the data is imputed due to lack of available probes, the imputed data has been shown to be very accurate when compared to observed measurements from Bluetooth probes and/or other data sources. Using imputed and smoothed data would be much more reliable, accurate, and significantly easier than dealing with the current dataset.

The smoothing and imputation recommendations are:

- A. Procure data at **every** epoch (time interval) regardless of the existence of a probe.
- B. Allow for imputation and smoothing.
- C. Have the data provider flag data that is imputed at multiple confidence intervals.

Example:

- i. High confidence: probes were present within the past few epochs, and up-stream and down-stream probes exist.
- ii. Medium Confidence: probes have been present relatively recently. This segment is fairly reliable, and the data provider is relatively confident in their imputation techniques for this particular scenario (whatever that may be).
- iii. Low Confidence: No probes present for a significant period of time on this segment, and no probes on upstream or downstream TMCs. Reverting to historic measurements.

- D. Procure a 3<sup>rd</sup> party to perform random spot evaluations of the data, and reduce pay to the data provider if spot evaluations do not meet certain data quality specifications (see the I-95 Corridor Coalition's procurement as a good example of how this can be done).

## **2. SPATIAL RESOLUTION**

Many vendors (HERE, INRIX, and TomTom) are now starting to offer data at sub-TMC segment resolutions. While sub-segment data can be of a significantly higher resolution, it is probably not necessary for purposes of national systems performance reporting and it creates new data management challenges that states and even some private sector consultants may not be ready to tackle.

The spatial resolution recommendations are:

- A. Stick with TMC-based segment reporting, not sub-segment reporting.
- B. Provide a “locked down” TMC-based network that can be used by State DOTs and MPOs for the purpose of national-level reporting.
- C. Require that the data provider strictly adhere to the published TMC standard—meaning that both inner and outer TMC segments should be provided as separate measurements, NOT merged together into one data point. Note that the current data provider does not do this.
- D. Procure services from the vendor or a 3<sup>rd</sup> party to handle state segmentation conflation on a reoccurring basis to ensure more states are making use of the data for internal purposes.

### **3. TEMPORAL RESOLUTION**

AASHTO recommends that FHWA continue to provide the data at 5-minute intervals for purpose of national-level reporting of performance. However, there has been discussion about providing the data down to a 1-minute internal for purposes *other than national-level reporting of performance measures*. Every data provider (HERE, INRIX, and TomTom) is capable of delivering data down to the 1-minute interval. Aggregating to the 5-minute intervals is likely a burden on the data provider as more processing is required, it limits the use of the data, and it can make it more difficult to perform certain types of data quality checks on the data. While 1-minute data does increase the size of the data files and the storage requirements, there are benefits of having higher temporal resolution that go well beyond what is needed for purposes of national-level reporting. AASHTO would not oppose FHWA procuring the data at 1-minute intervals for research and other purposes but asks that FHWA still provide the data in 5-minute intervals for the purpose of national-level reporting.

### **4. VEHICLE/DATA TYPES**

The current NPMRDS is divided into three sets of data: Passenger, Commercial, and Combined. These datasets vary greatly in quality and completeness. First, the data set provides speed data for both passenger and commercial vehicles that are operating on the same segment of roadway. Thus, there is an understanding that commercial vehicle speeds are largely similar to those of passenger vehicles. Second, there is widespread acceptance that the current commercial vehicle data set has many gaps and outliers to be considered useful and reliable for performance reporting. Finally, the Passenger vehicle dataset still contains a large number of smaller trucks and/or commercial vehicles. AASHTO strongly recommends that FHWA work with the data vendor to find a better way to truly and reliably separate commercial/heavy vehicle data. Please see further discussion under Section-by-Section comments, 490.605 Definitions.

### **5. STATE’S ABILITY TO LEVERAGE NATIONAL PROCUREMENT**

Many states may wish to purchase additional data beyond the coverage provided by the NPMRDS; however, data procurement can be both difficult and costly to individual states and agencies. Procurement is difficult because agencies don’t always understand what types of data to ask for, how to establish an appropriate data use agreement, etc. Procurement is costly because it takes a long time for states/agencies to research other state’s procurement lessons learned, and work through lengthy procurement policies. Providing a mechanism by which

states could leverage the FHWA data procurement to purchase additional spatial coverage would economically beneficial.

The procurement recommendations are:

- A. Ensure that states or local agencies are able to leverage the FHWA procurement vehicle to purchase additional data as needed.

## **6. ACCEPTABLE USE**

The current data use agreement between FHWA and HERE is fairly restrictive. Only States, MPOs, and/or Consultants working on behalf of States/MPOs are allowed to use the NPMRDS. The NPMRDS is also only supposed to be used for MAP-21 performance reporting. While this may have been done to help keep costs low, this also significantly limits the value of the data. If FHWA requires a more open DUA in their procurement, all of the data providers will still submit a response, and they will still remain competitive.

The acceptable use recommendations are:

- A. FHWA should make every effort to broker a more inclusive data use agreement that would open up the NPMRDS to other uses by states, MPOs, and researchers, thus adding significant value to the data and this procurement effort.
- B. For reference, FHWA should evaluate the I-95 Coalition's Probe Data Procurement DUA. While it is catered more towards real-time probe data, it still has many important and relevant DUA clauses that FHWA could adopt.

## **7. HPMS, SPEED LIMIT, AND NHS INTERSTATES/NON-INTERSTATES DATA PROVISION AND CONFLATION**

The most difficult requirement for MAP-21 reporting today is related to agencies needing to conflate both the HPMS volume data and their Speed Limit data over to the TMC segments. If FHWA allows agencies to use imputed data directly from the data vendor (as suggested above), then the need for speed limit data conflation goes away. However, the HPMS volumes will still need to be conflated for use in some of the measures. Conflating of the HPMS network to the TMC network is quite difficult (and costly) for each state and MPO to tackle. It would be significantly more cost effective to either require the data provider to do this volume conflation or to hire a 3<sup>rd</sup> party (like TTI) to perform the conflation services on behalf of all states.

Also, the NPRM requires states to report on NHS interstates and non-interstates separately, but the metadata provided with the NPMRDS does not include this differentiation. This means that states end up trying to do the legwork of determining which TMCs are/aren't in which HPMS-defined functional class, which can give mixed results. It is highly advisable to have the data provider do the conflation and provide metadata stating which TMC segment is in which HPMS-defined functional class so everyone is working with a consistent dataset. Similarly, having the data provider or FHWA provide metadata that indicates which urban area and MPO each segment falls within would significantly reduce workload and help avoid inconsistent results.

The conflation recommendations are:

- A. Require the data provider to provide posted speed limits as part of the dataset. Please note that AASHTO acknowledges that the current HPMS requires speed limit data and that State DOTs and MPOs could get speed limit data if the NPMRDS is conflated with HPMS. However, for national-level reporting not all State DOTs and MPOs will need a conflated data set. Thus, it is still important to include speed limit as a data element within the NPMRDS.
- B. Require the data provider or a 3<sup>rd</sup> party (like TTI) to perform HPMS AADT volume data conflation for the entire country. However, do not prevent states from providing their own conflated volumes if they have the ability and/or resources available to do this.
- C. Require the data provider to provide metadata stating the HPMS-defined functional class for each TMC segment (for use in identifying NHS interstate, freeways, and expressways for those measures that require the distinction).
- D. Require the data provider or a 3<sup>rd</sup> party to provide an urban area identifier with each TMC segment.
- E. Require the data provider or a third party to provide an MPO identifier with each TMC segment.

Appendix B:  
*AASHTO Recommendations on Simplifying the  
Measures Used for Performance of the NHS, Freight  
Movement and Delay to the Extent They are Applicable*

## **OVERARCHING RECOMMENDATIONS**

As discussed in Principal Comment 2, the measures proposed in the NPRM do not align with nationally accepted practices in use by the DOTs today. AASHTO believes that these measures, as presented, have unnecessary complexity and a few flaws that could be improved with minimal effort by FHWA. The adoption of a few common practices listed below would significantly decrease the cost of computing these measures while improving their practicality and understandability through the implementation of performance measures best practices.

The following overarching recommendations would make *all* of the measures easier to compute, manage, and update over time. Further, several of these recommendations will make the measures more understandable by the public. AASHTO notes, however, that nothing in this Appendix concerns the applicability or non-applicability of measures to specific types of roads or geographic areas. As explained above in AASHTO's actual comments, in several instances AASHTO recommends reducing the reach of the measurement and management requirements, so that some areas or roads are not covered. However, where they are applicable under the final rule, they should at least be improved over aspects of the proposed rule, which is what is discussed here.

## **ADDRESSING GAPS IN DATA**

Additional flexibility should be provided for filling in gaps in data beyond speed limit-based travel times. Some states may prefer to use imputed data from any of the top three data providers (HERE, INRIX, or TomTom) instead or work with the data provider to address the issues (see Appendix A). The results of the imputation have been well studied and verified against point sensors, floating car runs, and blue-tooth detectors. Using the imputed data sets from any of these three providers, which many agencies have already purchased, will yield more consistent and accurate performance measures and will significantly reduce the work load for DOTs. (See *Gap Filling* later in this appendix).

## **STANDARDIZING PERCENTILES**

Some measures call for the use of the 80<sup>th</sup> percentile, while others call for the 95<sup>th</sup> percentile. AASHTO strongly recommends standardizing to the 80<sup>th</sup> percentile as the preferred approach as it will reduce confusion and provide consistency across the metrics. Those states and private entities that are interested can always decide on their own to develop metrics using different percentiles.

## **HOLIDAYS**

As defined in the NPRM, PHTTR calculations require ignoring holidays. For clarity, an explicit list of holidays should be provided (or a link to an official reference). States can decide on their own whether to undertake measurement and management as to Holidays.

## **REPORTING SEGMENT DEFINITIONS THAT CHANGE THROUGHOUT THE YEAR**

The TMC definitions included with the NPMRDS get updated every three months. This presents a number of questions regarding how to aggregate data over the course of a year, particularly when a segment definition changes drastically or new segments are added (due to new roadways

or interchanges being built). There is currently no guidance in the ruling on how to resolve these issues. Considering the measures are rolled up to an annual report, this is an important issue to address.

The preferred approach is to “lock down” the segment definitions at the *start* of the year and require the NPMRDS provider to stick to these definitions throughout the year. In this scenario, new roads or interchanges would not show up in the NPMRDS until the year following their opening. This approach also allows some time for the DOTs to get familiar with how new facilities are being used by the traveling public before they need to set targets and report on their performance.

## **NPMRDS RECOMMENDED CHANGES**

There are a significant number of issues with the NPMRDS that make reporting more difficult (and therefore costly) than needed, less accurate, and in some cases outright meaningless.

Addressing these data issues would greatly simplify the reporting requirements and make the resulting metrics more accurate. Appendix B covers AASHTO’s recommended changes and enhancements to the NPMRDS.

## **SPECIFIC COMPUTATIONAL RECOMMENDATIONS**

### **SUBPART E:**

#### ***LEVEL OF TRAVEL TIME RELIABILITY (LOTTR)***

The term “reliability” is generally thought to indicate how consistent a given commute is from day to day throughout the year. The way LOTTR is currently defined instead highlights inconsistency in travel times *within the time period bins*. Since the smallest time period bin spans four hours, you can have a reporting segment that *reliably* sees a large fluctuation in travel times across those four hours (“rush hour” may only cover two of those four hours, for example). This segment would be reported as unreliable according to the LOTTR measure, while it may be considered reliable when using the industry definition of reliability.

This could be addressed several ways. One method would be to make the time periods smaller so more variability occurs from day to day rather than within the time periods. Moving to smaller time periods could also simplify the data preparation needed for PHTTR calculations; if hourly time periods were used for LOTTR, the computation steps of the two measures would be more similar than it is in the current NPMR.

#### ***PEAK HOUR TRAVEL TIME RATIO (PHTTR)***

We highly recommended changing three components of this measure: Gap filling, the use of median values instead of mean, and adding an additional AM peak hour time period.

#### **Gap Filling**

Multiple universities and consulting firms have conducted studies to investigate the effects on all of the proposed measures when gaps are ignored, gaps are filled with historic average data, gaps are filled with speed limits, and gapless third party data sources are used instead of the NPMRDS. The full results of one such analysis that

looked at three separate urbanized areas (Detroit, D.C., and Baltimore) are included in a slide deck in Appendix C of this document with a summary in Figure 1 below. The results show the extent of the missing data for both interstates and non-interstates going as high as 33% for interstates and 65% for non-interstates in some areas. As segment lengths and volumes increase, the percentage of available data also increases. Based on the results of this study AASHTO recommends allowing a State the flexibility for Federal performance measurement reporting, including the flexibility to use a gapless data source.

Detroit Metro Area		D.C. Metro Area		Baltimore Metro Area	
Percent of Missing Data		Percent of Missing Data		Percent of Missing Data	
	Interstates		Interstates		Interstates
LOTTR Hours	29.0%	50.7%	LOTTR Hours	17.7%	54.5%
AM Peak Hours	33.7%	56.7%	AM Peak Hours	21.6%	56.8%
PM Peak Hours	29.4%	50.7%	PM Peak Hours	19.2%	57.1%

Percent of Missing Data	
Interstates	Non-Interstates
LOTTR Hours	21.8%
AM Peak Hours	23.8%
PM Peak Hours	23.0%

Percent of Missing Data	
Interstates	Non-Interstates
LOTTR Hours	61.4%
AM Peak Hours	63.6%
PM Peak Hours	64.8%

The above numbers are derived from an evaluation of 6-months of data between May and October of 2014.  
LOTTR Hours = 6am – 8pm  
AM Peak Hours = 6am – 9am  
PM Peak Hours = 4pm – 7pm

Figure 1: Percent of Missing Data for Detroit, D.C., and Baltimore Metro Areas

### Median Values

An analysis of using mean vs. median values for the PHTTR calculations was also conducted by the same group (see Appendix C). A summary of the different system level PHTTR values resulting from mean and median methods for Detroit are shown below in Figure 2. Note that both commercial data providers (HERE and INRIX) are in close agreement with each other, and that the NPMRDS calculations using the median instead of the mean are more consistent with the commercial data providers. Using a median value would also be more consistent with LOTTR calculations (median = 50<sup>th</sup> percentile), and would remove both the extra work required and the need to filter out outliers (< 2 mph and > 100 mph in the current NPRM).

	Interstates		Non-Interstates		Combined	
	Mean	Median	Mean	Median	Mean	Median
<b>NPMRDS (no fill)</b>	62.6 %	82.8 %	61.3 %	87.1 %	62.2 %	84.1%
<b>NPMRDS (speed limit fill)</b>	67.3 %	85.1 %	81.4 %	96.4 %	71.6 %	88.6 %
<b>NPMRDS (historic avg. fill)</b>	66.4 %	85.0 %	78.8 %	95.3 %	70.2 %	88.2 %
<b>INRIX (modeled)</b>	84.9 %	88.2 %	90.9 %	93.5 %	86.9 %	89.9 %
<b>INRIX (high-confidence)</b>	84.9 %	88.2 %	90.8 %	93.5 %	86.9 %	89.9 %
<b>HERE (modeled)</b>	82.0 %	85.8 %	90.0 %	92.4 %	84.7 %	88.0 %
<b>HERE (high-confidence)</b>	82.0 %	85.8 %	90.0 %	92.1 %	84.7 %	87.9 %

\* Desired speed = 80% of posted speed limit

*Figure 2: Percent of Reporting Segments Providing for Acceptable Peak Hour Travel (PHTTR<1.5)*

## Peak Hour Time Periods

For PHTTR, the current NPRM requires using the hours between 6AM and 9AM for the morning peak periods. Different regions of the country have different expected working hours and social norms that make these peak periods non-uniform. It would be advisable to add the 9AM-10AM time period to the set of peak hours as this particular hour may see more traffic than the 6AM-7AM time period in many locations. Flexibility in defining regional peak periods may be necessary.

## SYSTEM PERFORMANCE MEASURES

The system-level summary calculations used are relatively simple and easy to understand at a glance. We have no additional recommendations beyond what has been mentioned above related to the NPMRDS.

## SUBPART F

### TRUCK TRAVEL TIME RELIABILITY (TTTR)

See the above comments on LOTTR and how the term “reliability” is generally used in the industry. The issue described there is even more drastic for the TTTR measure since there is no time period grouping at all, so agencies may see unreliability with respect to the time of day rather than trips occurring on different days of the year.

### AVERAGE TRUCK SPEED

When averaging speeds for a stretch of road, the industry standard is to use a harmonic mean instead of an arithmetic mean. This is not how the current NPRM calculation is defined. This issue can be addressed by changing the calculation slightly. The equation in the current measure is defined as:

$$\text{Average Truck Speed}(s) = \frac{\left[ \sum_{b=1}^T \frac{\text{Segment Length}(s)}{\text{Truck Travel Time}_b} \right]}{T} \times 60 \times 60$$

This equation first converts the travel time values to speeds and then finds the average. This should be changed to first find the average travel time and then convert to speed:

$$Average\ Truck\ Speed(s) = \frac{Segment\ Length(s)}{\left[ \frac{\sum_{b=1}^T Truck\ Travel\ Time_b}{T} \right]} \times 60 \times 60$$

### **SYSTEM FREIGHT MOVEMENT MEASURES**

We have no additional recommendations beyond what has been mentioned above related to the NPMRDS.

## **SUBPART G**

### **TOTAL EXCESSIVE DELAY**

The NPRM calls for using 35/15 mph thresholds for excessive delay. Because 35 mph on a 70 mph speed limit interstate is quite a bit worse than 35 mph on a 50 mph speed limit freeway, it would be more appropriate to use a percentage of the posted speed limit or a percentage of the free-flow speed as the “excessive threshold” instead. However, the current NPMRDS does not include posted speed limits or a reference speed (see *NPMRDS Recommended Changes* above).

### **ANNUAL HOURS OF EXCESSIVE DELAY PER CAPITA**

Dividing annual excessive delay by the total population will raise questions about whether the measure actually reports upon what it intends to report upon. It would make more sense to use some sort of estimated commuter population rather than overall population to get a more realistic idea of how the people experiencing the delay are affected. A good example of where this may have a large impact would be New York City where the overall population is very high (driving down the output of this measure), but a significant portion of that population makes use of public transportation or alternative modes of travel and are not impacted by roadway congestion.

### **NPMRDS VS. IMPUTED/GAP-FILLED DATASETS FROM HERE/INRIX**

The NPMRDS data consistently yields Annual Hours of Excessive Delay per Capita results that are significantly higher than those from commercial data providers using gap-filled/imputed/smoothed data. This is likely due to the extreme outliers in the NPMRDS. The alternative methods described above (moving away from the per capita) might help reduce inconsistencies; however, a formal analysis backing up this claim has yet to be conducted.

	<b>NPMRDS</b>	<b>INRIX</b>
<b>Detroit, MI</b>	2.39 hours	0.32 hours
<b>Washington, D.C.</b>	3.12 hours	1.93 hours
<b>Baltimore, MD</b>	1.95 hours	0.98 hours

*Figure 3: Annual Hours of Excessive Delay Per Capita--Interstates Only\**

### **INSTABILITY IN CALCULATIONS**

The current description of the equations creates opportunity for “unstable calculations”, meaning that the delay may be grossly overestimated based on the interplay of the length of each segment,

the evaluation period, and the speeds. These instabilities can lead to vast over estimates of delay during periods of very low speeds or road closures if *volume limiting* is not used. Consider the following example which demonstrates the need for volume limiting:

*For a 1 mile long segment, at 60 mph the travel time is 60 seconds. If the excessive delay speed threshold is 30 mph (the NPRM calls for is 35, but for the sake of this example, we are using 30), the corresponding excessive delay time is 120 seconds. If the reported speed is 6 mph, the corresponding travel time is 10 minutes or 600 seconds. The excessive delay per vehicle is then  $(600 - 120) = 480$  seconds generated for that 5 minute period, but a five minute period itself is only 300 seconds long. So for a 5 minute reporting period an 8 minute excessive delay is recorded.*

This instability can be addressed with maximums of delay that relate to the length of reporting period. Various academic institutions have written white-papers on this phenomenon and/or created their own algorithms to address these issues. These institutions have also addressed other instability issues that are worth considering. For example, at extremely slow speeds, AADT may grossly over-estimate volume, and at speeds of zero the expected volume is no longer appropriate. For extremely slow speeds and complete road closures, “volume limiting” algorithms need to be considered.

Outliers in the NPMRDS further compound this issue. Although a gapless or imputed data set would not be completely immune to these problems (volume limiting needs to be seriously considered), it would be less susceptible. Note that adding these types of checks into the calculations would add some level of computational complexity, but would result in much more reliable outcomes that are more defensible

Appendix C:

***Results of Peak Hour Travel Time Ratio (PHTTR)***

***Gap Filling Analysis Results***

# NPRM NPMRDS “Gap Filling” Analysis



*Any opinions herein are solely those of the University of Maryland CATT/CATT Laboratory staff.*

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## Purpose of this Analysis

- For the draft NPRM **Congestion** and **Delay** performance measures, what are the impacts of calculating these measures when:
  - Data gaps are **ignored**
  - Data gaps are **filled in with speed limit data**
  - Data gaps are **filled with historic average data**
  - **3<sup>rd</sup> party data sources are used** instead of the NPMRDS (e.g. commercial datasets from HERE, INRIX, or TomTom)

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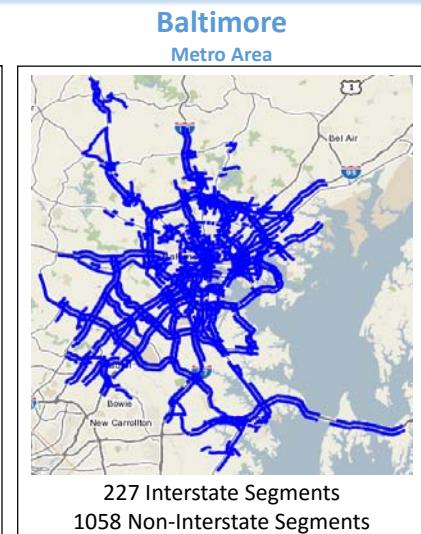
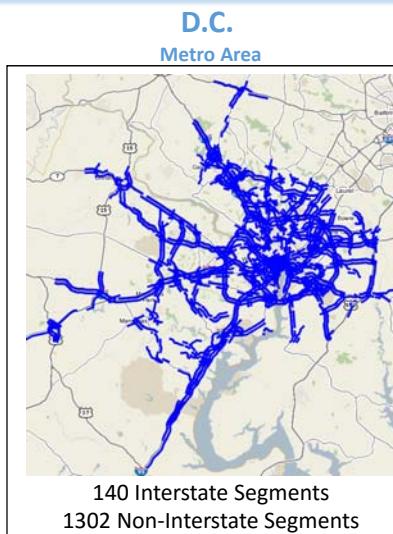
# Organization of this Presentation

- The Extent of the Gap problem
  - A look at the percentage of missing epochs in each region
- LOTTR sensitivity to gap fill method and comparison with INRIX / HERE
  - Sensitivity to gap fill method
  - Alternate method of calculating LOTTR
- PHTTR sensitivity to gap fill method and comparison with INRIX / HERE
  - Sensitivity to gap fill method
  - Comparison of results when using the median instead of the mean

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## Three Study Areas



NPMRDS, HERE, &amp; INRIX

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NPMRDS &amp; INRIX

NPMRDS &amp; INRIX

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## Notes on study areas

- Study areas were chosen by identifying 3 urbanized areas over 1,000,000 in population with readily available commercial probe data sets to use for comparison
- A geographic intersection was taken between these urbanized areas and TMC segment spatial definitions within UMD's base map data
- Missing segments in the final spatial coverage (previous slide) are the result of lack of distinct segment mapping between the data sets used (NPMRDS, INRIX, and HERE for Detroit; NPMRDS and INRIX for DC and Baltimore)

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## How prevalent are the NPMRDS temporal gaps?

Detroit Metro Area		D.C. Metro Area		Baltimore Metro Area		
		Percent of Missing Data		Percent of Missing Data		
	Interstates	Non-Interstates	Interstates	Non-Interstates	Interstates	
LOTTR Hours	29.0%	50.7%	17.7%	54.5%	21.8%	61.4%
AM Peak Hours	33.7%	56.7%	21.6%	56.8%	23.8%	63.6%
PM Peak Hours	29.4%	50.7%	19.2%	57.1%	23.0%	64.8%

The above numbers are derived from an evaluation of 6-months of data between May and October of 2014.

LOTTR Hours = 6am – 8pm

AM Peak Hours = 6am – 9am

PM Peak Hours = 4pm – 7pm

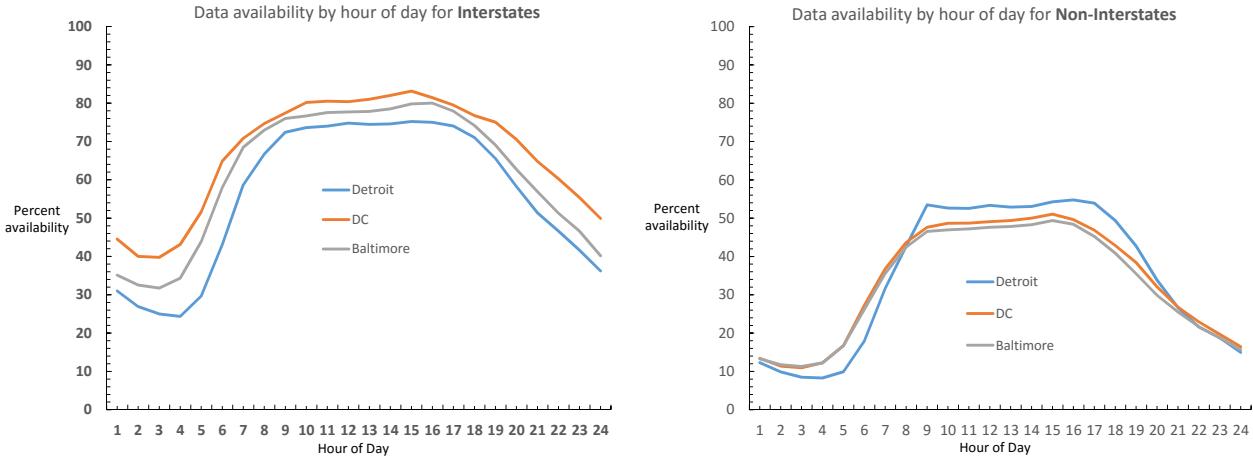
### Observations:

- Temporal data coverage on Interstates is better in more congested areas (DC and Baltimore).
- As segment length and volume increase, the percentage of available data increases. See slides 25-31 for more information.

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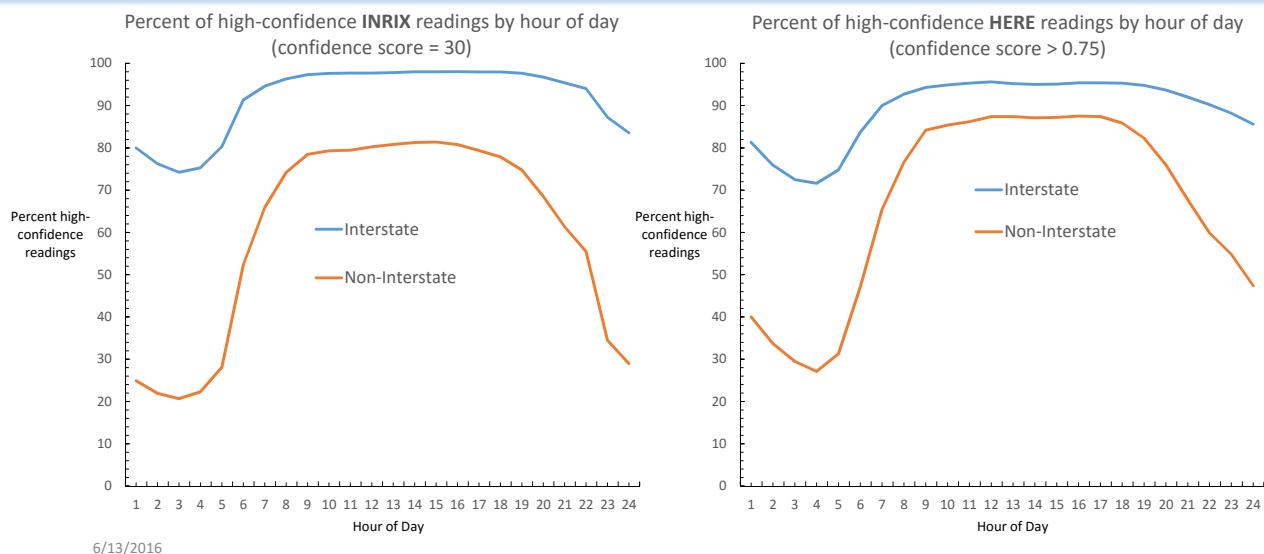
## Percentage of available readings in NPMRDS



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## Percentage of high-confidence readings in commercial data sets



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## Conclusion of Gap Analysis

- NPMRDS Gaps (missing data for epochs) follows the same trend as the high confidence data for INRIX and HERE
- Gaps are statistically correlated to volume – the lower the volume the more likely a data gap
  - Interstates have less gaps than non-interstates
  - Peak hours have less gaps than non-peak hours
- Completeness of NPMRDS data
  - Interstates: Peak hours ~70% Non-peak ~35%
  - Non-Interstates: Peak hours ~45% Non-peak ~10%
- Commercial data (INRIX and HERE) follow same trend, but are more complete than NPMRDS based on definitions provided by vendors

## A Look at LOTTR

The following three slides show the results of an evaluation of the **Level of Travel Time Reliability (LOTTR)** for each of the three Metro areas (Detroit, DC, and Baltimore).

The values in the table are the percent of reporting segments providing for **Acceptable Travel Time Reliability** (LOTTR < 1.5).

Two approaches to this calculation were taken:

**Draft:** LOTTR calculated as described in the draft MAP-21 documentation.

**Modified:** LOTTR calculated separately for weekday AM peak (6AM – 9AM), weekday PM peak (4PM – 7PM), and weekend 6AM – 8PM. The greatest of these 3 values was used as the LOTTR for the reporting segment.

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## Detroit LOTTR

6-month Data Analysis: May – Oct. 2014

Percent of reporting segments providing for an **Acceptable Travel Time Reliability** (LOTTR < 1.5)

	Interstates		Non-Interstates		Combined	
	Draft	Modified	Draft	Modified	Draft	Modified
<b>NPMRDS (no fill)</b>	95.2 %	70.8 %	88.6 %	70.2 %	93.1 %	70.6 %
<b>NPMRDS (speed limit fill)</b>	98.9 %	75.8 %	97.4 %	80.5 %	98.4 %	77.3 %
<b>NPMRDS (historic avg. fill)</b>	98.6 %	76.1 %	96.0 %	84.0 %	97.8 %	78.6 %
<b>INRIX (modeled)</b>	99.4 %	81.7 %	99.7 %	89.2 %	99.5 %	84.2 %
<b>INRIX (high-confidence)</b>	99.4 %	86.4 %	99.7 %	90.8 %	99.5 %	87.9 %
<b>HERE (modeled)</b>	98.9 %	82.7 %	100 %	93.9 %	99.3 %	86.4 %
<b>HERE (high-confidence)</b>	99.0 %	82.7 %	100 %	93.9 %	99.3 %	86.4 %

### Observations:

- For NPMRDS Non-Interstates, gaps account for 50% of the data, thus the fill method determines median.
- Draft values are generally very high, likely due to entire range of 6am – 8pm being included, washing out variability. This lead to the formulation of the modified calculation.

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## D.C. LOTTR

6-month Data Analysis: May – Oct. 2014

Percent of reporting segments providing for **Acceptable Travel Time Reliability** (LOTTR < 1.5)

	Interstates		Non-Interstates		Combined	
	Draft	Modified	Draft	Modified	Draft	Modified
<b>NPMRDS (no fill)</b>	83.6 %	51.6 %	67.4 %	47.9 %	71.2 %	48.8 %
<b>NPMRDS (reference speed fill)</b>	87.1 %	56.1 %	90.4 %	75.7 %	89.6 %	71.0 %
<b>NPMRDS (historic avg. fill)</b>	83.5 %	56.9 %	93.2 %	81.7 %	90.9 %	75.9 %
<b>INRIX (modeled)</b>	87.7 %	61.6 %	98.0 %	92.1 %	95.5 %	84.6 %
<b>INRIX (high confidence)</b>	85.9 %	62.6 %	97.8 %	78.0 %	94.9 %	74.2 %

**Observations:**

- Since NPMRDS coverage is better in the DC area for interstates, there is less of a discrepancy between no gap fill and historic average gap fill
- Despite the fact that the DC area is ranked as one of the most congested areas in the nation, the draft Interstate LOTTR is above 80%

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## Baltimore LOTTR

6-month Data Analysis: May – Oct. 2014

Percent of reporting segments providing for **Acceptable Travel Time Reliability** (LOTTR < 1.5)

	Interstates		Non-Interstates		Combined	
	Draft	Modified	Draft	Modified	Draft	Modified
<b>NPMRDS (no fill)</b>	96.4 %	72.5 %	68.1 %	47.6 %	75.9 %	54.4 %
<b>NPMRDS (reference speed fill)</b>	97.4 %	74.7 %	93.8 %	81.5 %	94.8 %	79.6 %
<b>NPMRDS (historic avg. fill)</b>	95.4 %	75.0 %	96.3 %	85.5 %	96.0 %	82.6 %
<b>INRIX (modeled)</b>	97.7 %	81.8 %	98.8 %	90.2 %	98.5 %	87.9 %
<b>INRIX (high confidence)</b>	97.7%	71.9 %	98.7 %	81.7 %	98.4 %	79.0 %

**Observations:**

- Since NPMRDS coverage is better in the Baltimore area for interstates, there is less of a discrepancy between no gap fill and historic average gap fill

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## LOTTR Conclusions

- ‘Historic Average Gap Fill’ or ‘Reference Speed Gap Fill’ on NPMRDS provides closest correlation with INRIX and HERE
- Modified algorithm identifies significantly more segments with unreliable travel time
- INRIX Modeled data yields higher LOTTR percentage - consistent with similar trend in the NPMRDS
- HERE Modeled and INRIX Modeled data provide comparable results
- LOTTR (both Draft and Modified calculation methods) measures reliability throughout the day or during peak hour, *not* day to day

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## A Look at PHTTR

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The following three slides show the results of an evaluation of the **Peak Hour Travel Time Reliability (PHTTR)** for each of the three Metro areas (Detroit, DC, and Baltimore).

The values in the table are the percent of reporting segments providing for **Acceptable Peak Hour Travel** (PHTTR < 1.5).

Two approaches to this calculation were taken:

**Mean:** PHTTR calculated as described in the draft MAP-21 documentation.

**Median:** PHTTR calculated using the median Peak Hour Travel Time for each segment instead of the mean.

## Detroit PHTTR

6-month Data Analysis: May – Oct. 2014

Percent of reporting segments providing for **Acceptable Peak Hour Travel** (PHTTR < 1.5)

	Interstates		Non-Interstates		Combined	
	Mean	Median	Mean	Median	Mean	Median
<b>NPMRDS (no fill)</b>	62.6 %	82.8 %	61.3 %	87.1 %	62.2 %	84.1%
<b>NPMRDS (speed limit fill)</b>	67.3 %	85.1 %	81.4 %	96.4 %	71.6 %	88.6 %
<b>NPMRDS (historic avg. fill)</b>	66.4 %	85.0 %	78.8 %	95.3 %	70.2 %	88.2 %
<b>INRIX (modeled)</b>	84.9 %	88.2 %	90.9 %	93.5 %	86.9 %	89.9 %
<b>INRIX (high-confidence)</b>	84.9 %	88.2 %	90.8 %	93.5 %	86.9 %	89.9 %
<b>HERE (modeled)</b>	82.0 %	85.8 %	90.0 %	92.4 %	84.7 %	88.0 %
<b>HERE (high-confidence)</b>	82.0 %	85.8 %	90.0 %	92.1 %	84.7 %	87.9 %

\* Desired speed = 80% of posted speed limit

### Observations:

- Commercial data providers (INRIX and HERE) are in close agreement
- NPMRDS data with gap fill in the median calculation is consistent with the commercial data providers

## D.C. PHTTR

6-month Data Analysis: May – Oct. 2014

Percent of reporting segments providing for **Acceptable Peak Hour Travel (PHTTR < 1.5)**

	Interstates		Non-Interstates		Combined	
	Mean	Median	Mean	Median	Mean	Median
<b>NPMRDS (no fill)</b>	40.8 %	66.9 %	29.1 %	79.4 %	31.8 %	76.4 %
<b>NPMRDS (reference speed fill)</b>	47.8 %	69.7%	63.8 %	94.3 %	60.0 %	88.5 %
<b>NPMRDS (historic avg. fill)</b>	47.3 %	68.0 %	58.7 %	91.3 %	56.0 %	85.8 %
<b>INRIX (modeled)</b>	65.4 %	75.2%	82.5 %	87.0 %	78.4 %	84.1 %
<b>INRIX (high confidence)</b>	65.1 %	74.6 %	81.4 %	86.6 %	77.4 %	83.6 %

\* Desired speed = 80% of INRIX provided reference speed

### Observations:

- Non-Interstate NPMRDS (with no gap fill) had a 25%-50% increase in acceptable peak hour travel when using the median speed. This is due to the influence of outliers on the mean of the distribution.

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## Baltimore PHTTR

6-month Data Analysis: May – Oct. 2014

Percent of reporting segments providing for **Acceptable Peak Hour Travel (PHTTR < 1.5)**

	Interstates		Non-Interstates		Combined	
	Mean	Median	Mean	Median	Mean	Median
<b>NPMRDS (no fill)</b>	72.4 %	84.5 %	35.8 %	85.2 %	45.9 %	85.0 %
<b>NPMRDS (reference speed fill)</b>	77.7 %	85.8 %	70.2%	95.8 %	72.2 %	93.0 %
<b>NPMRDS (historic avg. fill)</b>	76.7 %	84.9 %	67.1 %	94.6 %	69.7 %	91.9 %
<b>INRIX (modeled)</b>	83.9 %	87.8 %	89.0 %	94.3 %	87.6 %	92.5 %
<b>INRIX (high confidence)</b>	83.8 %	87.8 %	88.5 %	93.9 %	87.2 %	92.2 %

\* Desired speed = 80% of INRIX provided reference speed

### Observations:

- Non-Interstate NPMRDS (with no gap fill) had a 10%-50% increase in acceptable peak hour travel when using the median speed. This is due to the influence of outliers on the mean of the distribution.

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## PHTTR Conclusions

- 'Median' method for calculating PHTTR yields more consistent results between NPMRDS and the commercial data providers
  - Confirms the outliers in NPMRDS have inordinate impact on the mean
- Gap-filled NPMRDS data yielded more consistent results with commercial data providers than the no gap fill NPMRDS data
- INRIX and HERE data (both modeled and high confidence) yielded consistent results between each other

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## Overall Summary

- Based on the Detroit results, commercial data sets (INRIX and HERE) produce similar results at the system-wide level for both LOTTR and PHTTR regardless of the calculation method
- The discrepancies between NPMRDS and commercial datasets results are larger on non-Interstate than Interstate roadways
- For the LOTTR calculation, the gap-filled NPMRDS data yielded results more consistent with commercial data sets
- For the PHTTR calculation, the gap-filled NPMRDS data combined with the median calculation yielded results more consistent with commercial data sets

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## Possible Next Steps

- Conduct similar analysis on other geographies that may have drastically different congestion characteristics and multiple commercial data providers
- Conduct similar analysis on the Congestion/Delay metrics
- Perform volume weighted computations
- Identify and test other gap fill methods
- Explore methods to improve non-Interstate results
- Explore alternatives to mean or median such as the IQR mean which provides outlier immunity and distribution sensitivity

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# NPRM NPMRDS Congestion Measure Analysis



The following are preliminary findings. As such, they are incomplete and subject to change prior to final submission.

*Any opinions herein are solely those of the University of Maryland CATT/CATT Laboratory staff.*

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## Purpose of this Analysis

To compare the results of calculating **Annual Hours of Excessive Delay per Capita**, as defined in the MAP-21 draft documentation Subpart G, using the NPMRDS and a commercial 3<sup>rd</sup> party data source.

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## Notes on this analysis

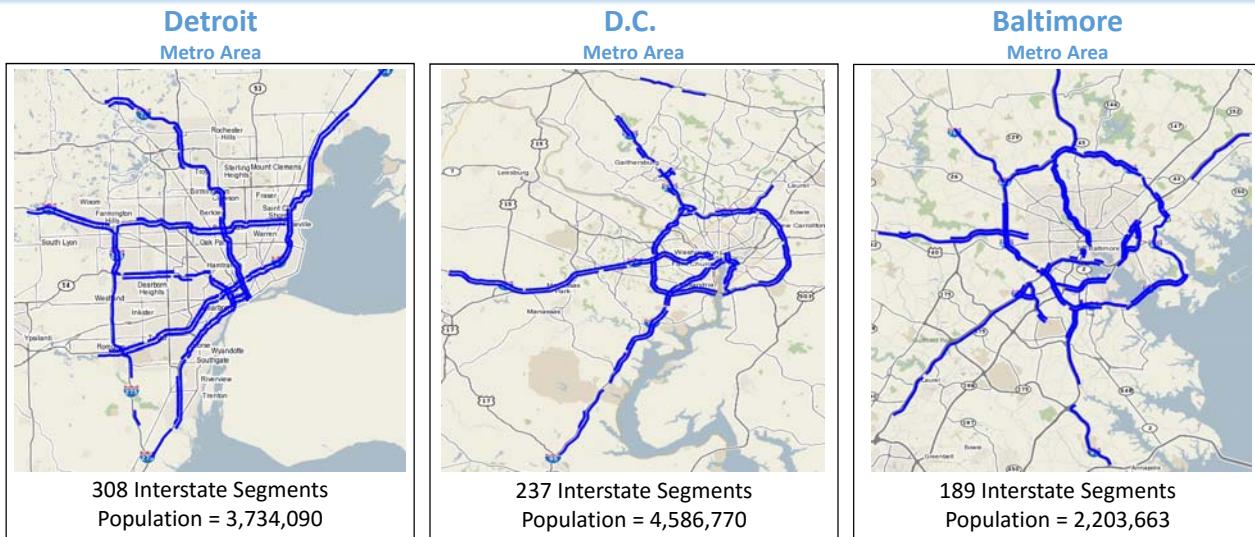
In the interest of time and due to the data sets readily available for this analysis, the following modifications to the congestion measure calculations were used:

- A 6-month temporal range (May – October 2014) was used rather than a full year
- Only **Interstates** were included rather than the full extent of the NHS
- 15-minute volume profiles were used rather than hourly
  - The **Total Excessive Delay** calculation defined in section 490.711(e) was modified to divide the 15-minute volume by 3 to account for this.
- Total populations were defined by 2010 census data rather than a more recent set

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## Three Study Areas



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## Annual Hours of Excessive Delay Per Capita

### Annual\* Hours of Excessive Delay Per Capita – Interstates Only

\* A 6-month time range was used for this analysis (May – October 2014)

	NPMRDS	INRIX
<b>Detroit, MI</b>	2.39 hours	0.32 hours
<b>Washington, D.C.</b>	3.12 hours	1.93 hours
<b>Baltimore, MD</b>	1.95 hours	0.98 hours

### Observations:

- NPMRDS values are significantly higher than the INRIX data set. This may be due to extreme outliers in the NPMRDS that greatly inflate the amount of delay.
- Using the NPMRDS, Detroit value is higher than Baltimore even though Baltimore is a more congested region

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## Summary

- NPMRDS resulted in significantly higher values than the commercial probe data set. This is likely due to extreme outliers in the NPMRDS
  - The DC and Detroit regions appear to be affected more, a trend also observed in UMD's PHTTR analysis
- Might there be an alternative value to total population that would make more sense in a congestion measure?
  - Higher population = lower congestion measure score seems unintuitive

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## Discovered Instability in Calculation

- Current formulation of equations creates opportunity for 'unstable calculation' – meaning that the delay may be grossly overestimated based on...
  - Length of segment
  - Evaluation period
  - Speed – particularly low speeds
- CATT Lab experienced similar instability in delay calculations resulting in vast over estimates of delay during very low speeds and road closures
  - Corrected with maximums and other approaches in calculations

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## Sample of instability – thought exercise

- 1 mile long segment
- At nominal 60 mph, the travel time is 60 seconds
- If excessive delay speed threshold is 30 mph (spec is 35, but 30 makes math easier), corresponding excessive delay time is 120 seconds.
- If the reported speed is 6 mph, the corresponding travel time is 10 minutes or 600 seconds
- The excessive delay **per vehicle** is then  $(600 - 120) = 480$  seconds generated for that 5 minute period
- **BUT**, a five minute period itself is only 300 seconds long. So for a 5 minute reporting period an 8 minute excessive delay is recorded

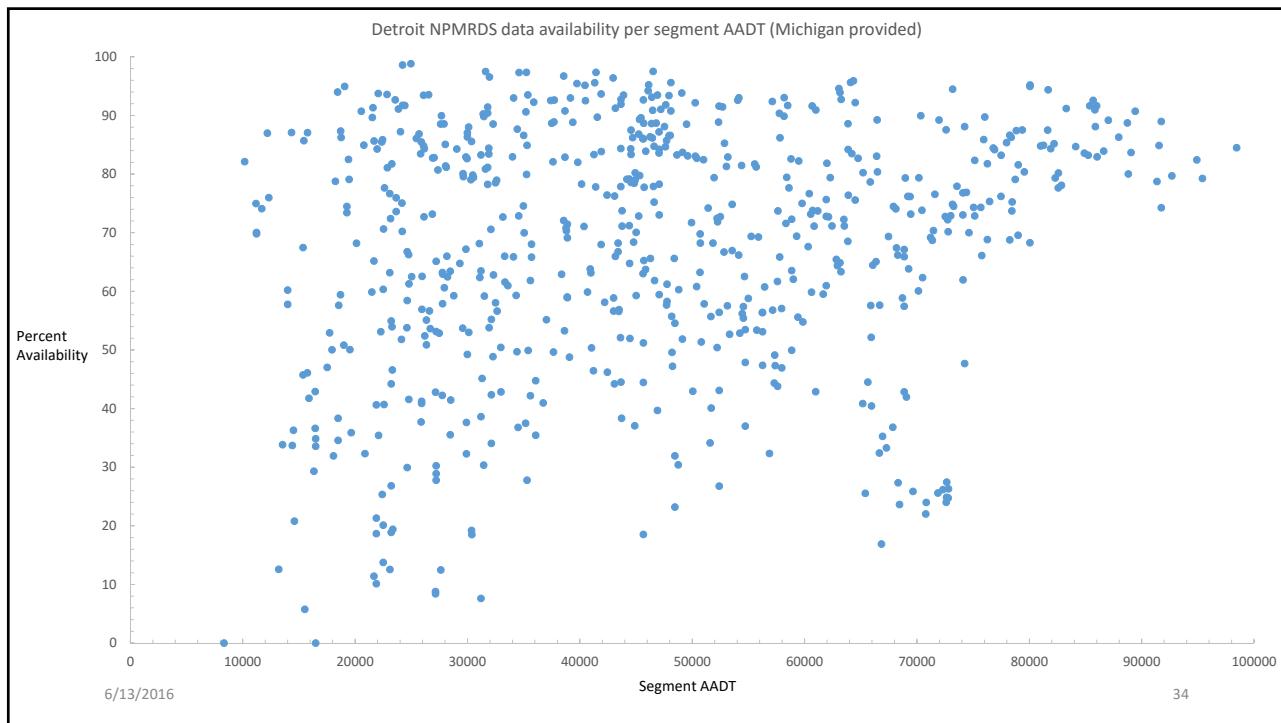
## Addressing the instability

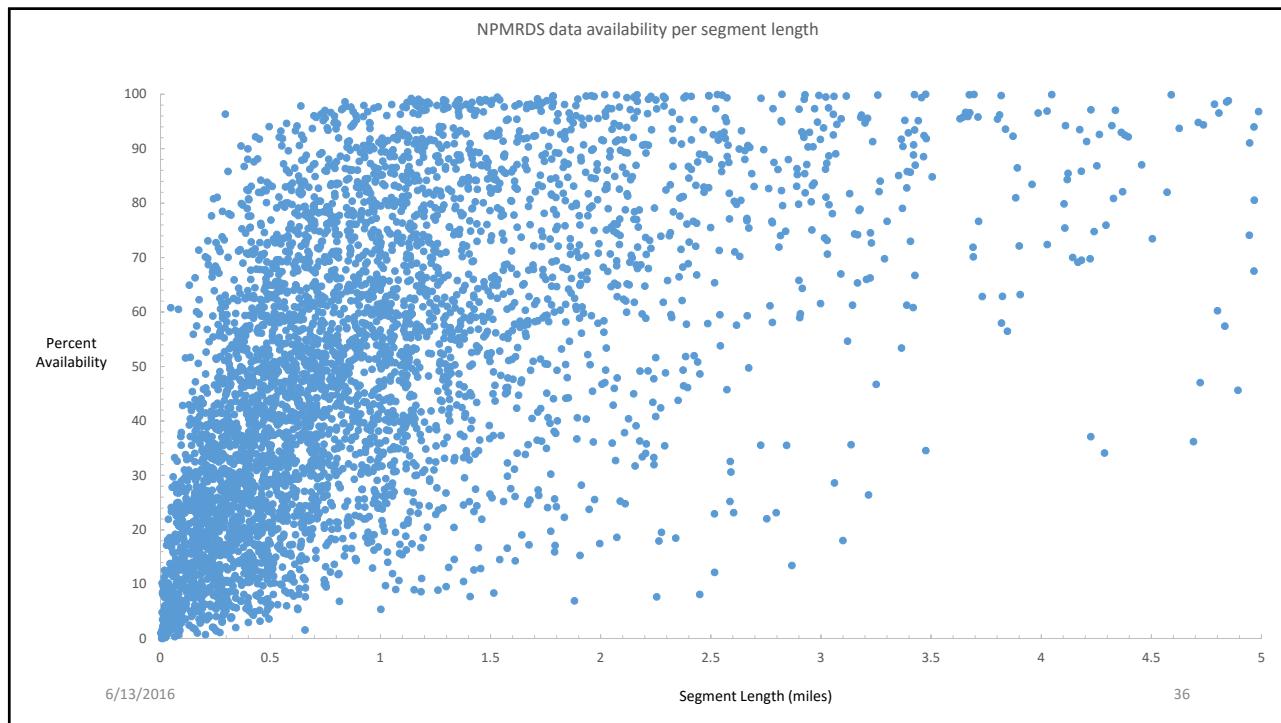
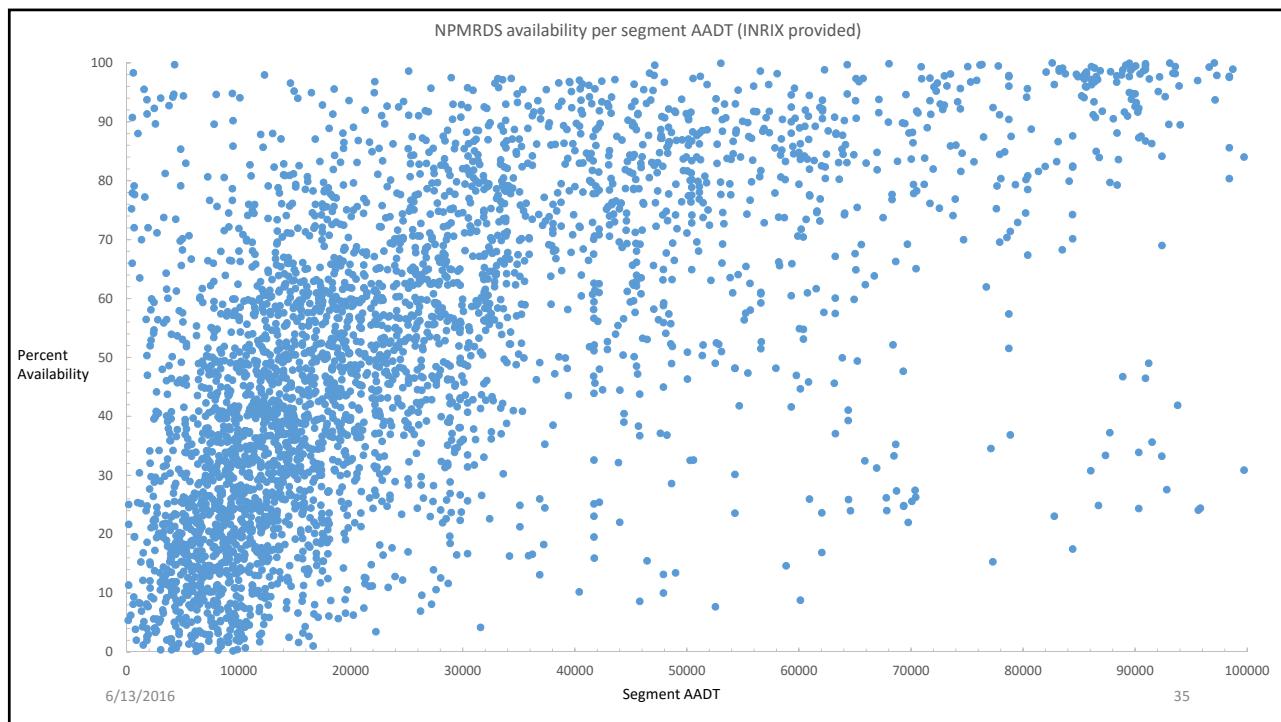
- Instability can be addressed with....
  - Maximums of delay that relate to length of reporting period. CATT has white paper that address these issues.
- Other issues that are linked
  - At extremely slow speeds, AADTs may grossly over-estimate volume
    - Volume-limiting in VPP UDC calculations for all freeway speeds <50 mph
  - At zero speed, segment is a parking lot
  - Similar issues are addressed by CATT in delay
- Outliers in NPMRDS aggravate above issues
  - Suggest investigating some type of averaging / smoothing

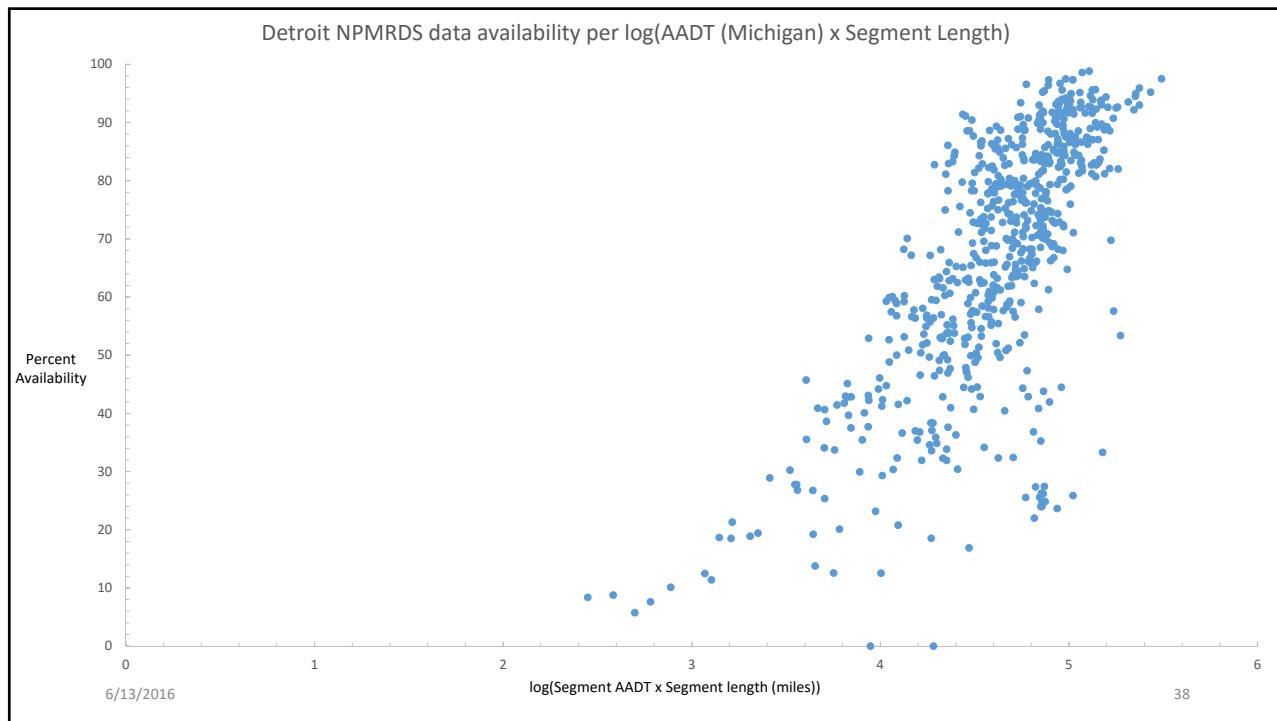
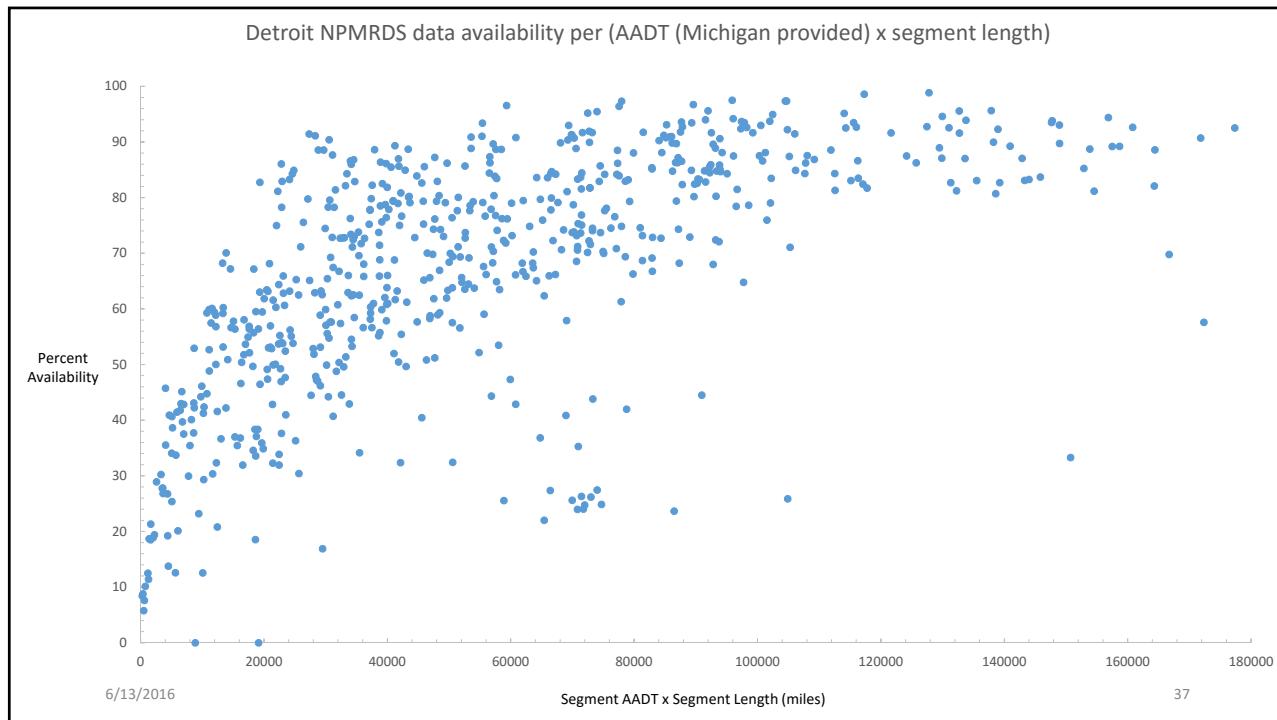
## Additional Materials

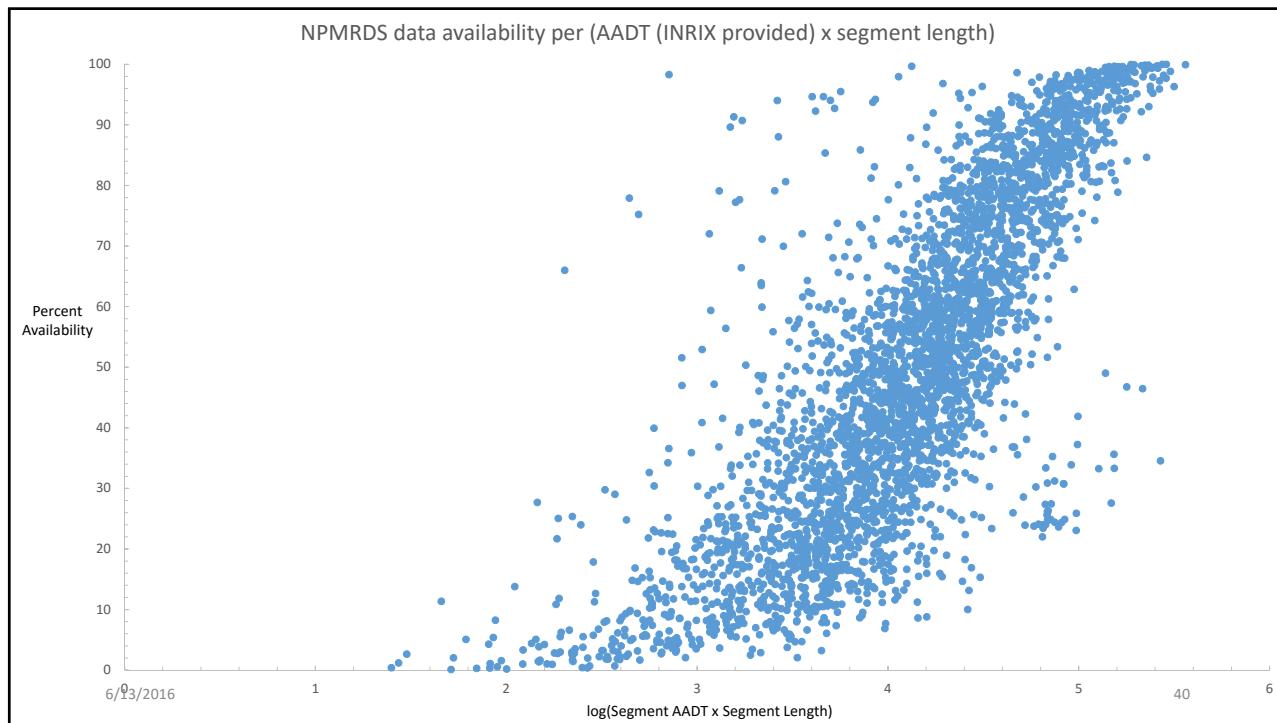
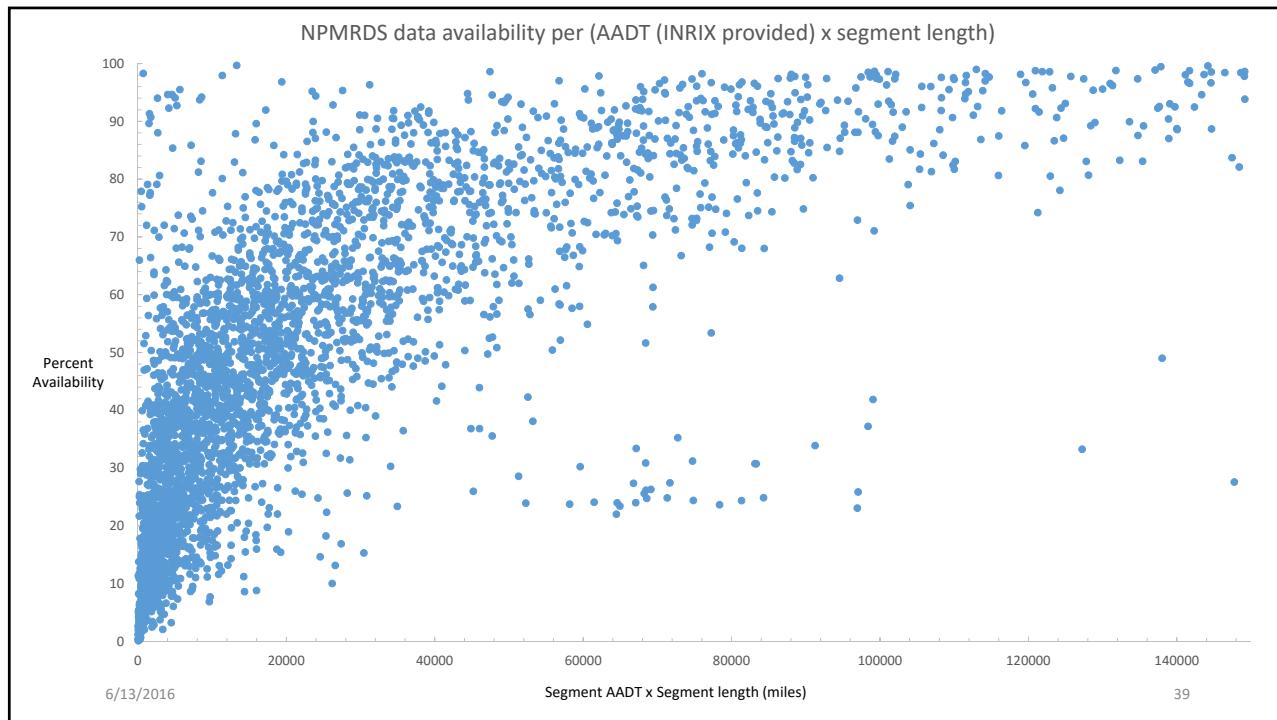
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## LOTTR draft – Detroit – NPMRDS (no fill)

- Green:  $x < 1.2$
- Yellow:  $1.2 \leq x < 1.5$
- Red:  $1.5 \leq x < 2.5$
- Dark red:  $x \geq 2.5$

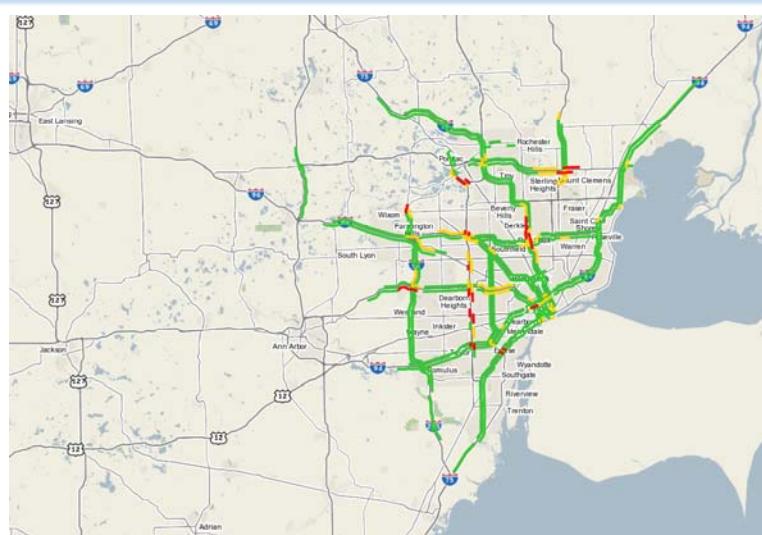


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## LOTTR draft – Detroit – NPMRDS (speed limit fill)

- Green:  $x < 1.2$
- Yellow:  $1.2 \leq x < 1.5$
- Red:  $1.5 \leq x < 2.5$
- Dark red:  $x \geq 2.5$



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42

## LOTTR draft – Detroit – NPMRDS (historic avg. fill)

- Green:  $x < 1.2$
- Yellow:  $1.2 \leq x < 1.5$
- Red:  $1.5 \leq x < 2.5$
- Dark red:  $x \geq 2.5$

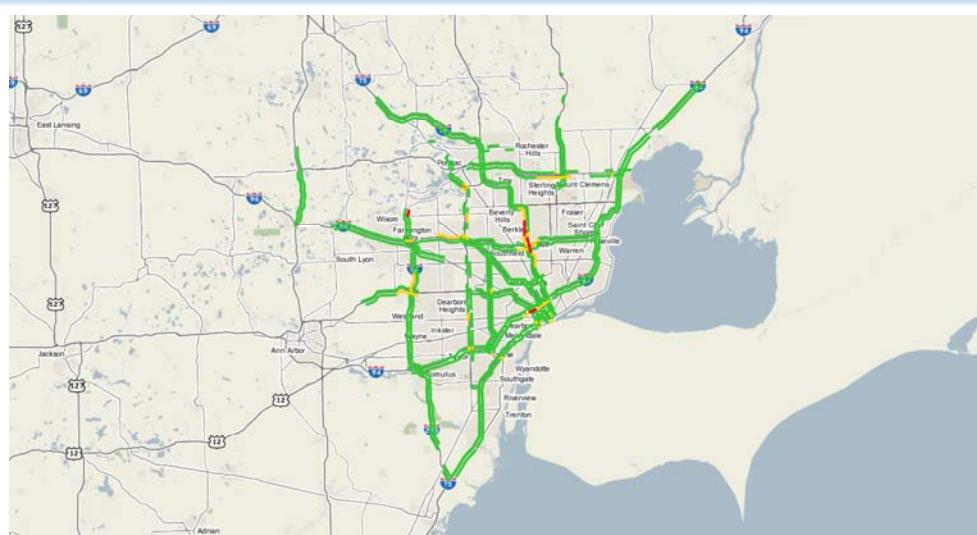


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43

## LOTTR draft – Detroit – HERE

- Green:  $x < 1.2$
- Yellow:  $1.2 \leq x < 1.5$
- Red:  $1.5 \leq x < 2.5$
- Dark red:  $x \geq 2.5$



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44

## LOTTR draft – Detroit – INRIX (modeled)

- Green:  $x < 1.2$
- Yellow:  $1.2 \leq x < 1.5$
- Red:  $1.5 \leq x < 2.5$
- Dark red:  $x \geq 2.5$

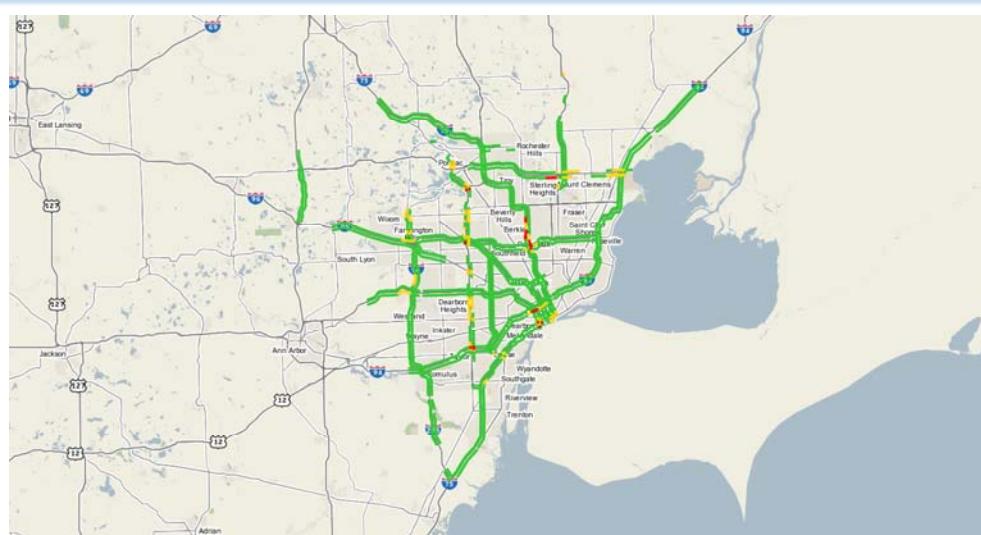


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45

## LOTTR draft – Detroit – INRIX (high-confidence)

- Green:  $x < 1.2$
- Yellow:  $1.2 \leq x < 1.5$
- Red:  $1.5 \leq x < 2.5$
- Dark red:  $x \geq 2.5$



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46

## LOTTR modified – Detroit – NPMRDS (no fill)

- Green:  $x < 1.2$
- Yellow:  $1.2 \leq x < 1.5$
- Red:  $1.5 \leq x < 2.5$
- Dark red:  $x \geq 2.5$

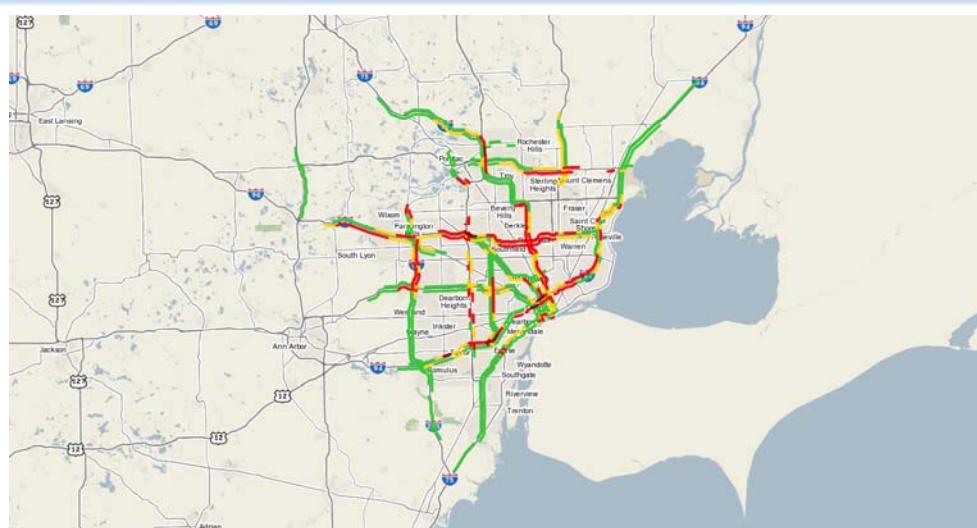


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47

## LOTTR modified– Detroit – NPMRDS (speed limit fill)

- Green:  $x < 1.2$
- Yellow:  $1.2 \leq x < 1.5$
- Red:  $1.5 \leq x < 2.5$
- Dark red:  $x \geq 2.5$



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48

## LOTTR modified– Detroit – NPMRDS (historic avg. fill)

- Green:  $x < 1.2$
- Yellow:  $1.2 \leq x < 1.5$
- Red:  $1.5 \leq x < 2.5$
- Dark red:  $x \geq 2.5$

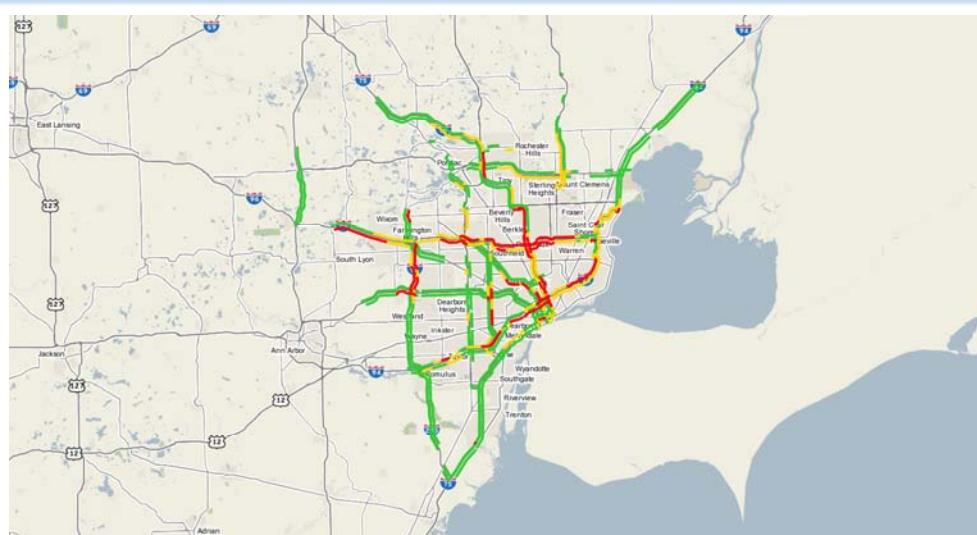


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49

## LOTTR modified– Detroit – HERE

- Green:  $x < 1.2$
- Yellow:  $1.2 \leq x < 1.5$
- Red:  $1.5 \leq x < 2.5$
- Dark red:  $x \geq 2.5$

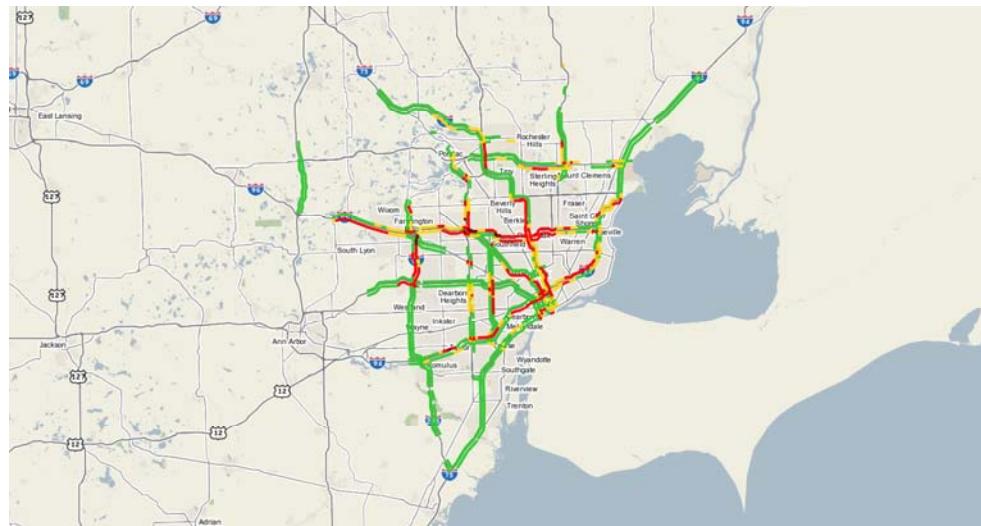


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50

## LOTTR modified– Detroit – INRIX (modeled)

- Green:  $x < 1.2$
- Yellow:  $1.2 \leq x < 1.5$
- Red:  $1.5 \leq x < 2.5$
- Dark red:  $x \geq 2.5$

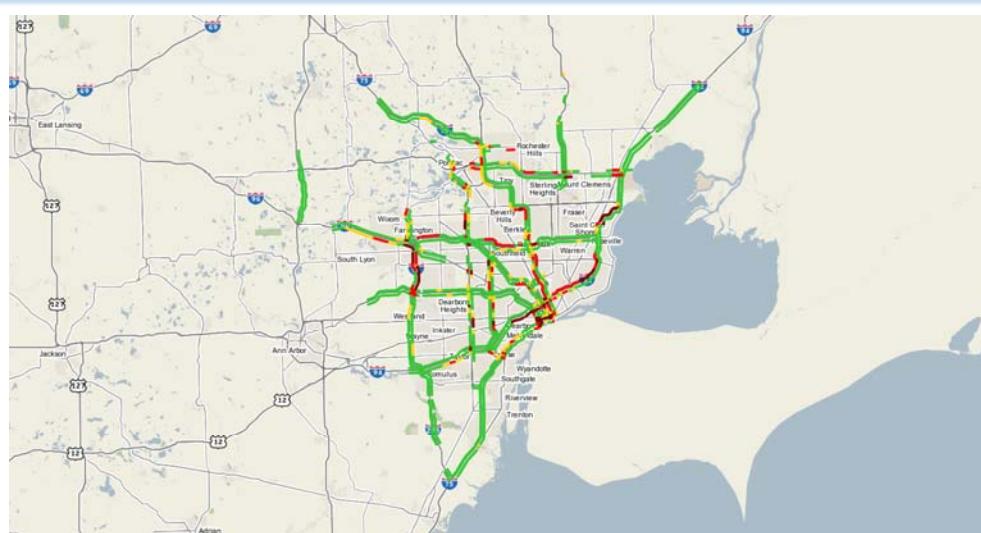


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51

## LOTTR modified– Detroit – INRIX (high-confidence)

- Green:  $x < 1.2$
- Yellow:  $1.2 \leq x < 1.5$
- Red:  $1.5 \leq x < 2.5$
- Dark red:  $x \geq 2.5$

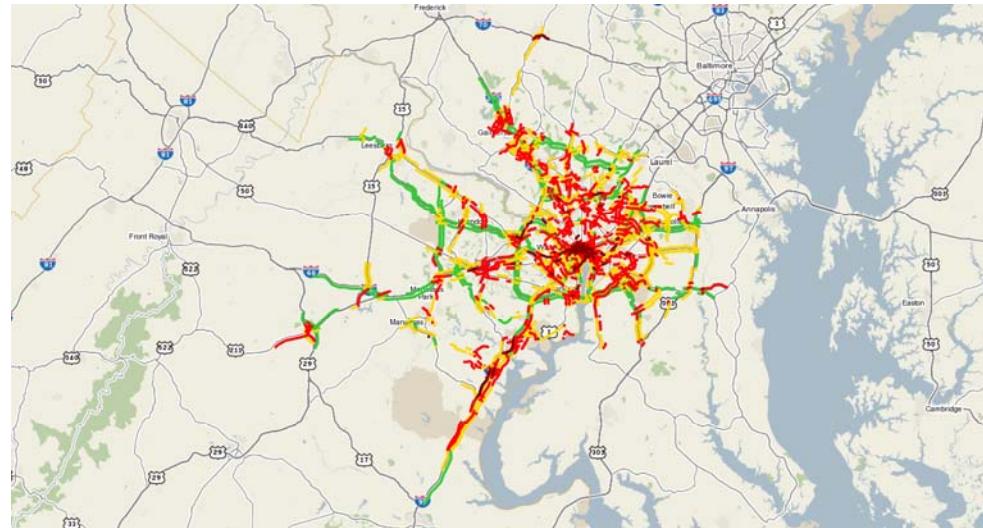


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52

## LOTTR draft – D.C. – NPMRDS (no fill)

- Green:  $x < 1.2$
- Yellow:  $1.2 \leq x < 1.5$
- Red:  $1.5 \leq x < 2.5$
- Dark red:  $x \geq 2.5$

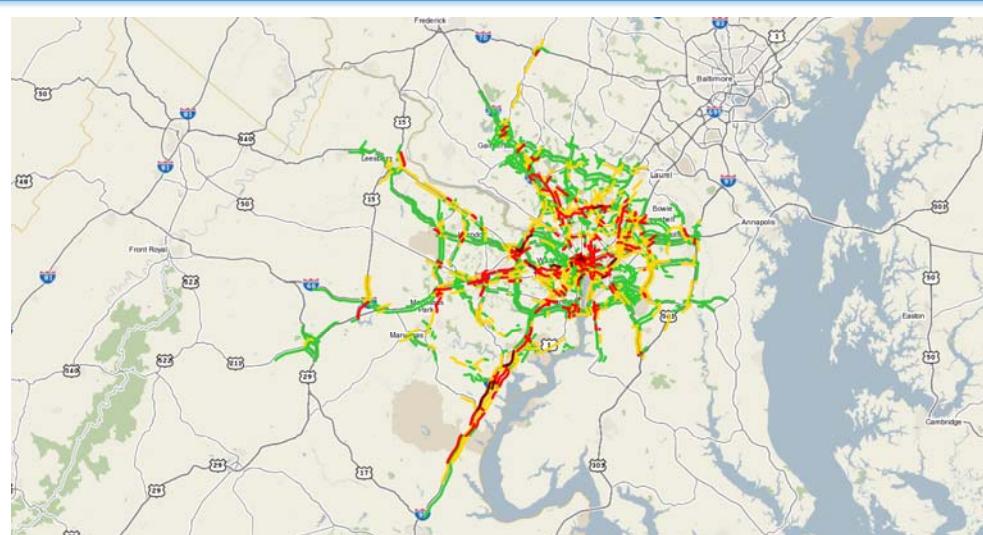


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53

## LOTTR draft – D.C. – NPMRDS (speed limit fill)

- Green:  $x < 1.2$
- Yellow:  $1.2 \leq x < 1.5$
- Red:  $1.5 \leq x < 2.5$
- Dark red:  $x \geq 2.5$

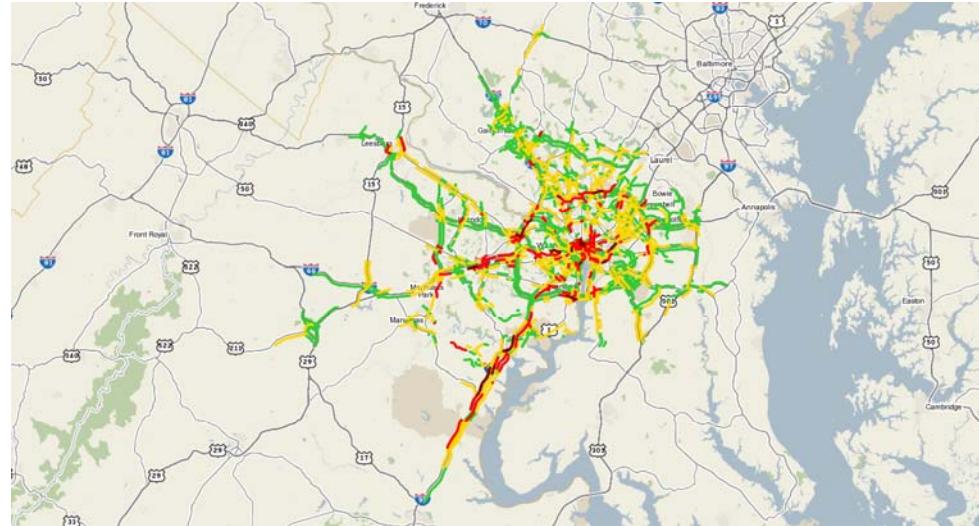


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54

## LOTTR draft – D.C. – NPMRDS (historic avg. fill)

- Green:  $x < 1.2$
- Yellow:  $1.2 \leq x < 1.5$
- Red:  $1.5 \leq x < 2.5$
- Dark red:  $x \geq 2.5$

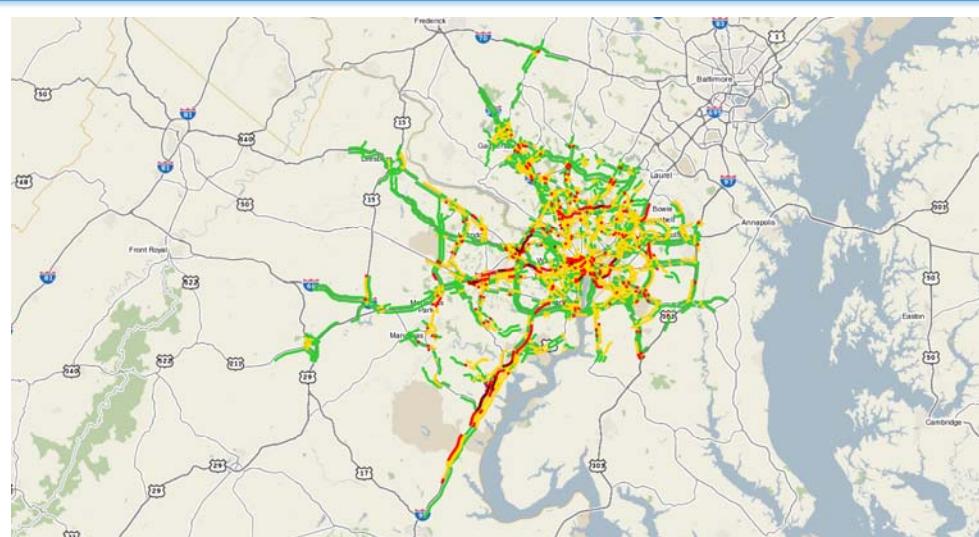


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55

## LOTTR draft – D.C. – INRIX (modeled)

- Green:  $x < 1.2$
- Yellow:  $1.2 \leq x < 1.5$
- Red:  $1.5 \leq x < 2.5$
- Dark red:  $x \geq 2.5$

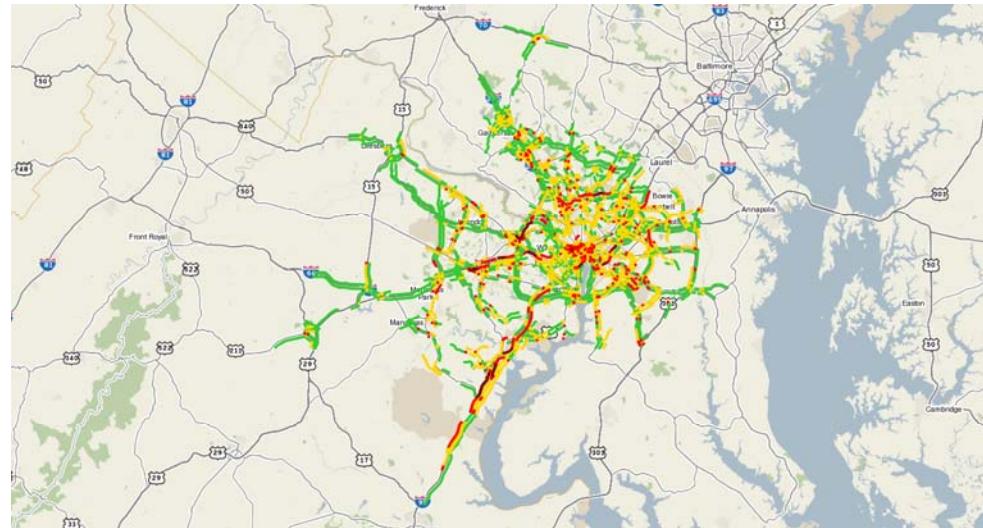


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56

## LOTTR draft – D.C. – INRIX (high-confidence)

- Green:  $x < 1.2$
- Yellow:  $1.2 \leq x < 1.5$
- Red:  $1.5 \leq x < 2.5$
- Dark red:  $x \geq 2.5$

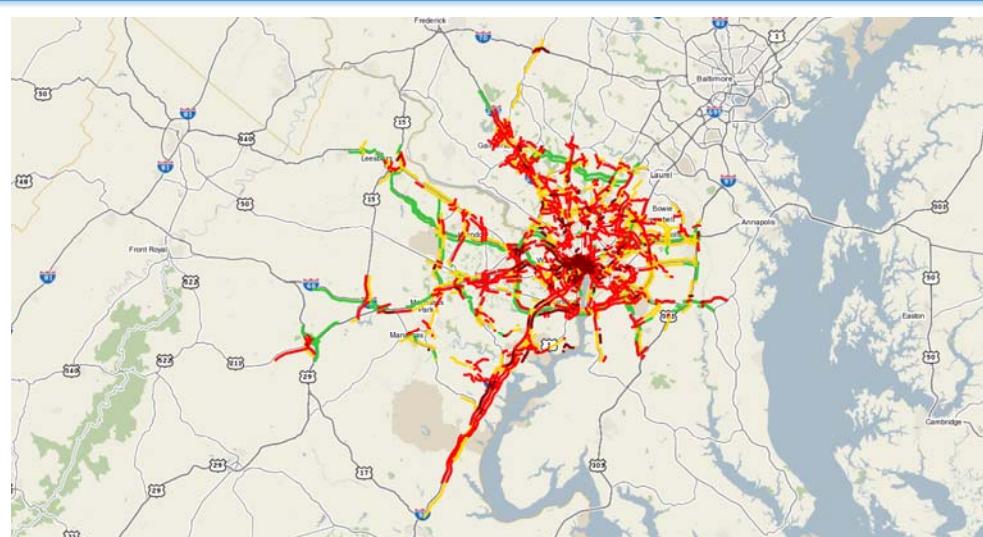


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57

## LOTTR modified – D.C. – NPMRDS (no fill)

- Green:  $x < 1.2$
- Yellow:  $1.2 \leq x < 1.5$
- Red:  $1.5 \leq x < 2.5$
- Dark red:  $x \geq 2.5$

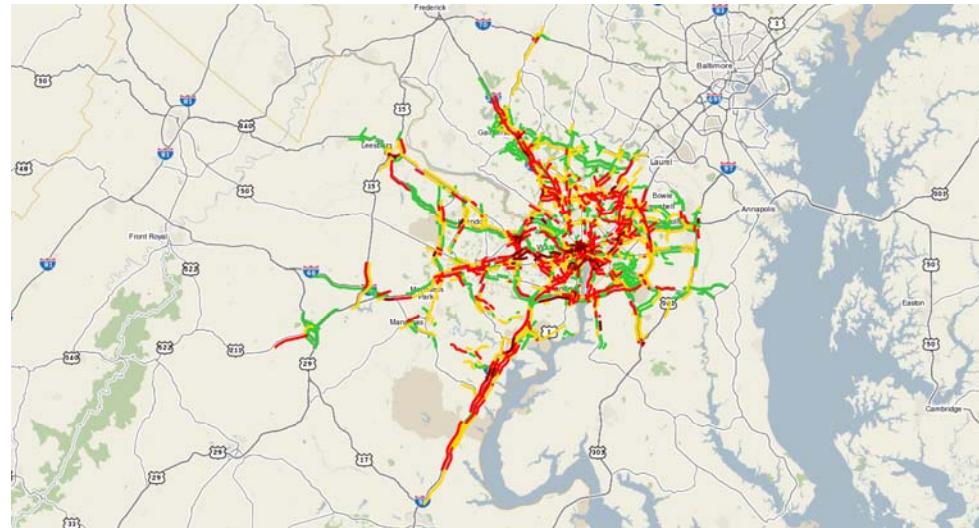


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58

## LOTTR modified– D.C. – NPMRDS (speed limit fill)

- Green:  $x < 1.2$
- Yellow:  $1.2 \leq x < 1.5$
- Red:  $1.5 \leq x < 2.5$
- Dark red:  $x \geq 2.5$

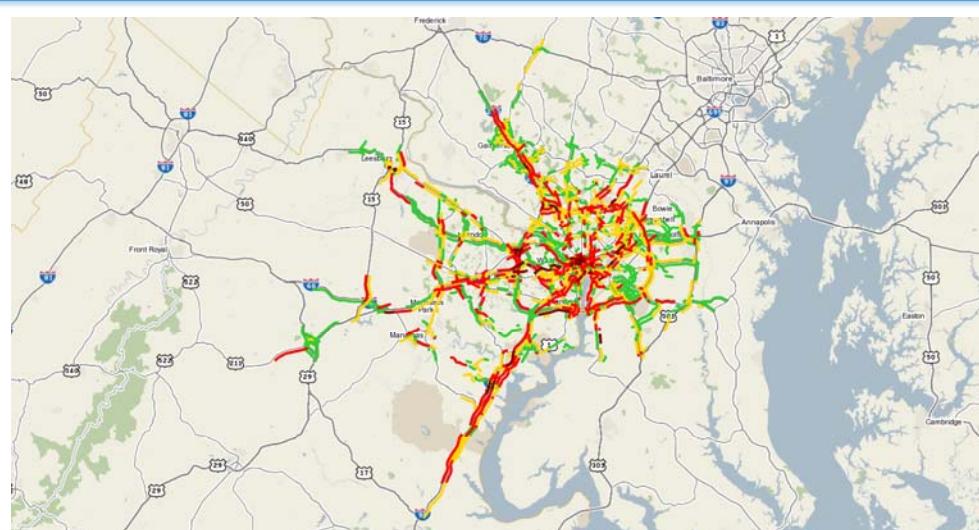


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59

## LOTTR modified– D.C. – NPMRDS (historic avg. fill)

- Green:  $x < 1.2$
- Yellow:  $1.2 \leq x < 1.5$
- Red:  $1.5 \leq x < 2.5$
- Dark red:  $x \geq 2.5$

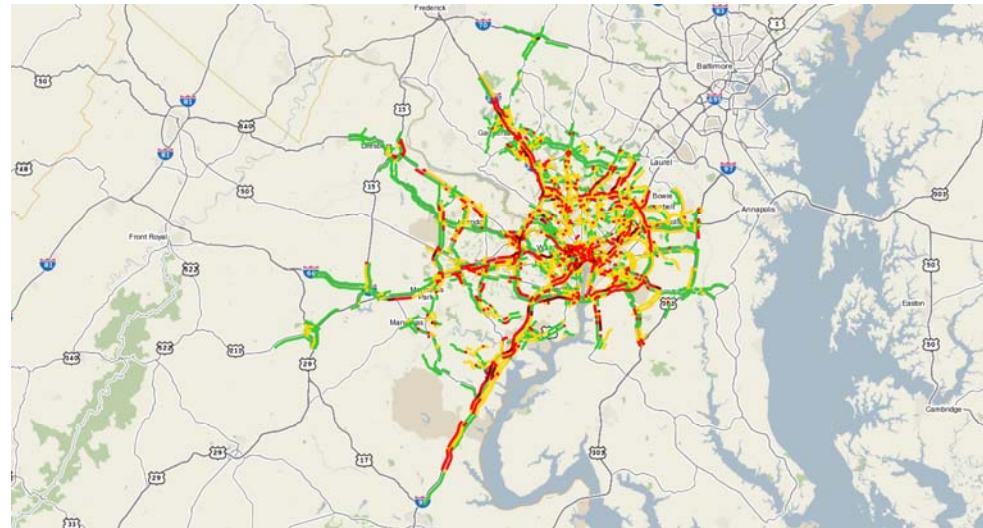


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60

## LOTTR modified– D.C. – INRIX (modeled)

- Green:  $x < 1.2$
- Yellow:  $1.2 \leq x < 1.5$
- Red:  $1.5 \leq x < 2.5$
- Dark red:  $x \geq 2.5$

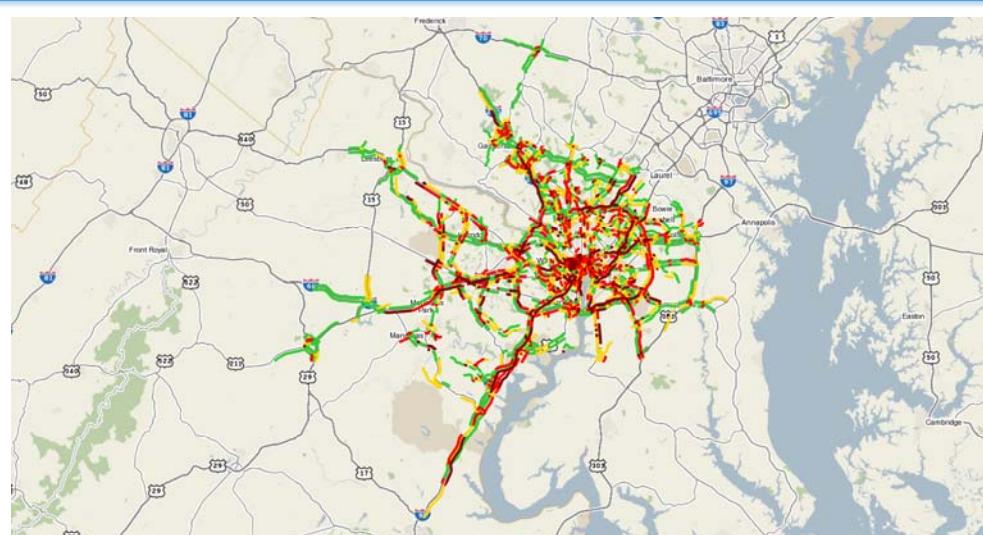


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61

## LOTTR modified– D.C. – INRIX (high-confidence)

- Green:  $x < 1.2$
- Yellow:  $1.2 \leq x < 1.5$
- Red:  $1.5 \leq x < 2.5$
- Dark red:  $x \geq 2.5$

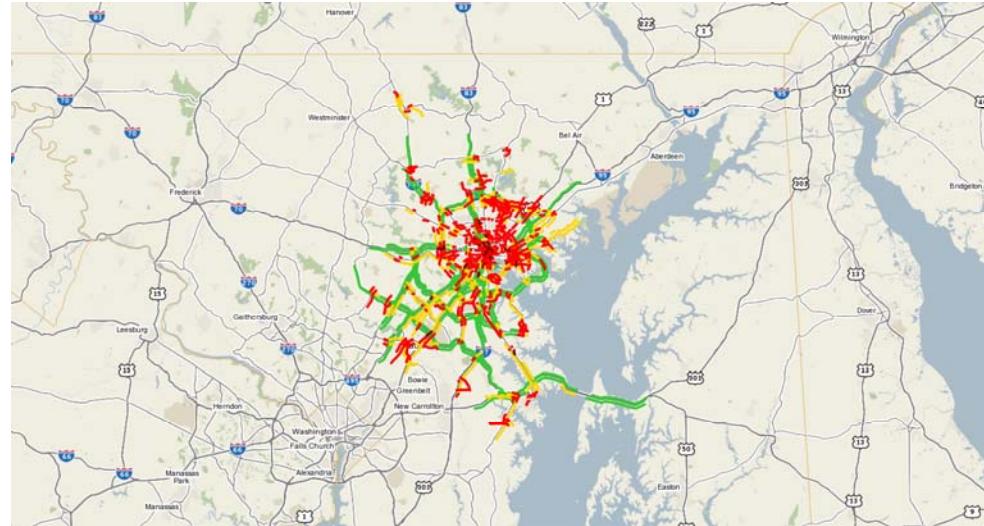


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62

## LOTTR draft – Baltimore – NPMRDS (no fill)

- Green:  $x < 1.2$
- Yellow:  $1.2 \leq x < 1.5$
- Red:  $1.5 \leq x < 2.5$
- Dark red:  $x \geq 2.5$

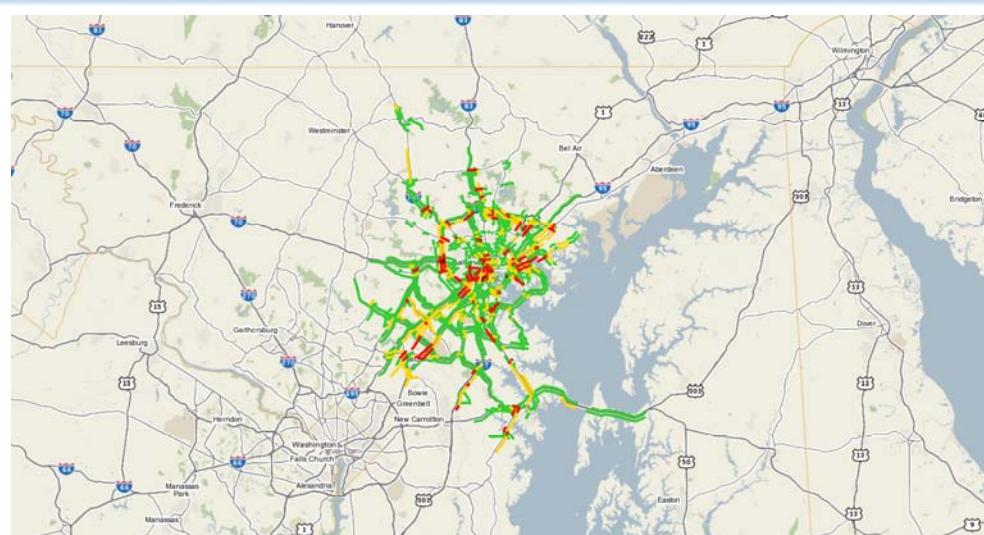


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63

## LOTTR draft – Baltimore – NPMRDS (speed limit fill)

- Green:  $x < 1.2$
- Yellow:  $1.2 \leq x < 1.5$
- Red:  $1.5 \leq x < 2.5$
- Dark red:  $x \geq 2.5$

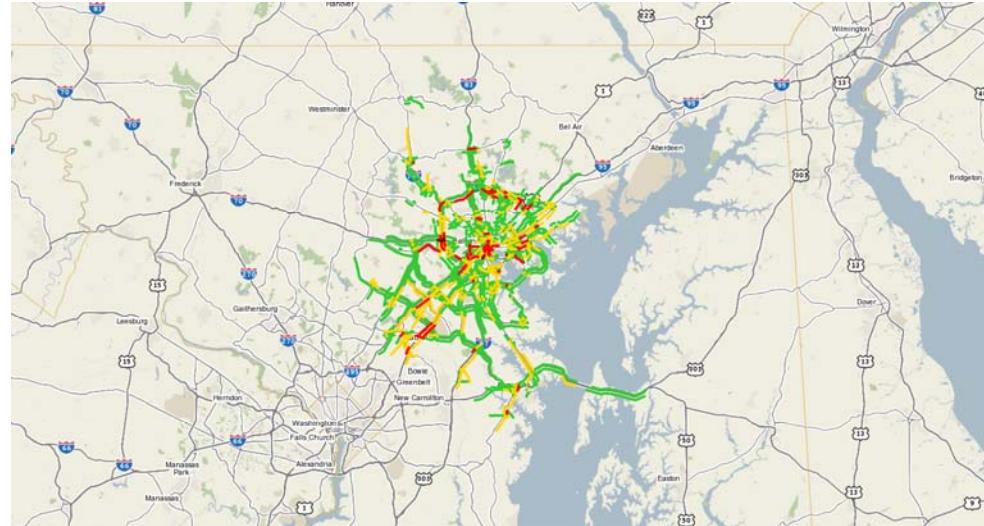


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64

## LOTTR draft – Baltimore – NPMRDS (historic avg. fill)

- Green:  $x < 1.2$
- Yellow:  $1.2 \leq x < 1.5$
- Red:  $1.5 \leq x < 2.5$
- Dark red:  $x \geq 2.5$

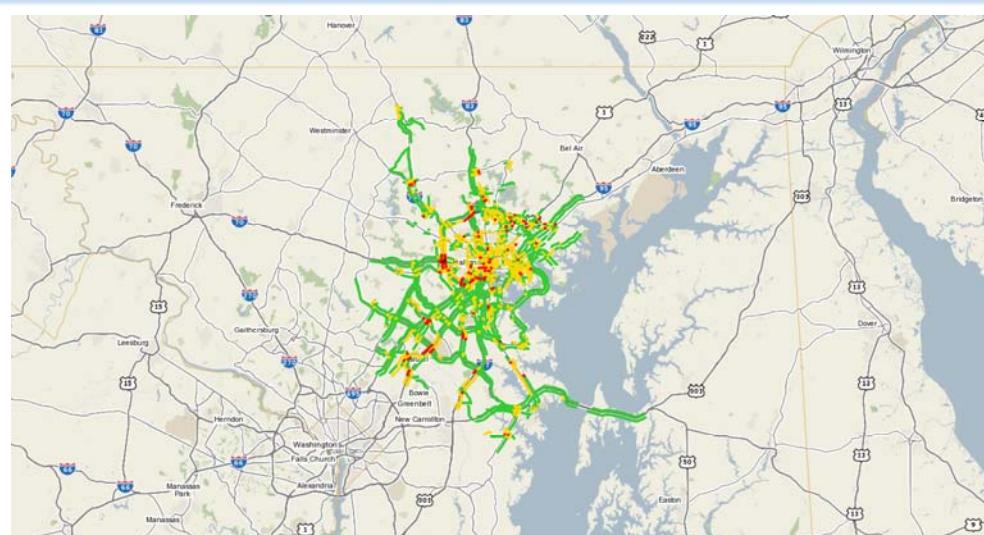


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65

## LOTTR draft – Baltimore – INRIX (modeled)

- Green:  $x < 1.2$
- Yellow:  $1.2 \leq x < 1.5$
- Red:  $1.5 \leq x < 2.5$
- Dark red:  $x \geq 2.5$

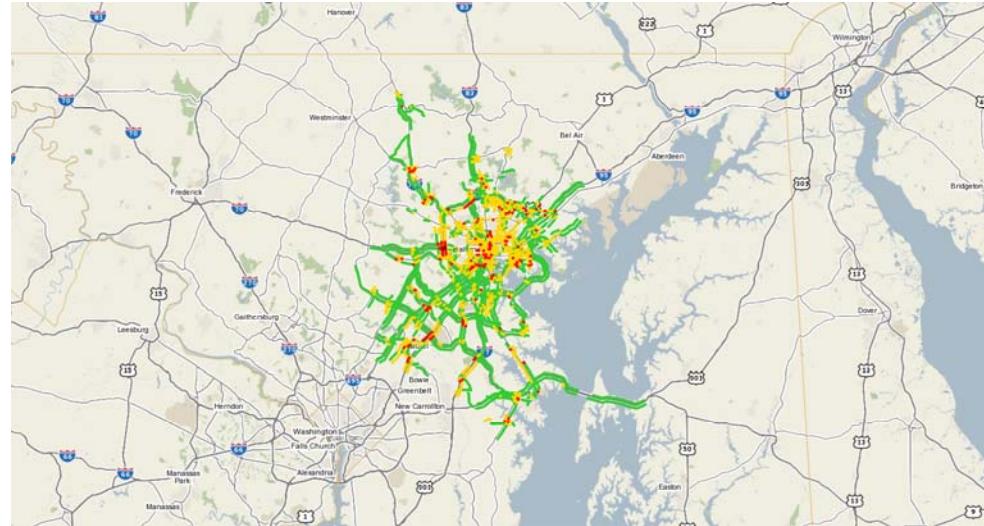


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66

## LOTTR draft – Baltimore – INRIX (high-confidence)

- Green:  $x < 1.2$
- Yellow:  $1.2 \leq x < 1.5$
- Red:  $1.5 \leq x < 2.5$
- Dark red:  $x \geq 2.5$

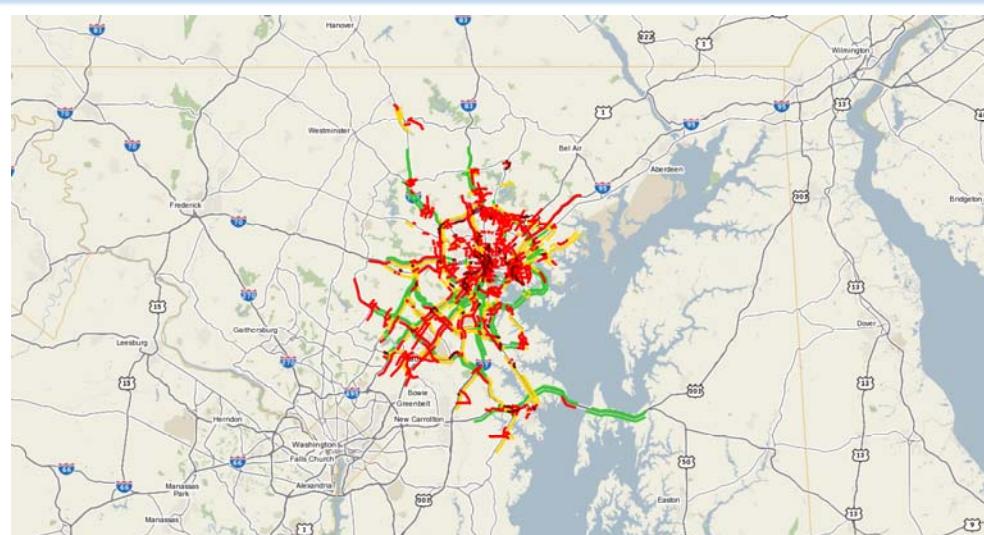


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67

## LOTTR modified – Baltimore – NPMRDS (no fill)

- Green:  $x < 1.2$
- Yellow:  $1.2 \leq x < 1.5$
- Red:  $1.5 \leq x < 2.5$
- Dark red:  $x \geq 2.5$

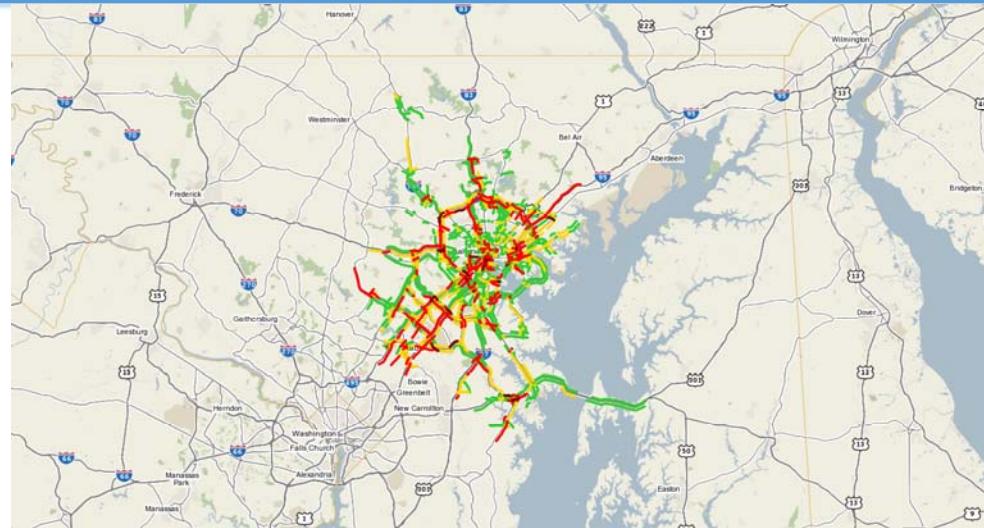


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68

## LOTTR modified – Baltimore – NPMRDS (speed limit fill)

- Green:  $x < 1.2$
- Yellow:  $1.2 \leq x < 1.5$
- Red:  $1.5 \leq x < 2.5$
- Dark red:  $x \geq 2.5$

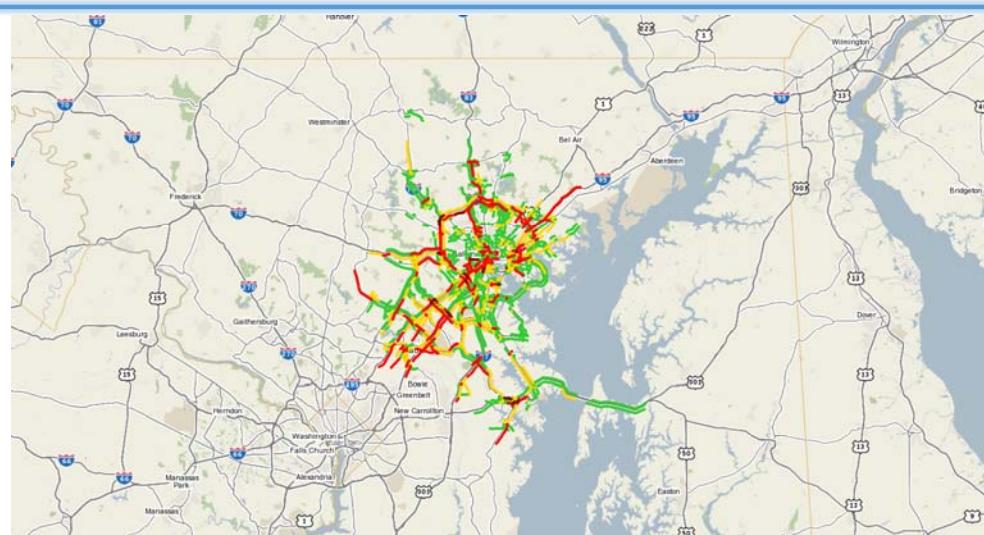


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69

## LOTTR modified – Baltimore – NPMRDS (historic avg. fill)

- Green:  $x < 1.2$
- Yellow:  $1.2 \leq x < 1.5$
- Red:  $1.5 \leq x < 2.5$
- Dark red:  $x \geq 2.5$

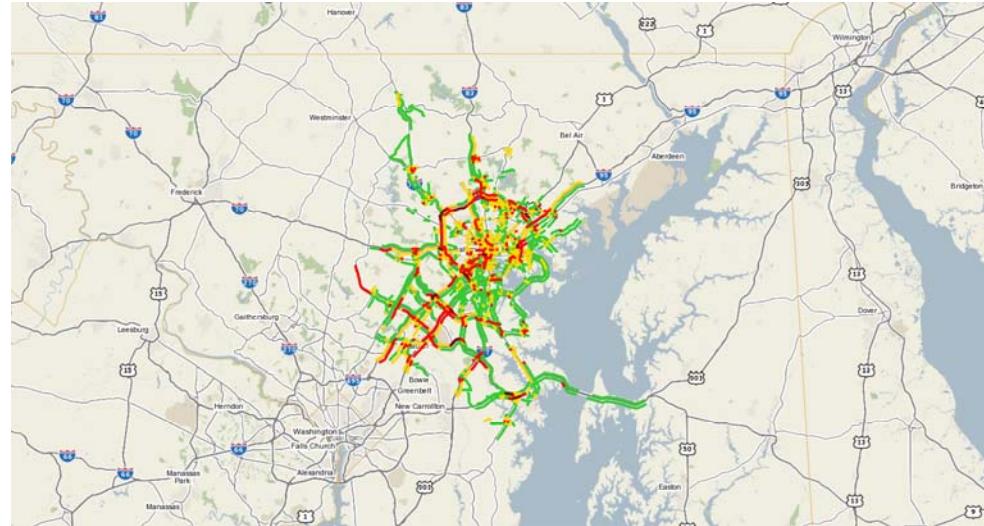


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70

## LOTTR modified – Baltimore – INRIX (modeled)

- Green:  $x < 1.2$
- Yellow:  $1.2 \leq x < 1.5$
- Red:  $1.5 \leq x < 2.5$
- Dark red:  $x \geq 2.5$

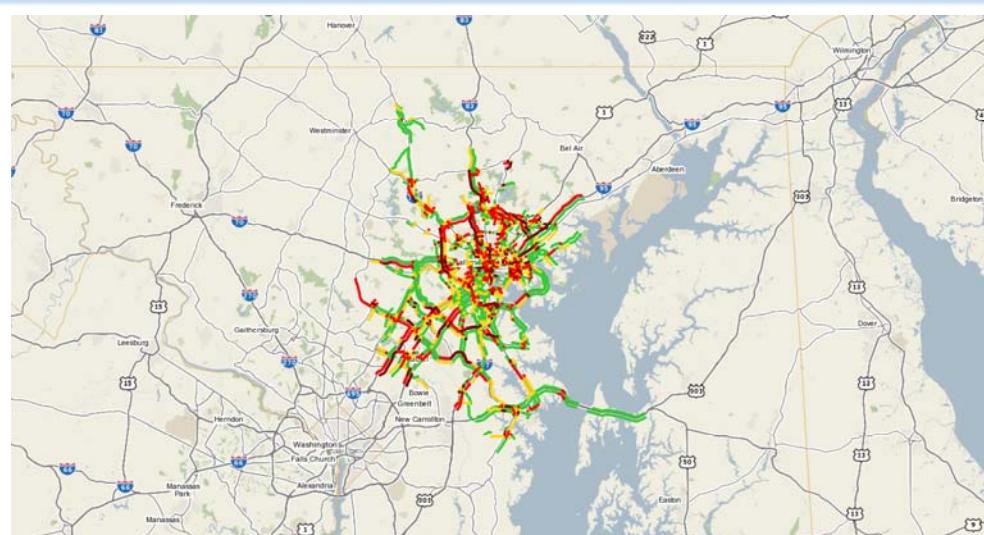


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71

## LOTTR modified – Baltimore – INRIX (high-confidence)

- Green:  $x < 1.2$
- Yellow:  $1.2 \leq x < 1.5$
- Red:  $1.5 \leq x < 2.5$
- Dark red:  $x \geq 2.5$



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72

## PHTTR mean – Detroit – NPMRDS (no fill)

- Green:  $x < 1.2$
- Yellow:  $1.2 \leq x < 1.5$
- Red:  $1.5 \leq x < 2.5$
- Dark red:  $x \geq 2.5$

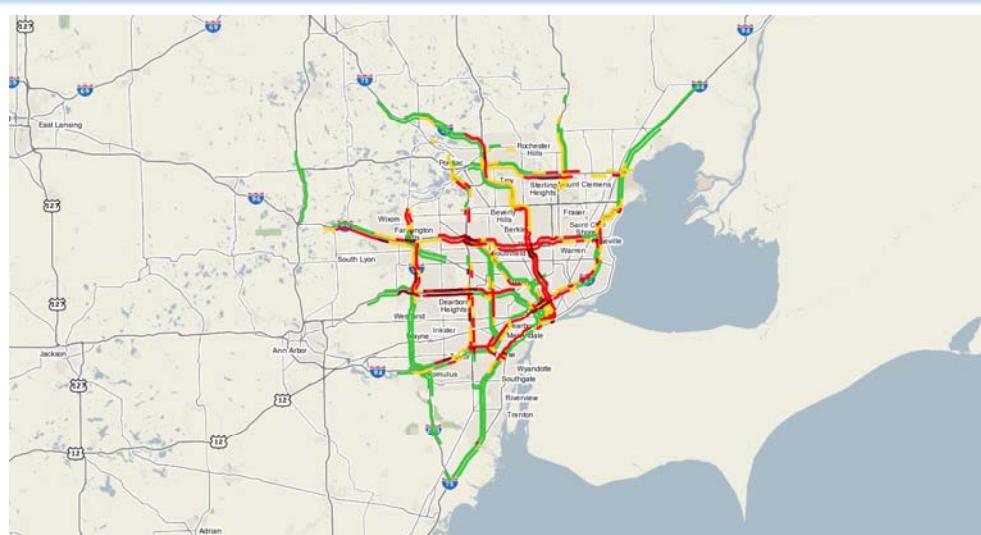


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73

## PHTTR mean – Detroit – NPMRDS (speed limit fill)

- Green:  $x < 1.2$
- Yellow:  $1.2 \leq x < 1.5$
- Red:  $1.5 \leq x < 2.5$
- Dark red:  $x \geq 2.5$

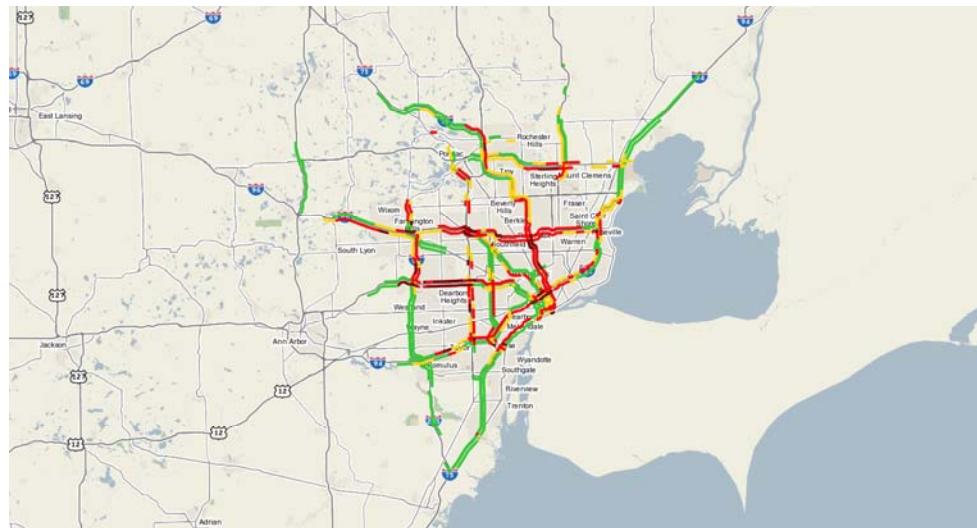


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74

## PHTTR mean – Detroit – NPMRDS (historic avg. fill)

- Green:  $x < 1.2$
- Yellow:  $1.2 \leq x < 1.5$
- Red:  $1.5 \leq x < 2.5$
- Dark red:  $x \geq 2.5$

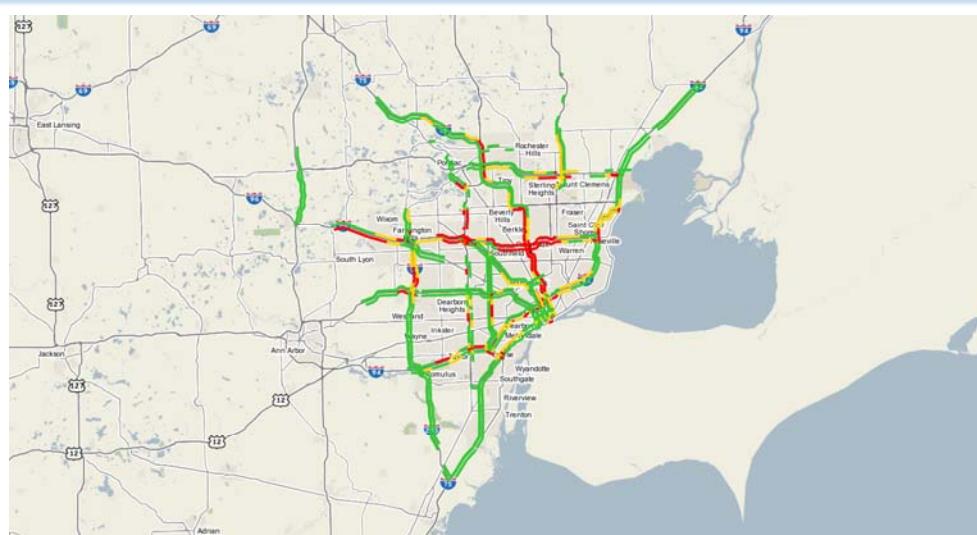


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75

## PHTTR mean – Detroit – HERE

- Green:  $x < 1.2$
- Yellow:  $1.2 \leq x < 1.5$
- Red:  $1.5 \leq x < 2.5$
- Dark red:  $x \geq 2.5$



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76

## PHTTR mean – Detroit – INRIX (modeled)

- Green:  $x < 1.2$
- Yellow:  $1.2 \leq x < 1.5$
- Red:  $1.5 \leq x < 2.5$
- Dark red:  $x \geq 2.5$

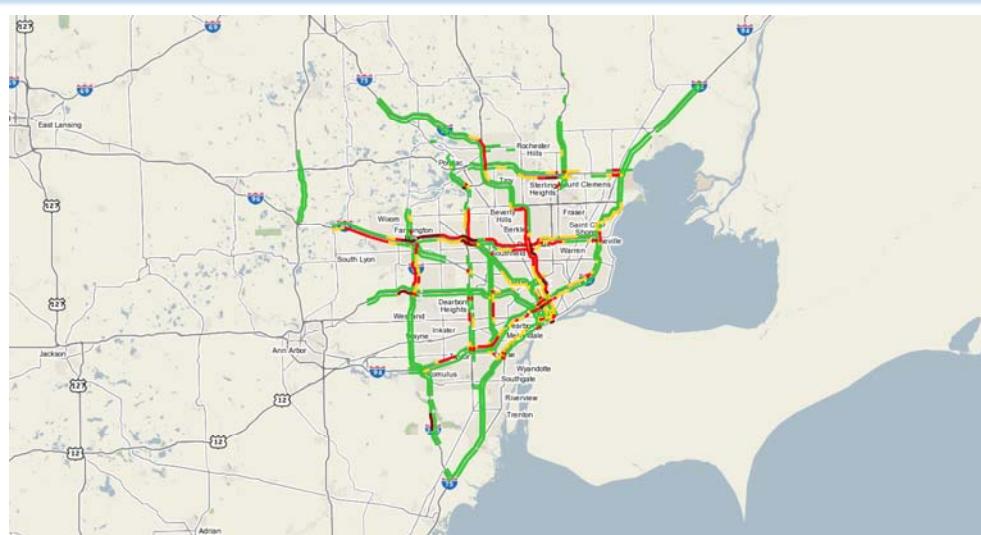


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77

## PHTTR mean – Detroit – INRIX (high-confidence)

- Green:  $x < 1.2$
- Yellow:  $1.2 \leq x < 1.5$
- Red:  $1.5 \leq x < 2.5$
- Dark red:  $x \geq 2.5$

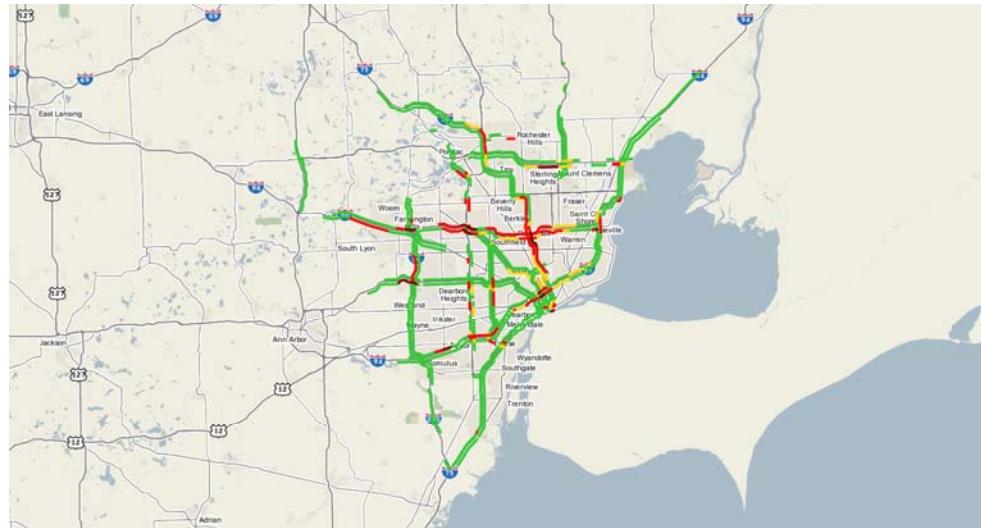


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78

## PHTTR median – Detroit – NPMRDS (no fill)

- Green:  $x < 1.2$
- Yellow:  $1.2 \leq x < 1.5$
- Red:  $1.5 \leq x < 2.5$
- Dark red:  $x \geq 2.5$

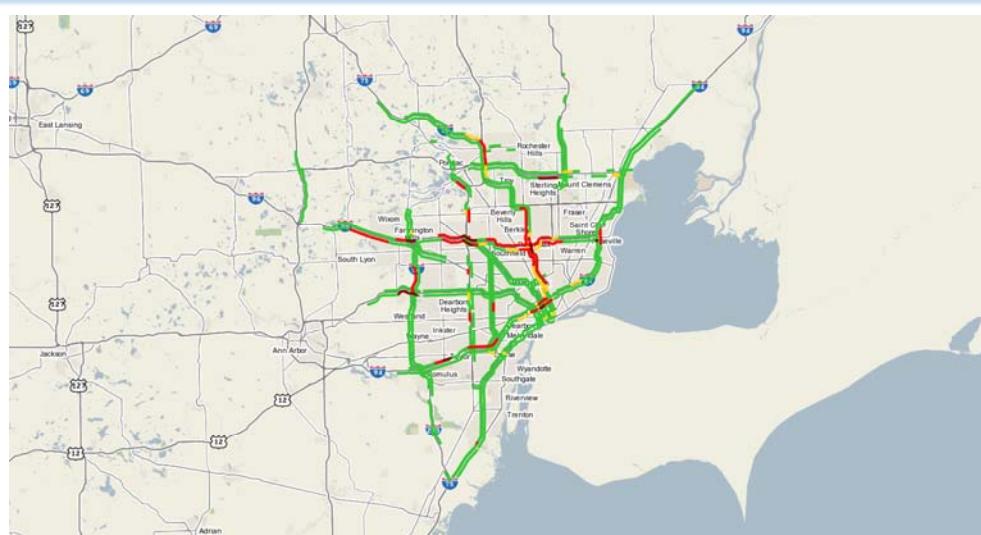


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79

## PHTTR median – Detroit – NPMRDS (speed limit fill)

- Green:  $x < 1.2$
- Yellow:  $1.2 \leq x < 1.5$
- Red:  $1.5 \leq x < 2.5$
- Dark red:  $x \geq 2.5$

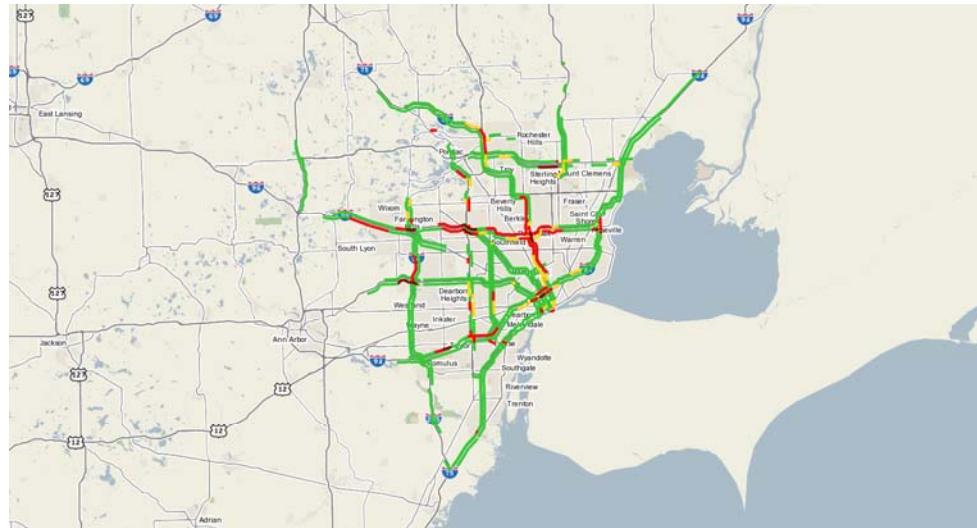


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80

## PHTTR median – Detroit – NPMRDS (historic avg. fill)

- Green:  $x < 1.2$
- Yellow:  $1.2 \leq x < 1.5$
- Red:  $1.5 \leq x < 2.5$
- Dark red:  $x \geq 2.5$

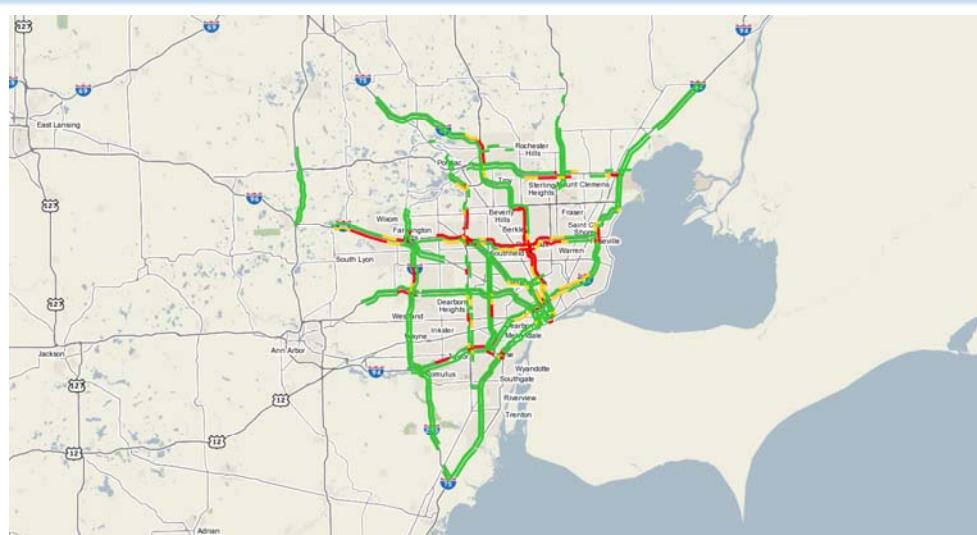


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81

## PHTTR median – Detroit – HERE

- Green:  $x < 1.2$
- Yellow:  $1.2 \leq x < 1.5$
- Red:  $1.5 \leq x < 2.5$
- Dark red:  $x \geq 2.5$

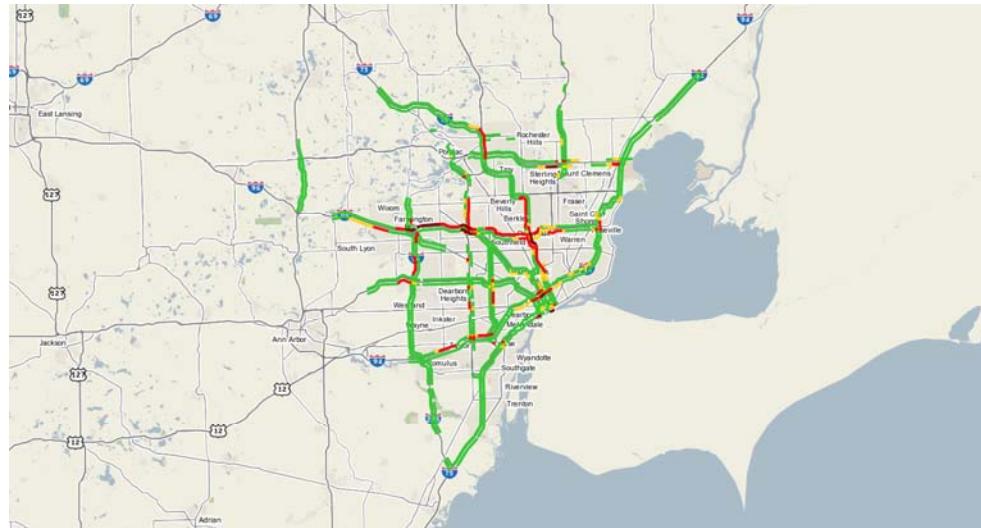


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82

## PHTTR median – Detroit – INRIX (modeled)

- Green:  $x < 1.2$
- Yellow:  $1.2 \leq x < 1.5$
- Red:  $1.5 \leq x < 2.5$
- Dark red:  $x \geq 2.5$

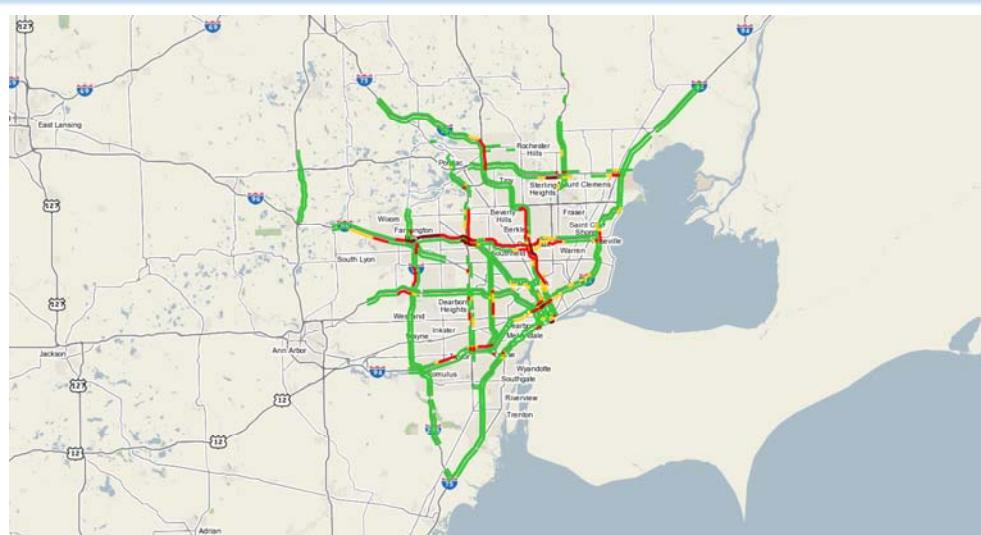


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83

## PHTTR median – Detroit – INRIX (high-confidence)

- Green:  $x < 1.2$
- Yellow:  $1.2 \leq x < 1.5$
- Red:  $1.5 \leq x < 2.5$
- Dark red:  $x \geq 2.5$

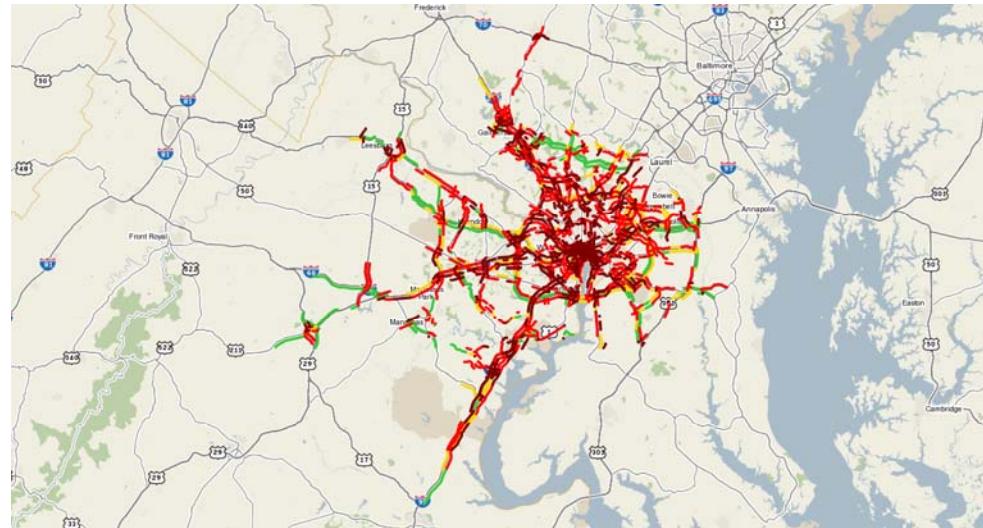


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84

## PHTTR mean – D.C. – NPMRDS (no fill)

- Green:  $x < 1.2$
- Yellow:  $1.2 \leq x < 1.5$
- Red:  $1.5 \leq x < 2.5$
- Dark red:  $x \geq 2.5$

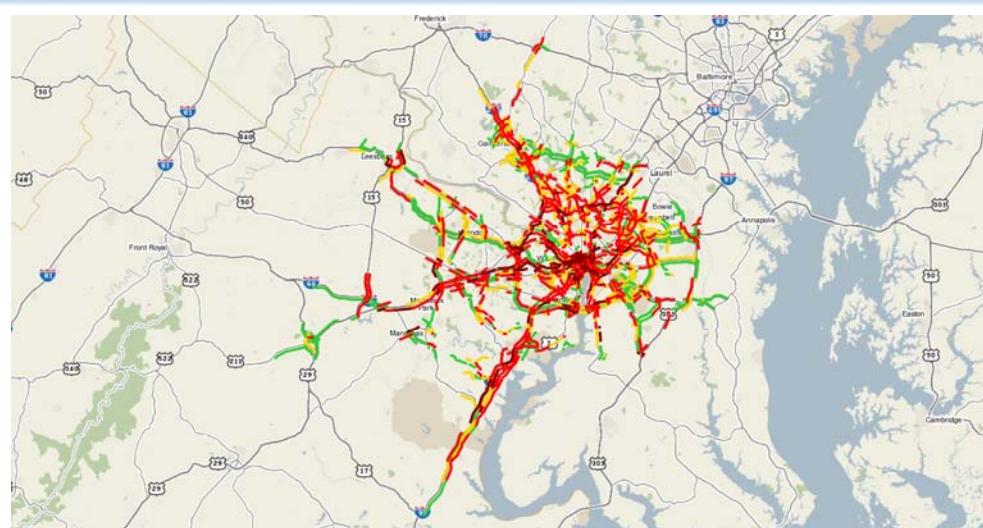


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85

## PHTTR mean – D.C. – NPMRDS (speed limit fill)

- Green:  $x < 1.2$
- Yellow:  $1.2 \leq x < 1.5$
- Red:  $1.5 \leq x < 2.5$
- Dark red:  $x \geq 2.5$

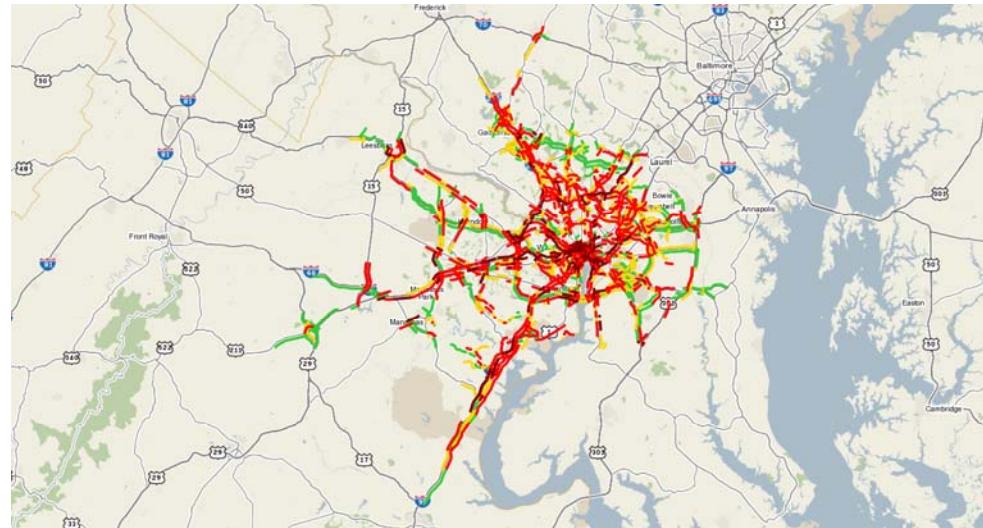


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86

## PHTTR mean – D.C. – NPMRDS (historic avg. fill)

- Green:  $x < 1.2$
- Yellow:  $1.2 \leq x < 1.5$
- Red:  $1.5 \leq x < 2.5$
- Dark red:  $x \geq 2.5$

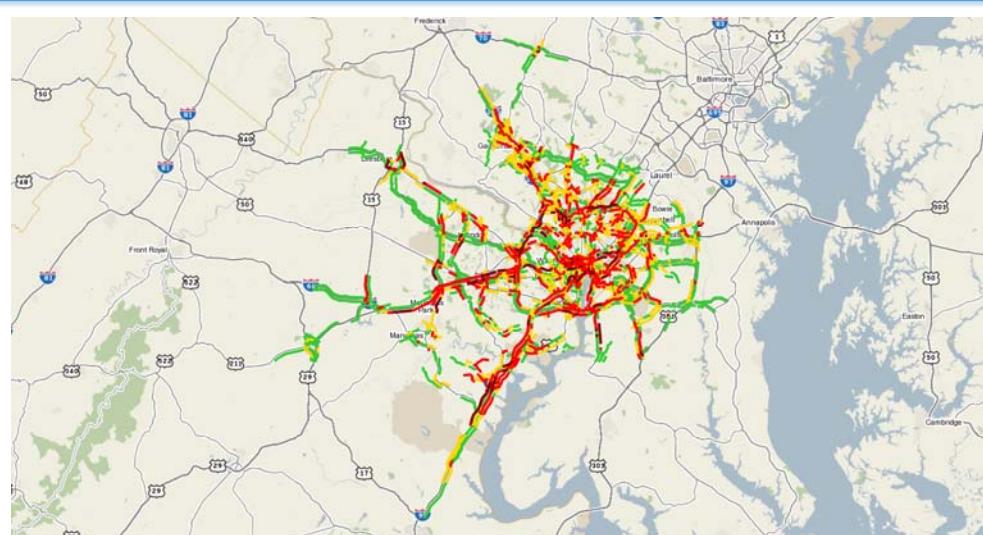


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87

## PHTTR mean – D.C. – INRIX (modeled)

- Green:  $x < 1.2$
- Yellow:  $1.2 \leq x < 1.5$
- Red:  $1.5 \leq x < 2.5$
- Dark red:  $x \geq 2.5$

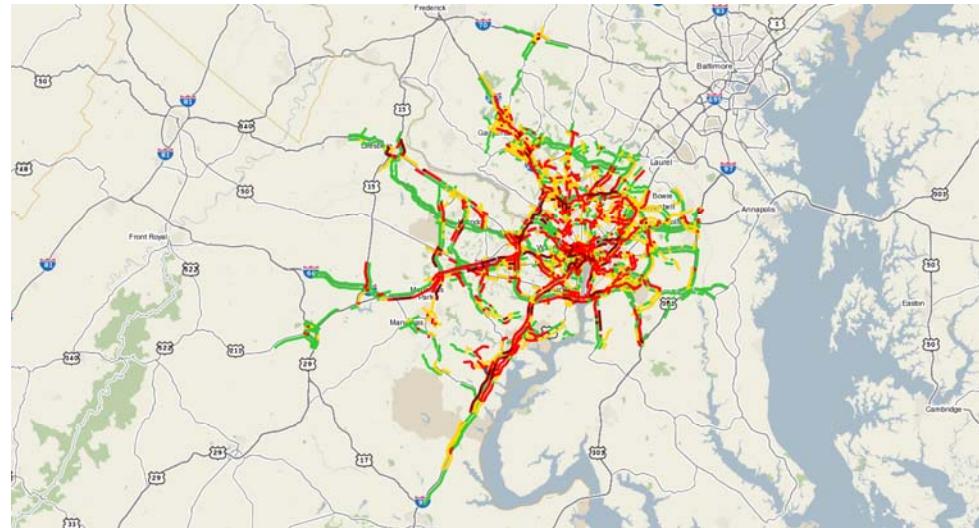


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88

## PHTTR mean – D.C. – INRIX (high-confidence)

- Green:  $x < 1.2$
- Yellow:  $1.2 \leq x < 1.5$
- Red:  $1.5 \leq x < 2.5$
- Dark red:  $x \geq 2.5$

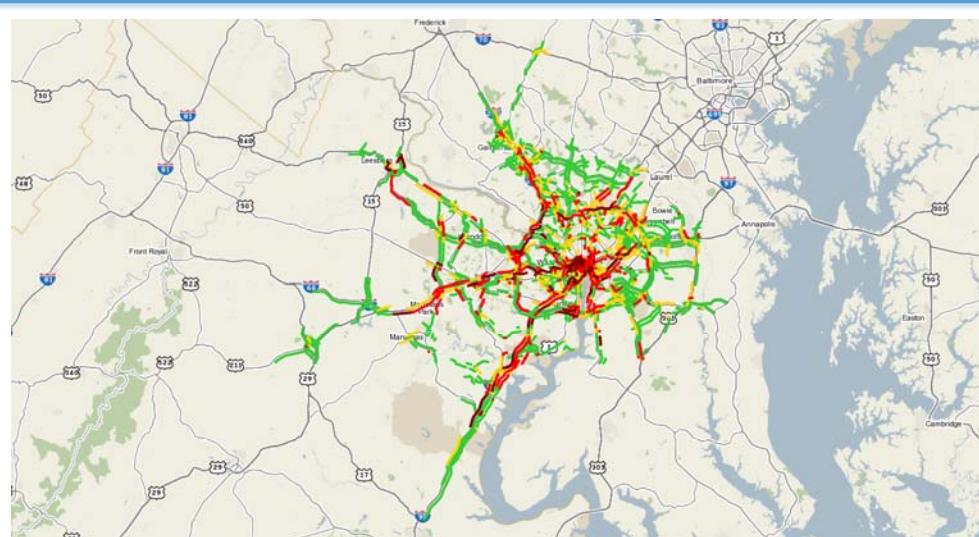


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89

## PHTTR median – D.C. – NPMRDS (no fill)

- Green:  $x < 1.2$
- Yellow:  $1.2 \leq x < 1.5$
- Red:  $1.5 \leq x < 2.5$
- Dark red:  $x \geq 2.5$

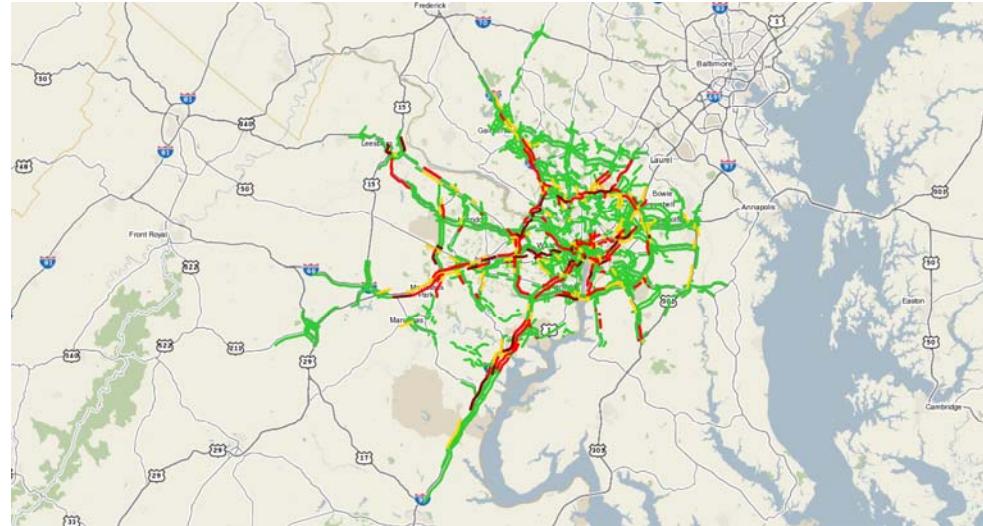


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## PHTTR median – D.C. – NPMRDS (speed limit fill)

- Green:  $x < 1.2$
- Yellow:  $1.2 \leq x < 1.5$
- Red:  $1.5 \leq x < 2.5$
- Dark red:  $x \geq 2.5$

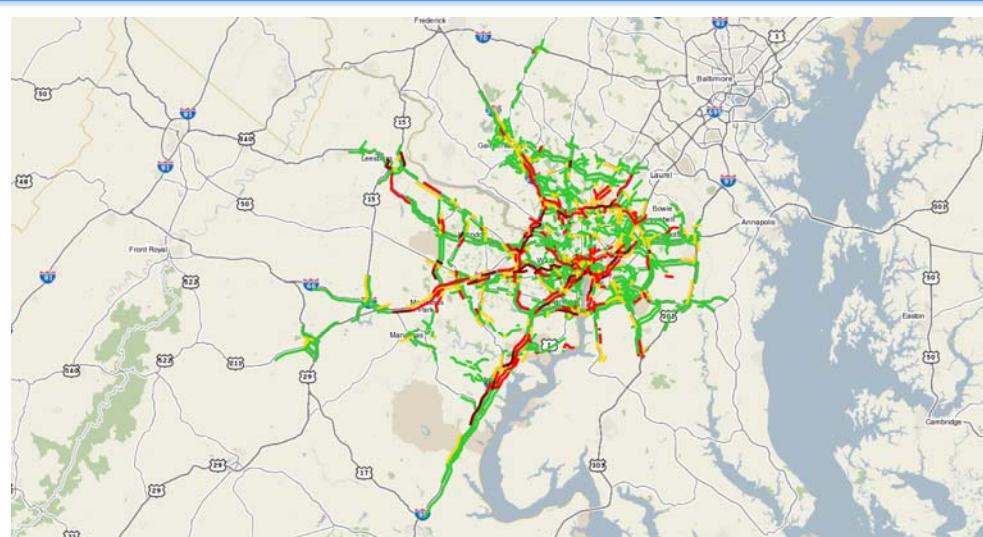


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## PHTTR median – D.C. – NPMRDS (historic avg. fill)

- Green:  $x < 1.2$
- Yellow:  $1.2 \leq x < 1.5$
- Red:  $1.5 \leq x < 2.5$
- Dark red:  $x \geq 2.5$

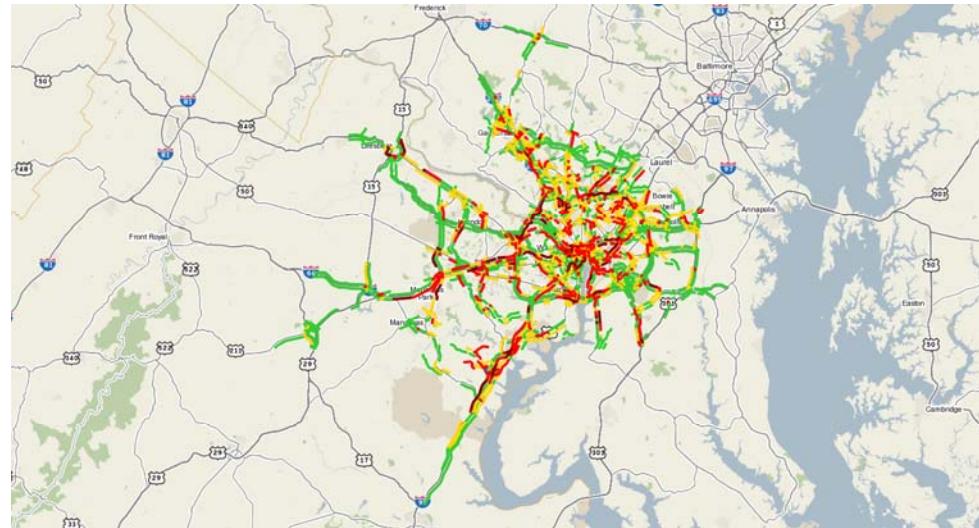


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## PHTTR median – D.C. – INRIX (modeled)

- Green:  $x < 1.2$
- Yellow:  $1.2 \leq x < 1.5$
- Red:  $1.5 \leq x < 2.5$
- Dark red:  $x \geq 2.5$

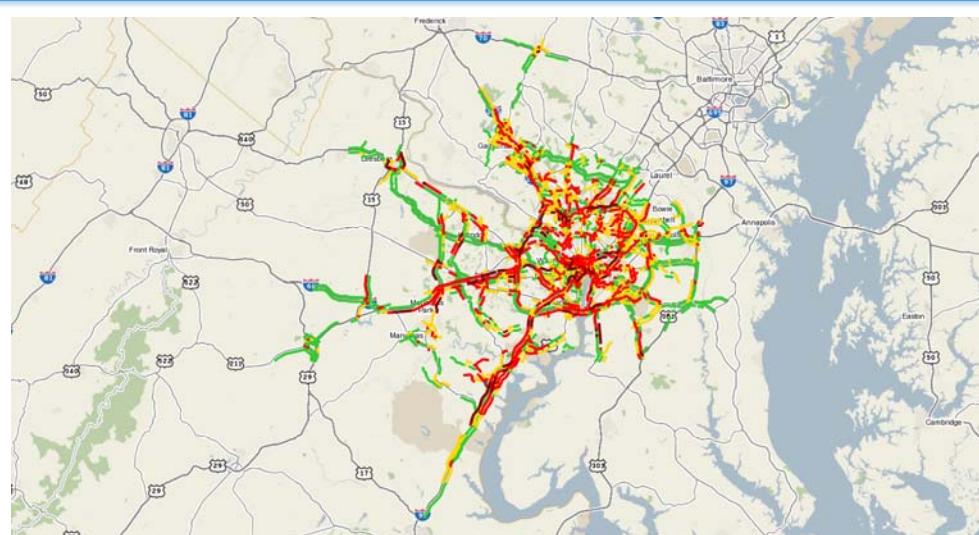


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93

## PHTTR median – D.C. – INRIX (high-confidence)

- Green:  $x < 1.2$
- Yellow:  $1.2 \leq x < 1.5$
- Red:  $1.5 \leq x < 2.5$
- Dark red:  $x \geq 2.5$

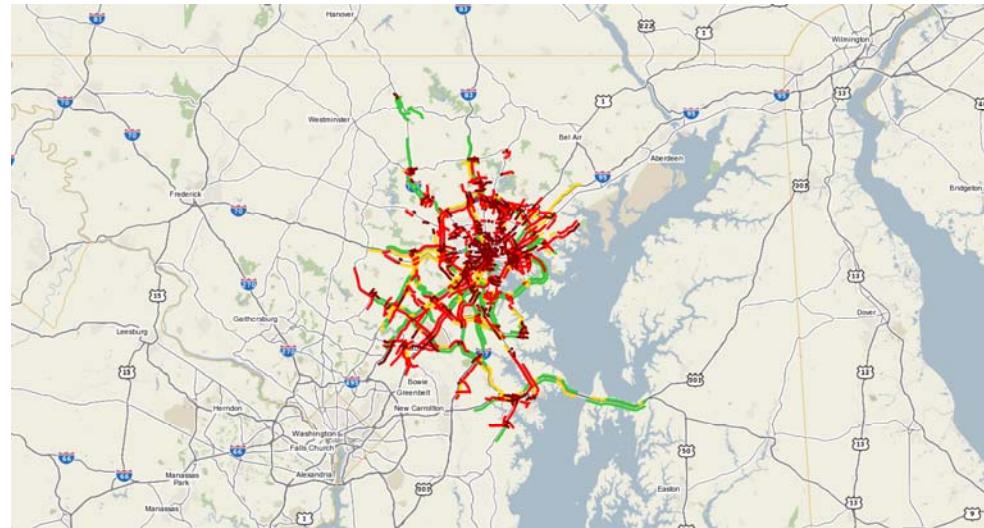


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## PHTTR mean – Baltimore – NPMRDS (no fill)

- Green:  $x < 1.2$
- Yellow:  $1.2 \leq x < 1.5$
- Red:  $1.5 \leq x < 2.5$
- Dark red:  $x \geq 2.5$

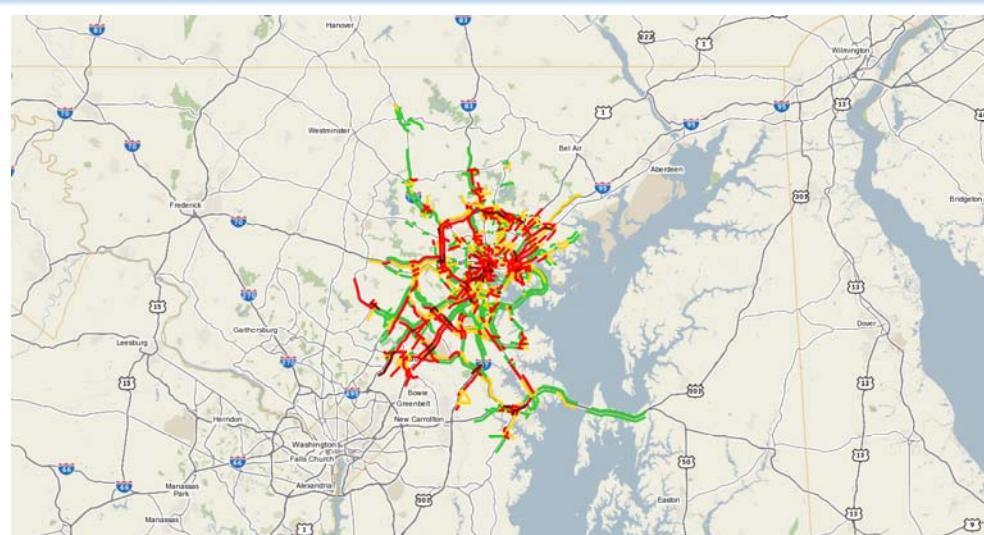


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## PHTTR mean – Baltimore – NPMRDS (speed limit fill)

- Green:  $x < 1.2$
- Yellow:  $1.2 \leq x < 1.5$
- Red:  $1.5 \leq x < 2.5$
- Dark red:  $x \geq 2.5$

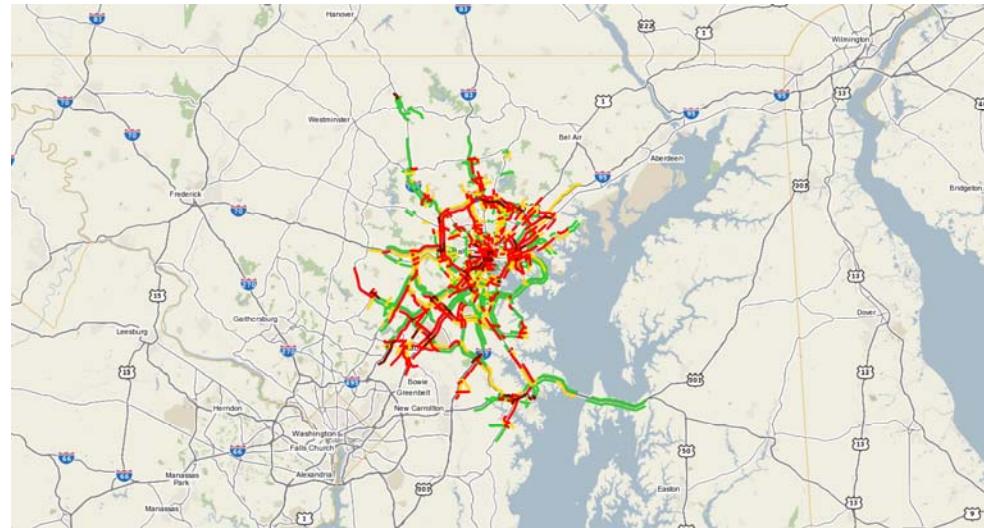


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## PHTTR mean – Baltimore – NPMRDS (historic avg. fill)

- Green:  $x < 1.2$
- Yellow:  $1.2 \leq x < 1.5$
- Red:  $1.5 \leq x < 2.5$
- Dark red:  $x \geq 2.5$

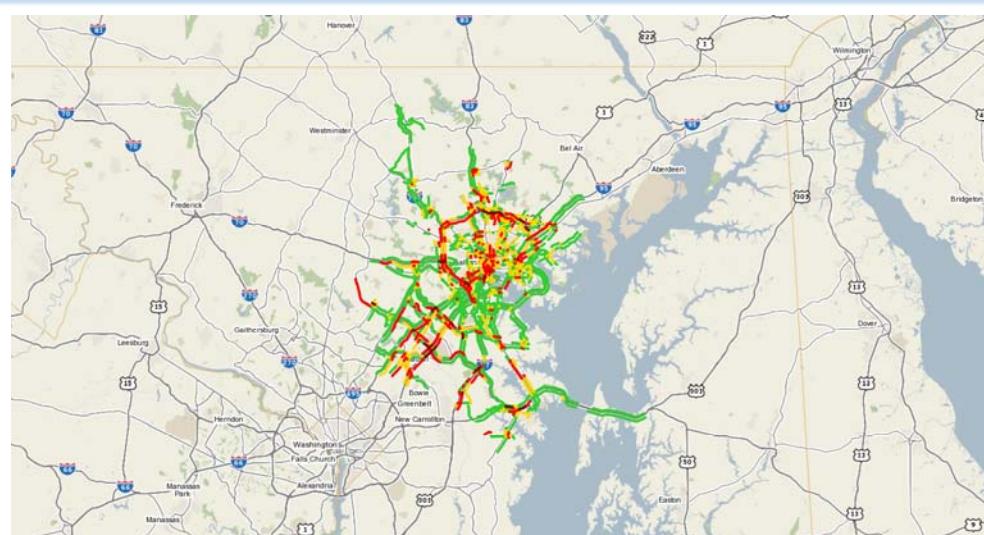


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97

## PHTTR mean – Baltimore – INRIX (modeled)

- Green:  $x < 1.2$
- Yellow:  $1.2 \leq x < 1.5$
- Red:  $1.5 \leq x < 2.5$
- Dark red:  $x \geq 2.5$

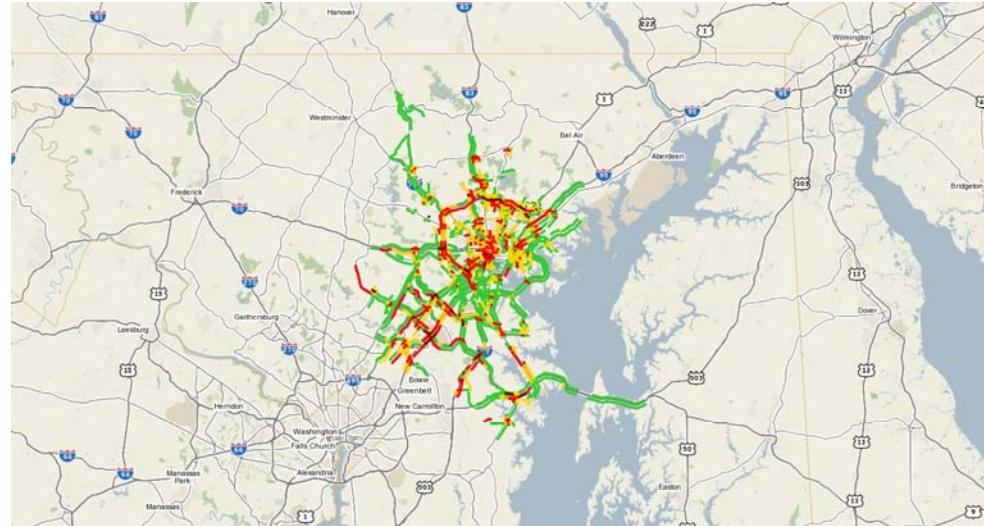


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98

## PHTTR mean – Baltimore – INRIX (high-confidence)

- Green:  $x < 1.2$
- Yellow:  $1.2 \leq x < 1.5$
- Red:  $1.5 \leq x < 2.5$
- Dark red:  $x \geq 2.5$

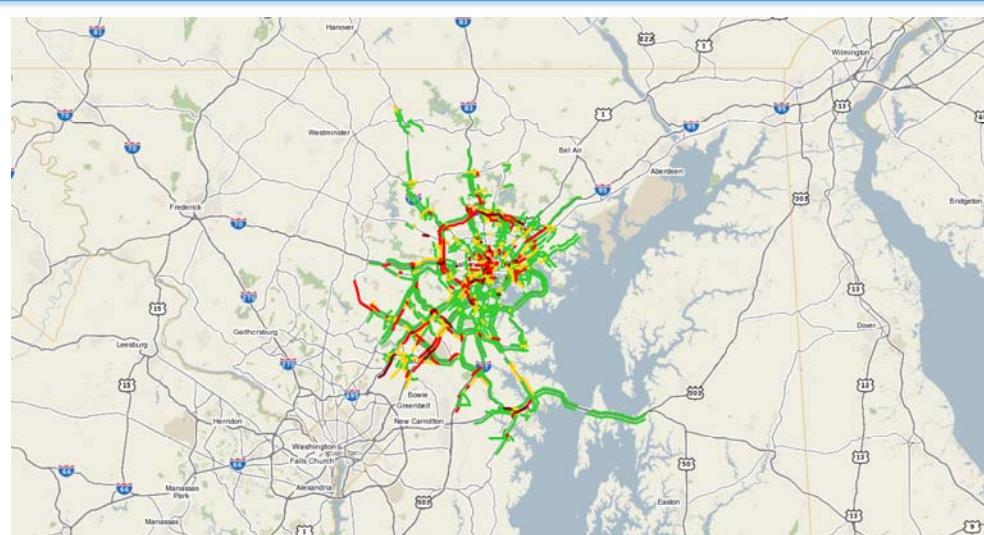


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99

## PHTTR median – Baltimore – NPMRDS (no fill)

- Green:  $x < 1.2$
- Yellow:  $1.2 \leq x < 1.5$
- Red:  $1.5 \leq x < 2.5$
- Dark red:  $x \geq 2.5$

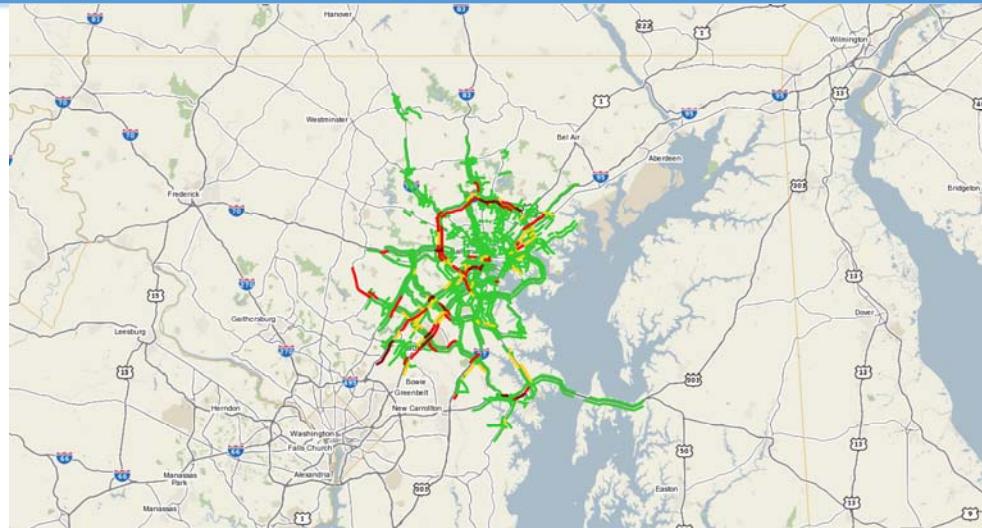


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100

## PHTTR median – Baltimore – NPMRDS (speed limit fill)

- Green:  $x < 1.2$
- Yellow:  $1.2 \leq x < 1.5$
- Red:  $1.5 \leq x < 2.5$
- Dark red:  $x \geq 2.5$

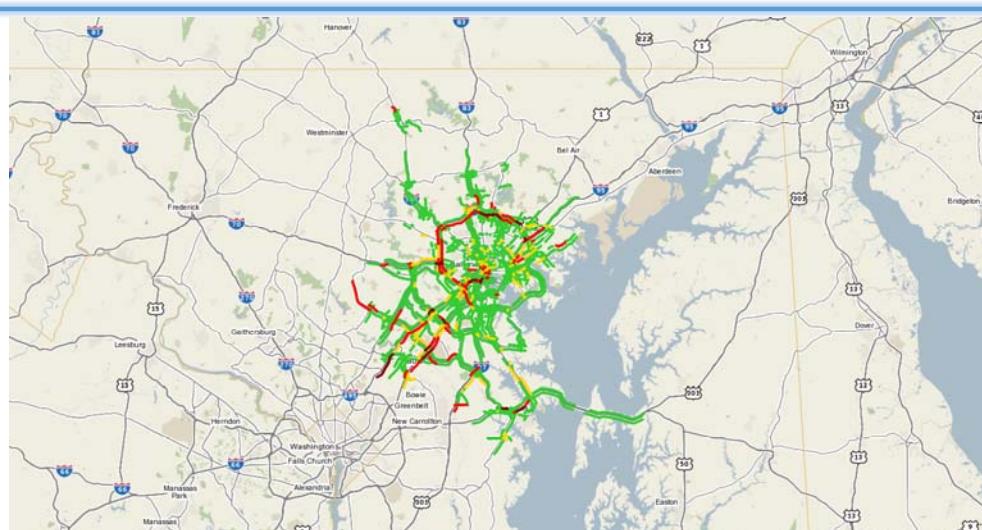


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## PHTTR median – Baltimore – NPMRDS (historic avg. fill)

- Green:  $x < 1.2$
- Yellow:  $1.2 \leq x < 1.5$
- Red:  $1.5 \leq x < 2.5$
- Dark red:  $x \geq 2.5$

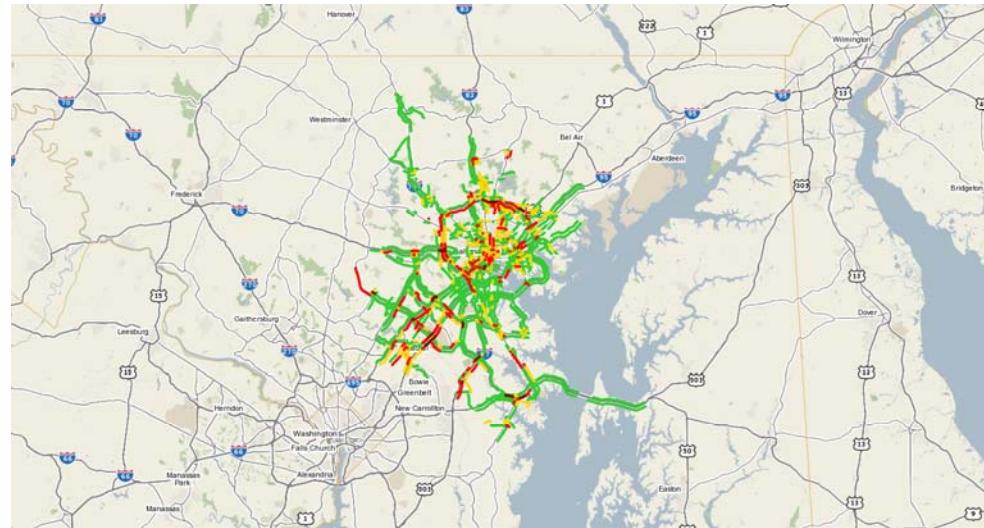


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## PHTTR median – Baltimore – INRIX (modeled)

- Green:  $x < 1.2$
- Yellow:  $1.2 \leq x < 1.5$
- Red:  $1.5 \leq x < 2.5$
- Dark red:  $x \geq 2.5$

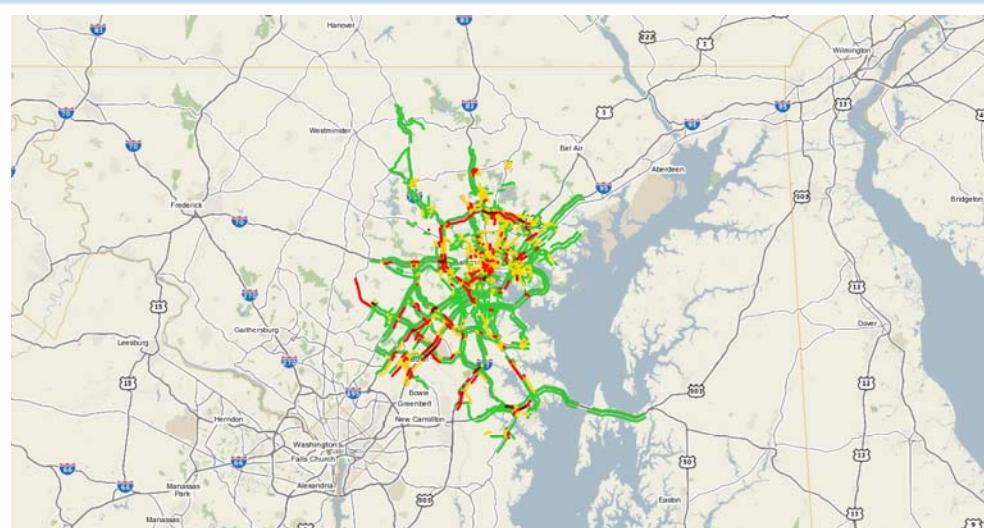


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## PHTTR median – Baltimore – INRIX (high-confidence)

- Green:  $x < 1.2$
- Yellow:  $1.2 \leq x < 1.5$
- Red:  $1.5 \leq x < 2.5$
- Dark red:  $x \geq 2.5$



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