Hampton Roads Transportation Operations Subcommittee – Operations Strategy Phase 2

Regional Traffic Operations Center – Expanded Analysis

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1.0   Introduction

The urbanized area of Hampton Roads contains 14 county-level jurisdictions consisting of 5 counties and 9 Cities. Seven of these cities have responsibilities for operating and maintaining the arterial roadway networks and traffic signal systems within their respective jurisdictions. In addition, the Virginia Department of Transportation operates and maintains the Region's interstate facilities and the arterial roadway networks and signal systems in the surrounding counties.

One of the long-term strategies identified in the May 2016 report was to establish a Regional Traffic Operations Center (TOC). To accomplish this strategy, it is envisioned that the region should focus on this TOC as being operations driven, not maintenance driven. The priorities will be concentrated on real-time condition and performance monitoring, standardized reporting across the region, and regional incident management with traffic signals still controlled by their own respective jurisdictions with pre-determined allowances for control/visibility by others.

There are two main approaches that can be used to accomplish this: a unified/single physical Regional TOC, or individually-operated TOCs with a virtual regional TOC/data clearinghouse. In either case, there are several Memoranda of Understandings (MOU) and regional operation roles that will have to be met as part of this effort. Some of these MOUs will need to focus on incident management, dispatching technicians, corridor reporting, and populating a single platform with up-to-date traffic and incident and lane closure information.

One focus of the regional TOC would include how each municipality reports incidents and the consistency of the data. Having one common platform where everyone can report this information would be beneficial so that all the incidents are coming in real-time rather than using different platforms that may be lagging. This central repository could be like that of 511 or even the existing Regional Traffic Incident Management Information System (RTIMIS) platform where everything can be reported to one place and then disseminated for everyone to access, to determine next steps, and to collaborate with neighboring municipalities and VDOT. If a common platform such as RTIMIS is not used, the agencies would each need to develop interfaces between each other for sharing information from the individual platforms hosted by each agency, which is extremely likely to be less cost-effective.

As part of this strategy, having participation from VDOT and each of the municipalities in Hampton Roads will have an impactful role in a successful regional TOC. Part of the challenge may stem from how involved each municipality wants to be with this process within the region. To be successful, there needs to be a baseline of information that will be shared by each agency. For example, daily/weekly/monthly summaries of performance of major arterials crossing municipality boundaries would play a key role for the region to help keep track of how roadways are operating during normal conditions or during a particular event. Georgia DOT's Regional Traffic Operations Program (RTOP) provides good examples of using dashboards and monthly reports to monitor and manage infrastructure and reliability metrics[1]. It is envisioned that this will require increased activity and commitment by the HRTO Subcommittee members in the early stages of this effort to establish policies, support the MOU development process, and technical oversight of standing up the Regional TOC initiatives (physically or virtually). Once the TOC is in place, the

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[1] Regional Traffic Operations Program *August 2017 Performance Summary*

Subcommittee's role would likely shift towards reviewing cases of anomalies to normal incident management scenarios and identifying where deficiencies in policies need to be fixed.

Comparisons with other regions around the country, potential benefits, and potential cost savings are covered in this technical memorandum for the evaluation of implementing the regional TOC.

2.0   National Practice Review

During preliminary investigation of this task, comparable regions around the country were identified and the top three were reviewed with the subcommittee. After discussions in the subcommittee, the final list was agreed upon to consist of the Memphis region, Denver region, and Georgia DOT's Regional Traffic Operations Program (RTOP). These groups provide a diversity from some that operate as independent entities within a region to those that operations under a single unit. Some provide 24/7 coverage while the majority did not. Elements from each of these national examples of what other regions are doing around the country have been reviewed, and applicable practices have been summarized herein.

2.1 Memphis[2] [3]

The Memphis Metropolitan Planning Organization (MPO) consists of 24 elected officials, Memphis Area Transit Authority (MATA), Memphis-Shelby County Airport Authority (MSCAA), Memphis-Shelby County Port Commission (MSCPC), and representatives from the Tennessee Department of Transportation (TDOT) and Mississippi Department of Transportation (MDOT). The Shelby County Department of Regional Services provides staff to the Memphis MPO and serves as its fiscal and administrative agent.

As part of the Memphis MPO's Safety and Mobility plan, they developed two subplans; the Congestion Management Process (CMP) and the Regional ITS Architecture and Deployment. The CMP Process is "a performance planning process that addresses congestion and mobility within the Memphis MPO Boundary." They have created strategies to focus on congestion mitigation using the following categories: Demand Management, Operation Improvements, Multimodal Strategies, and Strategic Capacity Enhancements. This process identifies key elements that need to be accomplished in both the long-term and short-term and are based upon the *Livability 2040* Regional Transportation Plan.

The second subplan focused within Safety and Mobility is the Regional ITS Architecture and Deployment. This plan "provides a long-range plan for deployment, integration, and operation of ITS." The Memphis MPO has created architectures to continuously update and document the needs, plans and visions within the area to help determine what the MPO needs to be focusing on to accomplish their goals. To help develop their plan, the MPO and its stakeholders came up with three steps: 1. Identify Needs and ITS Inventory, 2. Develop ITS Service Packages, and 3. Identify Sequence of ITS Projects to Deploy in the Region. Within these steps, service packages were developed to help solidify what they wanted to accomplish. Some of these included Traffic Management, Emergency Management, Maintenance and Construction Management, Public Transportation Management, Traveler Information and Commercial Vehicle Operations.

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[2] *Memphis MPO Congestion Management Process* (August 2015)
[3] *Memphis Urban Area Regional ITS Architecture and Deployment Plan* (October 2014)

Memphis represents an example of a group of agencies that provide signal operations support to the metropolitan area. While there are some agencies that manage their own signal system and traffic operations centers, two entities, Bartlett and Germantown, provide connectivity with the City of Memphis' TOC for joint operational controls. Memphis and Germantown currently have a memorandum of understanding in place to coordinate the operation of traffic signals and ITS systems. Additionally, both TOCs agreed to provide mutual assistance and serve as backup coverage for traffic signal and ITS operations. The agreement leaves the door open for further collaboration with other municipalities/counties/agencies as the desire to expand the grouping continues in the future. The agreement covers the communication connection requirements between one another, and the operations and maintenance roles and responsibilities (shared and individual).

2.2 Denver[4]

The Denver region is another example of a group of agencies acting in concert with one another to operate/manage the transportation network as a team, and to track performance measurement in a standard fashion across the region.

Denver Regional Council of Governments (DRCOG) is Denver, Colorado's "planning organization where local governments collaborate & establish guidelines, set policy and allocate funding in areas of transportation and personal mobility, growth and development, and aging and disability resources." Participating within the DRCOG are 9 counties and 48 municipalities making up its board in addition to six (6) committees: Advisory Committee on Aging, Executive Committee, Finance and Budget Committee, Performance and Engagement Committee, Regional Transportation Committee, and the Transportation Advisory Committee. The DRCOG has created their own policy statements for state and federal legislative issues. These policy statements are made with a mutual understanding between the DRCOG, the Colorado Department of Transportation (CDOT) and the Regional Transportation District (RTD) to address common issues before final adoption of the Statewide Transportation Plan.

Additionally, within the DRCOG's 2018 Policy Statement on State Legislative Issues, it was stated, with emphasis coming from Congress, that local government involvement is imperative. There is a big focus between state and local partners to come together to plan for the future, despite "serious funding shortages for meeting transportation needs". Given the financial budget, the DRCOG tries to utilize systemic measures to help improve their transportation needs. Beyond the annual Policy Statements, the DRCOG has also created several regional plans including the following, Metro Vision, Regional Transportation Plan, Transportation Improvement Program, Area Plan on Aging, Bicycle and Pedestrian Plan, and the Transit Plan.

The following figure depicts the operational relationships of the Colorado Traffic Management Center (CTMC) with surrounding/partnering jurisdictions. The figure also shows that performance measurement is managed as a region by the CTMC and the RTD for routine reporting to DRCOG.

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[4] DRCOG *2040 Metro Vision Regional Transportation Plan* (April 2017)
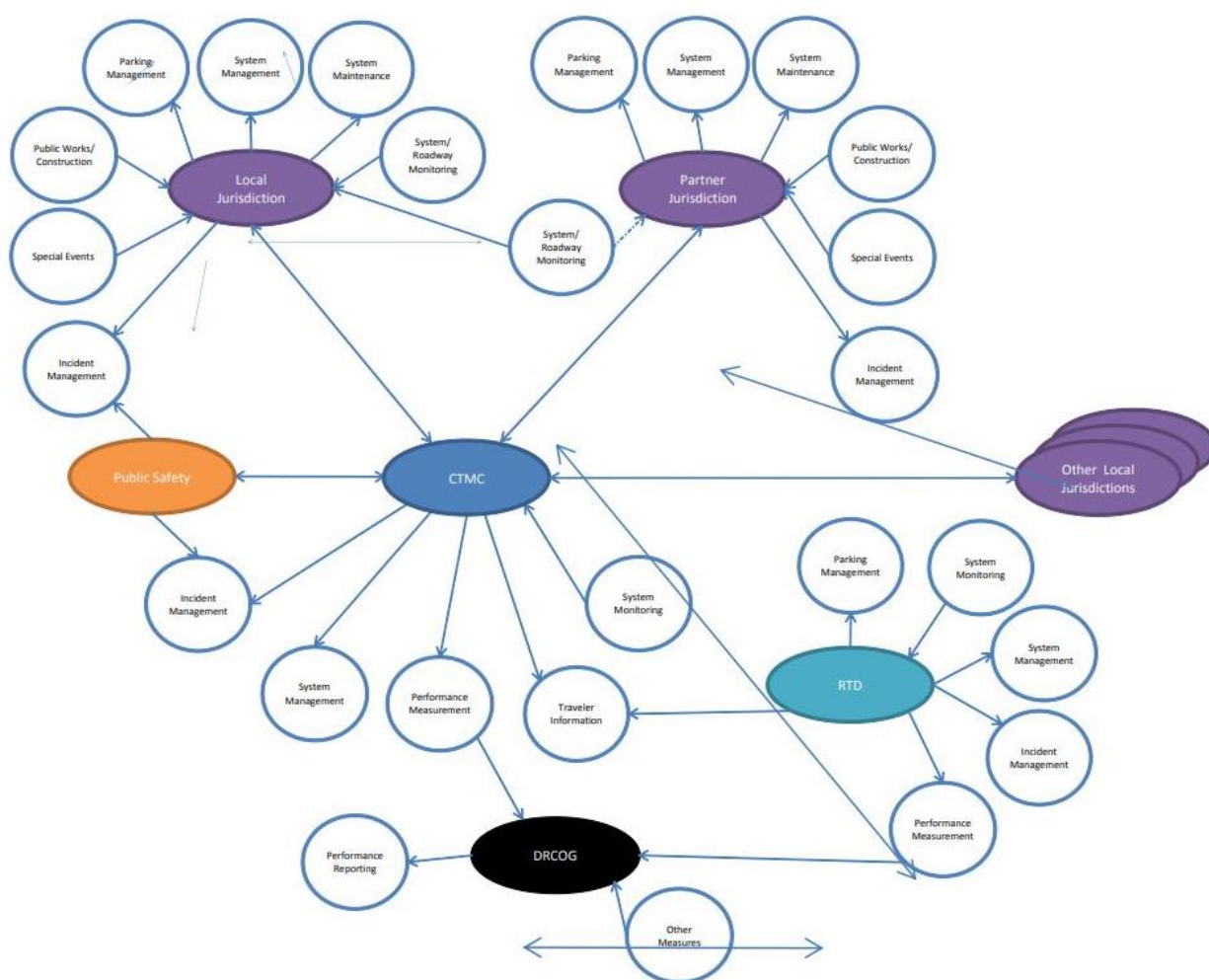
2.3 GDOT/Atlanta RTOP[5]

The GDOT RTOP program is another example where the DOT has taken the regional lead, but has outsourced some of the operations and maintenance on a corridor-by-corridor basis to contractors.

The Georgia Department of Transportation (GDOT) is currently running a program called the Regional Traffic Operations Program (RTOP) that mainly focuses on traffic signal maintenance and operations across approximately 12 counties and 13 cities. They work to improve travel time reliability, make data-driven operational decisions and have an active management of the arterial networks. GDOT has partnered with local agencies and private contractors to help manage their initiative. RTOP manages over 1,700 signals, over 400 miles of arterials, thousands of vehicle and pedestrian detectors, and hundreds of

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[5] Georgia Department of Transportation Safety and Operation

CCTVs and BlueTOADs. As part of RTOP's goal, they are looking to get every one of their intersections online using cellular communications such as Verizon or CDMA and 4G.

RTOP includes several different teams amongst their program. Some of these teams include Zone Managers, Traffic Engineers, Traffic Signal Operations Specialists (TSOS), Communications Teams, and Advanced Signal Timing Performance Measures (ATSPM). Each of these roles involves their own tasks that are specific to them. Some of these roles are staffed at GDOT's TMC while other roles are contracted out.

For RTOP to be successful, a matrix was created to describe the roles and responsibilities of each team member depending on their category. Some of these categories were System Evaluation and Baseline, Active Management, System Management, Operations Improvements, and Performance Monitoring. Additionally, to help the program be successful, priority groups were created for the systems in addition to memorandum of understandings. These few items alone helped lay out the foundation of the program and leading to its success.

GDOT's Traffic Management Center's (TMC) infrastructure includes Intelight MaxVIEW, NaviGAtor, BlueTOAD server, Nexus Worx, and TSOS Operators. All intersections on the network are running with a 2070 controller in a Caltrans 332 signal cabinet.

From an operations standpoint, one of the tables (Table 3.2 Agency Responsibilities from the RTOP Concept of Operations) that summarized the roles for given traffic management aspects is repeated here for convenience:

Table 3.2 – Agency Responsibilities

Program Component	GDOT Lead		Local Lead	
	GDOT	Local	GDOT	Local
Corridor Signal Timing	X		X	
Timing Adjustments	X			X*
Maintenance	X			X
After Hours/Emergency Response		X		X
Detector, Communication, and Surveillance Repair	X		X	
Peak Hour Management and Monitoring	X			X
Major Repairs		X		X

*Subject to GDOT Approval

The respective agency shown as the lead has responsibility for operations and maintenance of the system, which includes performing system evaluations, performing real-time observations, making timing adjustments, performing hardware upgrades and conducting system maintenance. The local agency will remain responsible for all emergency response and major system repairs in both scenarios. However, where the local agency leads, GDOT assigns a Corridor Manager, who will perform routine analysis of the system operations and make routine adjustments to signal timing (with review by the local agency prior to implementation).

3.0   Municipal Needs / User Input

As expressed by HRTO members during stakeholder interviews, the needs are focused on operations-driven goals (regardless of where personnel are located).   Managing maintenance in a regionally-orchestrated fashion is not currently of interest. After interviewing several agencies within HRTO to gather perspectives on regional operations collaboration, the following common themes surfaced. These themes fall into two primary areas: 1) Incident Management and Central Reporting, and 2) Central Summary of Performance/Condition Monitoring.

- Incident Management and Central Reporting
    - Handling Incident call-ins/reports from CAD feeds (Corridors of Regional Significance first… and beyond)
    - Dispatching Technicians (City/VDOT/contractors)
    - Regionwide Real-time Corridor Data
    - Populating 511 (and RTIMIS)
    - Signal Control allowances by Jurisdiction
    - Timing Adjustments (by others) for prescribed conditions
- Central Summary of Performance/Condition Monitoring (Archival)
    - Corridor Performance Reporting (Monthly/Quarterly/Annually)

These needs can be accomplished through current agency structures, but it will involve extensive data sharing and Center-to-Center (C2C) connectivity as depicted in the figure below.
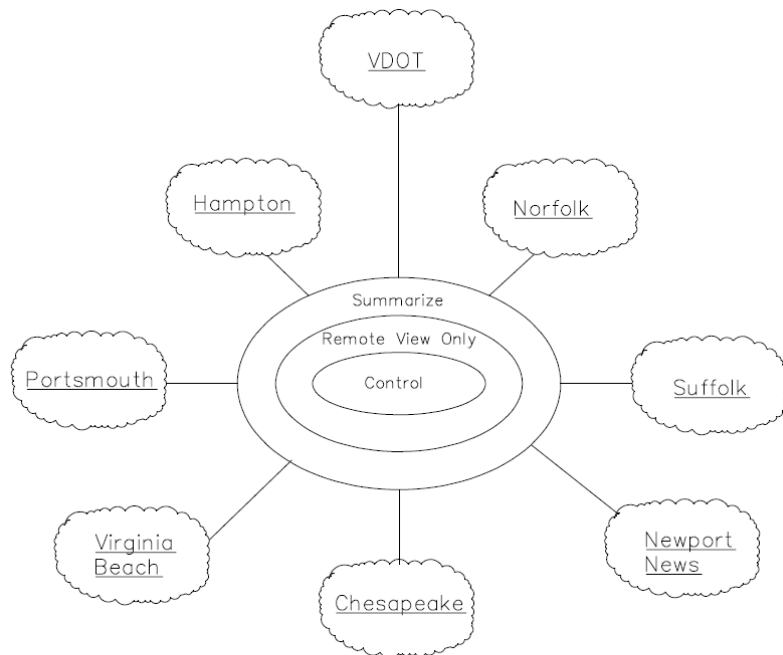

REGIONAL TOC INDIVIDUAL OWNERSHIP

Alternatively, a central/virtual TOC shown below using a common central system and data archival system can connect with each City's field devices to continually gather and store information for the benefit of the entire region. Jurisdictional roles can still be defined within the system to grant or deny control of devices as needed. There can also be permutations of these two

examples, whereby a municipality chooses to maintain their own central system and establishes a C2C link to the others through the single system interface. In either case, there is an incumbent responsibility of all agencies involved to raise the bar towards these initiatives.
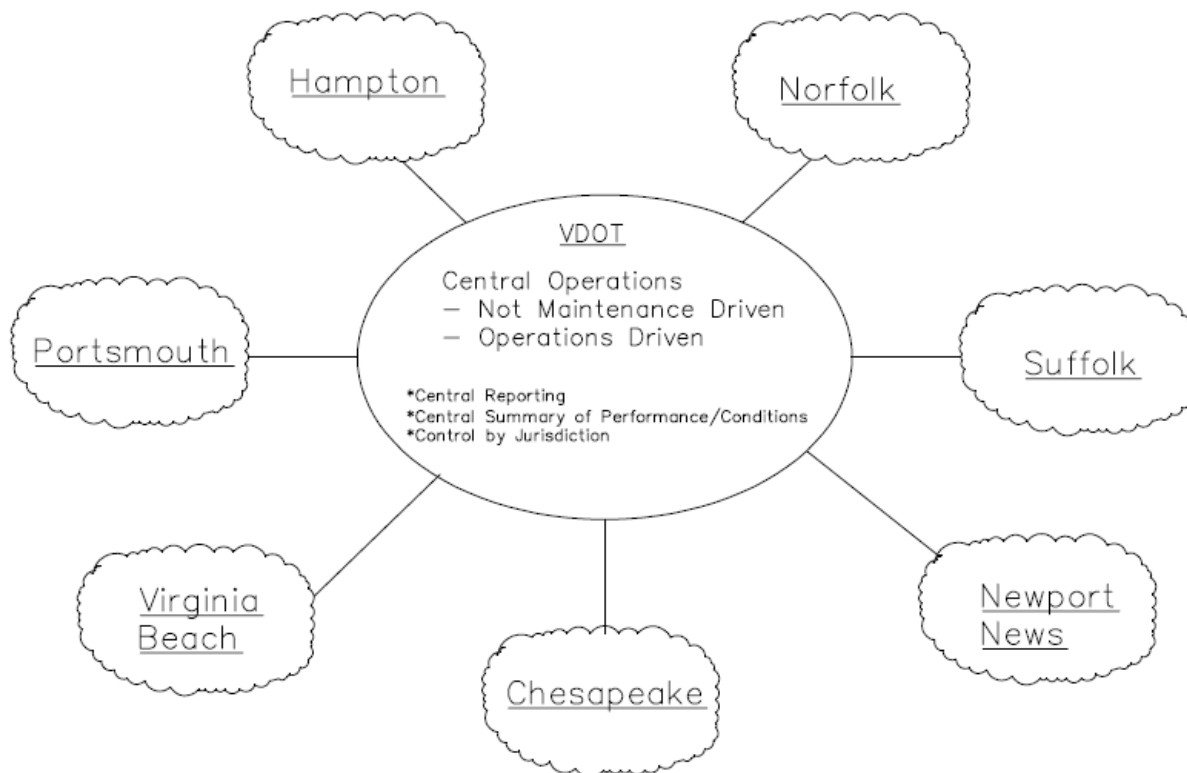
An agency that chooses to continue using the current individually-procured TOC approach, would need to work with their peers of the HRTO to provide similar data sets from their system to maintain the same level of reporting across the region, as well as provide the inputs into 511 and/or RTIMIS for their jurisdiction.

This centralized approach does put a heavier emphasis on a reliable regional communications network for transportation connectivity, which also plays a role in the proposed Hampton Roads Regional Connectivity Ring (RCR) under separate initiatives.

4.0   Potential Benefits

4.1 Performance Improvements

➢   Standardized reporting consistency

➢   Improved situational awareness by partnering agencies

➢   Performance improvement regionally (across municipal lines) with prioritization strategies

➢   Streamlined data entry (under centralized scenario)

➢   Consistent incident management (under centralized scenario)

Common reporting and monitoring by themselves don't immediately contribute to performance, but over time these tools allow regional traffic operations staff to focus attention more effectively on the highest priorities. Performance improvements can be ranked on a corridor-by-corridor basis across agency lines for the betterment of the region. In Austin Texas, through a study and analysis by the University of Texas Center for Transportation Research, a set of prioritizations was developed based on three metrics (percent of corridor experiencing speed decrease, percent of corridor experiencing speed decrease greater than X miles per hour, and maximum segment speed decrease) for each of the three time-of-day periods (AM, mid-day, and PM). To gather this level of information for the analysis, the City used a mixture of self-deployed sensors (Bluetooth, video analytics, side-fire radar) and crowd-sourced information sources (e.g. INRIX).

This closely relates to the deployment upgrade recommendations for the Corridors of Regional Significance (CORS) in a separate Technical Memorandum within this project.

4.2 Cost Savings Potential

4.2.1   DEVICE/SOFTWARE STANDARDIZATION

VDOT has established a statewide standard for Signal Controllers using the 2070ATC (as well as NEMA ATC variations for municipalities to purchase) throughout the Commonwealth. If the region elects to collaborate on a regional purchase of D4 controller software, all the region's agencies could stand to benefit. The region could save approximately $360,000 by sharing a bulk D4 license purchase as noted in the "Common Controller Standard Migration Assessment for Regional Signal System Operators" Technical Memorandum dated August 2018.

Additionally, VITA and VDOT are currently in the process of procuring a Statewide central signal system (CSS) software solution. While the region does not have to adopt that platform, the municipalities could stand to financially and technically benefit from collaborating in a similar fashion to the prior discussion about using a common controller and controller software solution. The collective value of each agency purchasing an individual CSS at an average cost of $300,000, equates to roughly $2.4M. If the region collectively made a purchase of a regional CSS with geographic redundancy, the probable cost is

anticipated to be slightly over half of that total, or approximately $1.5M. As noted previously in the signal controller discussion above, it is anticipated that additional migration/integration efforts will be associated with the few adaptive corridors and special logic functions in Virginia Beach, Chesapeake, and Newport News. Factoring another $100k for this migration support, the regional total would be approximately $1.6M. Thus, saving each partner agency roughly $100k in comparison to procuring individual CSS. However, it should be noted that Chesapeake, Newport News, and Portsmouth recently upgraded their CSS and have not set aside any further funds for software upgrades in the short-term. Furthermore, Norfolk is currently in the middle of a CSS procurement (Fall 2018/Winter 2019).

Setting financials aside, the region would benefit from a unified CSS software solution by having visibility to signal operations throughout the entire network. Individual agencies could be established with monitoring rights for portions or all of the network, and with full control of signals within their jurisdiction. This approach also minimizes the amount of effort to standardize reporting, integrate systems and data, not to mention managing user access/roles from a single place. The ability to share staffing for regional traffic management or special events would also be greatly simplified by only needing to familiarize with a single user interface across all parties involved. Queueing in various parts of the system would be more visible when evaluated across the entire region, and in turn mitigation strategies can be identified with the broader network in mind.

Network integration and firewall management will need to be considered and may require some use of locality-specific communication servers to minimize firewall paths to/from a unified central system for the region. Alternatively, each locality could elect to deploy their own instance of the same CSS, but the cost savings would be less of an impact on decision-making.

4.2.2   SHARED DATA/SERVICE ACQUISITION COSTS

There are many software and data platform solutions on the market now that afford agencies the ability to fill in missing data gaps. Without deploying additional field detection or travel time monitoring infrastructure, agencies can obtain this data from third-parties that can generate origin-destination information, link speeds, and overall travel times for given segments by leveraging other data sources such as cellular devices and commercial vehicles. In lieu of independently procuring data services for use with signal performance measures, all the region's transportation agencies could partner together on a single procurement for a pool of licenses and data feeds to be used for intersection, corridor, and broader network optimization. Some products/services are merely providing the dataset, while others provide additional analytics regarding the data at hand. The big advantage of these software/data solutions over field infrastructure is that they can be re-positioned as needed, month-to-month, week-to-week, or even day-to-day. Evaluating the various solutions available on the market is beyond the scope of this project, but a few notable industry examples and data services and performance analytics solutions are provided below:

- StreetLight data

- Waycare A-I analytics data

- Miovision analytics data

- Traction performance analytics data

- Iteris SPM

Nominally, the setup/startup charges for establishing services can be expensive when handled by each agency (in the range of 10s of thousands of dollars), with annual fees approaching or exceeding $100,000. Beyond the setup charges, much of the expense is attributed to data acquisition usage. With usage varying by agency from month-to-month, sharing the burden across multiple agencies is another opportunity for the region to save costs while analyzing the transportation network as a whole instead of agency-by-agency.

4.2.3   SHARED STAFFING COST

While review of the national examples of comparable regions, as well interviews of local transportation staff, have not necessarily painted an overwhelming case for 24/7 for traffic signal operations, current staffing levels are not allowing VDOT and localities to address the desired needs and performance management for the region. In most cases, it is a financial challenge to fund another dedicated traffic operations position per agency, let alone multiple positions to cover 24/7 operations with overlapping shifts.

However, if the regional traffic operators were to band together to support one or two central positions, the cost burden (if not absorbed by a single agency such as VDOT) would be dramatically less than each agency funding their own.

5.0   Potential Staffing Scenarios

- One group to staff additional personnel for peak and/or off-peak timeframes
- Contract out TOC operations to a third-party that reports to this group (i.e. HRTO)
- Distributed roles between each agency

The first two options provide more consistency with operations/management of the transportation network. It is simply a matter of defining whether one agency (e.g. VDOT) takes the lead, or whether the region elects to outsource the role altogether. If the role is not absorbed into the VDOT staffing of the existing regional TOC, then MOUs would have to address shared funding of the additional positions or contracts.

Distributing roles between agencies may be more challenging for the region to identify/assign roles to each agency based on personal preferences, and more complex coordination between agencies. Furthermore, this alternative will put added responsibilities and stress on agencies that are already stretched thin and trying to backfill open positions. While an individual agency could elect to tackle the roles/duties such as performance management reporting for their own jurisdiction, it would need to be done in accordance with standards set by the region. This may also entail managing their own subscription to performance measurement data sources individually instead of as a region.

6.0   Summary and Next Steps

As noted earlier in this memorandum, it is envisioned that the levels of discussion will need to increase between member agencies within the HRTO subcommittee. It is recommended that the frequency of the meetings move from 6x per year to once per month. Comparisons with other regions around the nation were explored in this memorandum, with noteworthy elements drawn from each to form the recommendations relevant to this region. Additionally, the potential benefits and staffing considerations for a regional TOC were also reviewed. The following items highlight the recommended next steps stemming from this memorandum.

MOU content, policy development, and data/reporting standards: In the off-period meetings, these items can be the primary focus, while the current meetings can continue their respective focus areas every other month. Top priorities for initial MOUs and Policies are recommended as follows:

- Inter-agency control of signals (e.g. VDOT to Municipality / vice versa); who can control which signals and under what (if any) circumstances
- Performance Measures standardization (minimum levels of data by agency; particularly if each one manages their own TOC and operations data set)
- Data input / sharing requirements by each agency
- Funding collaboration (TOC staffing, subscription crowd-source data for use in performance measures, software licensing/maintenance,…)
- Shared resource collaboration (e.g. portable DMS, splice equipment, …)

Staffing: One of the most efficient ways to embrace the performance improvement goals set forth herein would be to expand the role of the VDOT Hampton Roads TOC to support arterial operations during set periods of time and/or circumstances in lieu of each agency hiring additional staff respectively. The facility and the contracting mechanisms are already available, but memoranda/agreements must be arranged between the members of this group of agencies to establish the roles and levels of participation pertaining to incident management, operations, and monitoring/reporting.

Centralized vs. decentralized: Two methods of interconnectivity and collaboration are explored in this memorandum, but neither are required to be all-or-nothing scenarios. However, adopting a unified central system will minimize the number of custom data interfaces required for sharing information between one another, and ultimately save money/licensing fees in the long-term.

Agencies that elect not to embrace the shared environment would at a minimum need to maintain a similar level of performance monitoring and reporting to keep pace with the regional improvement/prioritization efforts. Network/firewall configurations will need to be reviewed amongst member agencies to appropriately secure interconnected devices and software platforms. Once established, the Hampton Roads Regional Connectivity Ring (RCR) may one day be leveraged to connect member cities to one another over a high-speed fiber network.

Standardization efforts: It is recommended that the region endeavor to begin standardizing on common hardware and software to improve regional situational awareness, data sharing, as well as sharing support contracts, not to mention reducing software customization efforts between systems. Regional crowd-sourced data contracts can also be established as a shared commodity starting with the Corridors of Regional Significance.