Hampton Roads Transportation Operations Subcommittee – Operations Strategy Phase 2

Common Controller Standard Migration Assessment for Regional Signal System Operators

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1.0 Introduction

In the May 2016 Report of the Hampton Roads Transportation Operations Strategy, it was noted that a common controller platform was of interest to the Region, but would take some time to accommodate such an effort. At the time of the report, VDOT had not completed their selection process for a statewide controller platform. Now that this process has been completed, this memorandum analyzes the impacts of the new statewide controller platform on the existing base of equipment in the Hampton Roads region, and evaluates potential interim migration options such as firmware/local controller software upgrades for agencies already in possession of one of the two hardware vendors selected by the statewide platform.

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.

This memorandum will provide a high-level review of what the migration is anticipated to entail for the Hampton Roads region, and identify potential opportunities stemming from the migration for each municipality.

2.0 Cabinet/Controller Standards in Hampton Roads

2.1 NEMA TS-1 Environment

In 1976, the NEMA developed the TS-1 standard for solid state, actuated traffic signal controllers. The controller, a self-contained unit housing both hardware and software produced by a single manufacturer, specifies the pins on three connections – the A, B and C connectors – and allows manufacturers to add an additional feature on a fourth D connector. The TS-1 standard also laid out a universally-accepted nomenclature for actuated controllers, defined the functionality of cabinet components, and set a standard for interchangeability of cabinet components between manufacturers. A TS-1 cabinet has shelf-mounted components (a power supply, detector amplifiers, and a conflict monitor) and connections to field units that terminate at a back plane with plug-in load switches.

- Communicates with the controller through Point to Point wiring. Fully Controller interface is facilitated through four connectors: A, B, C, and D.
- Output Positions: Variable – 4, 8, 12, or 16
- Standard Detection: These cabinets can support many physical detection inputs but consolidates these detectors into phase 1-8 for input into the controller
- D – Connector Options:
    - The D Connector is a separate connection to the controller from a specific panel. NEMA identifies this connector as proprietary to each manufacturer. The intent of the connector is to provide additional inputs and outputs for the controller. The D

Connector is typically used for preemption and system detection inputs and Special Function outputs (e.g. blank out signs).

- The D Connector panel, installed in the cabinet, is configured by the cabinet manufacturer for the controller manufacturers pin out requirements. When the controller is being upgrade, changed, or replaced with another manufacturers controller, the D Connector feature may not be compatible or work properly. A D Connector "Adapter" may be required to convert the legacy cabinet connector pin out to the new controller manufacturer's pin out.

2.2 NEMA TS-2 Environment

The NEMA TS-2 specification was published in 1992 to improve upon the TS-1. The NEMA TS-2 incorporates more modern technology to improve redundancy, diagnostics and interchangeability between vendors. This section highlights some of the more important improvements of the TS-2 over the TS-1. The most noticeable difference is the replacement of the A, B, C and D connectors with a single serial data link connector (SDLC). This provides greater flexibility to communicate with cabinet components. The four connectors on the TS-1 were pin-based, meaning each pin served a specific limited function. Any additional functionality had to be provided through a manufacturer-specific D connector, which limited interchangeability. The SDLC connector provides two-way communication with cabinet components simplifies cabinet wiring and eliminates the manufacturer-specific D connector, improving interchangeability. The improved wiring simplicity using serial connections improves cabinet diagnostics and troubleshooting. In addition, the TS-2 specifies self-test routines and verification of load switch performance for the controller and MMU. Furthermore, detector health is also continuously monitored by the controller by checking for no activity, maximum presence and erratic output. When detectors fail in a TS-2 cabinet, the controller can place a constant call (as if a vehicle were always present) and log the failure, preventing "entrapment" where an actuated phase is never served even when a vehicle is waiting.

- Output Positions: Variable: 4,8, 12, 16
- Communicates with the controller through Serial Data Link Circuit (SDLC) and therefore Inputs and Outputs are mappable
- Cabinets can be delivered with a TS-1 style D Connector Panel and operate in a hybrid mode (TS-1/TS-2) for controller interface with inputs and outputs.
- More Advanced Technical Skill to Debug
- Supports up to 64 Detectors based on the number of input card racks installed in the cabinet.

2.3 Caltrans 332/336 Environment

A key distinction between the Caltrans family of equipment and the NEMA family is that the controller firmware is typically provided separately from the hardware. The controller firmware only needs to adhere to the hardware constraints (memory addressing, communication port addressing, pin addressing, etc.) to drive the equipment connected to a Caltrans 332/336 cabinet environment. Unlike a TS-1

environment where the cabinet's inputs/outputs are hardwired, a NEMA TS-2 cabinet and Caltrans cabinets are not, which allows much more flexibility to configure them in software.

When selecting the statewide signal controller platform involving a 2070-style ATC controller, VDOT also selected D4 firmware. Localities can also purchase a NEMA compatible controller from both McCain and Econolite.

In comparison to the original 170-controller, the 2070 controller is highly modular. Different capabilities can be provided by the appropriate selection of modules. The standard ensures any module can be replaced with the same module from another manufacturer. A main chassis holds a processor card, a communications module, a field I/O unit and a power supply. A NEMA interface with A, B, C and D connectors can be used to retrofit 2070s into NEMA TS-1 cabinets. An SDLC module can be included to interface with NEMA TS-2 cabinets.

The Caltrans 332/336 cabinet environment generally consists of the following:

- Interfaces with the controller through point to point wiring via a C1 or C11 Connector.
  - C1 = 104 Pin Connector (54 Outputs / 44 Inputs)
  - C11 = 37 Pin Connector (8 Outputs / 20 Inputs)
- Output Positions:
  - 332: up to 3 Output Rack Panels = Variable 12, 16, or 18 (LA Cabinet Spec)
  - 336: 2 output rack panels = 12
- Input Positions:
  - 332: Two Input Card Racks – 28 Detector Inputs, 6 Preemption, 4 PED Detectors.
  - 336: One Input Card Racks – 14 Detector Inputs, Preemption, 4 PED Detectors.

2.4 ATC Environment

The Advanced Transportation Controller (ATC) standards are a group of standards that provide an open architecture hardware platform and software platform, which can support a variety of ITS applications. The group of standards consist of the ATC Controller (ATC 5201 standard), the ATC application programming interface (API) (ATC 5401 standard), and the standard specifications for an ITS roadside cabinet. The ITS Roadside Cabinet specification was initially focused primarily on traffic control applications: traffic signal control, ramp metering control, and lane use signals. As such, the cabinet structure is modular, providing sufficient rack space, power management, and serial buses for traditional traffic control input devices, load switches, and monitoring that is commensurate with prior cabinet architectures. In addition, the serial control and monitoring bus is similar to the NEMA TS2-2003 Type 1 cabinet. The cabinet's increased detector input capacity, along with the architecture/modular nature supports adding other ITS/special function assemblies in the future.

- Interfaces with the controller through Serial Bus via a Serial Interface Unit
- Features:
  - Can operate as 120 Vac or 48 Vdc.
  - High-Density and smaller form factor components reduce cabinet space.
  - Module and interchangeable components

  - Utilizes three Serial Bus': SB1 is for controller to cabinet interface, SB2 is manufacturer specific, and SB3 is for CMU to Switch pack and Flasher Unit interface.
- Output Positions: 16 or 32
- Input Positions: Up to 120 Detector Inputs

2.5 Statewide Controller platform options

While VDOT has identified their statewide preference towards using a 2070ATC controller environment, a NEMA option has also been selected for the benefit of sharing the use of the contract with the Commonwealth's municipalities, which are predominantly using a NEMA cabinet environment. McCain and Econolite were both selected as vendor options within the Statewide contract.

McCain can offer both the 2070ATC style as well as a NEMA style controller, while Econolite's Cobalt NEMA controller is the only version available within the contract (and is approximately twice the price of the eX2 type 1 under this contract).

- McCain 2070LXN2 Controllers: $1,397.00
- McCain NEMA eX2 type 1 controller (TS-2 cabinet): $978.00
- McCain NEMA eX2 type 2 controller (TS-1 cabinet): $1,324.00
- D4 Software: $750.00
- 20% Bulk software discount for system wide upgrade 100 licenses for $60,000 (avg. $600/int.)
- 20% Bulk software discount for system wide upgrade 150 licenses for $90,000 (avg. $600/int.)
- 20% Bulk software discount for system wide upgrade 200 licenses for $120,000 (avg. $600/int.)
- ~23% Bulk software discount for system wide upgrade 300 licenses for $175,000 (avg. $583/int.)
- ~25% Bulk software discount for system wide upgrade 400 licenses for $225,000 (avg. $563/int.)
- ~33% Bulk software discount for system wide upgrade 1,000 licenses for $500,000 (avg. $500/int.)
- ~38% Bulk software discount for system wide upgrade 1,500 licenses for $700,000 (avg. $467/int.)
- ~40% Bulk software discount for system wide upgrade 1,900 licenses for $845,000 (avg. $445/int.)

The 2070ATC controller is modular in nature, thus the CPU and other peripheral modules can be replaced individually over time without replacing the entire chassis. The controller can be placed inside a NEMA cabinet, but inherently the wiring for the 2070 controller chassis is on the back of the unit, which may present concerns to some maintenance staff that are accustomed to wiring NEMA devices from the front since the majority of NEMA cabinets only open from the front. For the sake of the following section evaluation, NEMA environments will be considered to remain NEMA and Caltrans will remain Caltrans. If any municipality were to choose a different cabinet environment, the cost differential between each style is shown above. Cabinet change-outs are not currently being considered as part of this evaluation.

It should also be noted that individually, each municipality/agency in Hampton Roads qualifies for the 20-25% bulk pricing discount for the D4 local controller software. However, if the region were to collectively make a joint purchase that discount could climb to the 40% level, saving each individual agency 15-20%.

3.0 Hampton Roads Signal Systems and Associated Migration Impacts

Within the Hampton Roads region, the signal systems that are currently deployed share some similarities, but largely there is not a single common thread in place at present. Most of the region is using NEMA TS-2 cabinet standards, while Norfolk is predominantly using the Caltrans environment for 170/2070 controllers. Three municipalities are running Econolite controllers, but most of them are not the newer Cobalt controllers that support the D4 software. Suffolk has been rapidly migrating to McCain ATC controllers that can support the D4 software. Hampton and Virginia Beach are currently using the Trafficware/Naztec platform, which does not share any commonality with the Statewide platform selection. The following is a presentation of the summaries of each agency's current system overview, and the benefits and issues associated with migrating to the statewide controller standard.

3.1 City of Chesapeake

A. Existing System Summary

The City of Chesapeake upgraded their central software system within the last two years, and they are running an Econolite hardware platform with Kapsch's EcoTrafiX central system software. The City has been migrating from ASC/2 and ASC/3 TS-2 controllers to Econolite Cobalt controllers as needed. The City uses card-based detector rack systems in their cabinets, and employs Adaptive programming for some corridors based on additional detection devices. In short:

System	Kapsch EcoTrafiX
Cabinet type(s)	NEMA TS-2
Controller type(s)	Econolite ASC/2, ASC/3, and some Cobalt
Detection System in cabinets	Card/Rack-based
Other	Some adaptive controls with other detection devices

B. Migration Implications

While the City has an existing familiarity with the Econolite family of controllers, the relatively minimal base of Cobalt controllers that support the D4 software would require a widespread replacement of most of the City's controllers to embrace the standard.

The City upgraded its central system to EcoTrafix within the last 2 years, and has not set aside funding for another major software purchase of its kind. The City of Chesapeake has over 170 traffic signals under their maintenance and control. The City extensively use of communications systems made up of 900 MHz low band and 5.8 GHz broadband wireless to Cox Communications Leased line hubs.

The City has several traffic adaptive corridors, which would require manipulation to fit into a regional standard, or to await completion of the Statewide software procurement to incorporate adaptive into a regional central software system.

C. *High-level opinion of probable cost for migration*

The individual line-up budgets from the Statewide controller contract are as follows:

- McCain NEMA eX2 type 1 controller: $978.00
- D4 Software: $750.00
- Bulk D4 software discount for system wide upgrade 200 licenses for $120,000.

For Chesapeake to adopt the Statewide controller platform based on the available contract, it is recommended to use the McCain NEMA eX2 type 1 controller.

Since the breakeven for the bulk D4 software purchase occurs at 160 controllers, for Chesapeake the most cost-efficient strategy would be to pay the bulk D4 purchase ($120,000) for all its signals and accommodate room to grow. Based on the Statewide Controller contract pricing, the probable cost for migrating 170 controllers to the McCain eX2 type 1 controller would be approximately $167,000 based on self-installation by the City. When applying a 15% contingency, this equates to an approximate upgrade of ***$330,000***.

Chesapeake: Controller Estimate Per Region/City			
Item	Unit	Qty.	Extended
• 2070LXN2 Controllers:	$1,397.00	0	$0.00
• McCain NEMA eX2 type 1 controller:	$978.00	170	$166,260.00
• McCain NEMA eX2 type 2 controller:	$1,324.00	0	$0.00
D4 Software: per intersection	$750.00	0	$0.00
• Bulk software discount for system wide upgrade 100 licenses for $60,000.	$60,000.00	0	$0.00
• Bulk software discount for system wide upgrade 150 licenses for $90,000.	$90,000.00	0	$0.00
• Bulk software discount for system wide upgrade 200 licenses for $120,000.	$120,000.00	1	$120,000.00
• Bulk software discount for system wide upgrade 300 licenses for $175,000.	$175,000.00	0	$0.00
• Bulk software discount for system wide upgrade 400 licenses for $225,000.	$225,000.00	0	$0.00
		Subtotal	$ 286,260.00
		15% Contingency	$ 42,939.00
		Total	$ 329,199.00

3.2 City of Hampton

A. *Existing System Summary*

The City has been running a Trafficware/Naztec platform with ATMS.NOW for the better part of the last 15-20 years. The City of Hampton has approximately 190 traffic signals under their maintenance and control. The majority of the City's signal network communicates over fiber optics. The City also uses card-based detector rack systems in their cabinets. In short:

System	Trafficware (Naztec): ATMS.NOW
Cabinet type(s)	NEMA TS-1/TS-2 (about 50% of each type)
Controller type(s)	NEMA TS-2 type 1 and 2: Trafficware Series 900
Detection System in cabinets	Card/Rack-based
Other	Some additional detection devices

B. Migration Implications

The City has an existing familiarity with the Trafficware/Naztec family of controllers, which do not support the D4 software and would require a widespread replacement of the City's controllers to embrace the standard. The City, however, has been running this platform for the better part of the past 15+ years. The City of Hampton has nearly 190 traffic signals under their maintenance and control. Approximately 50% of the City's cabinets are still of the TS-1 standard variety. The City extensively uses communications systems made up of fiber optic networks.

Any special logic functions may require additional effort to port over/configure into the new platform.

C. High-level opinion of probable cost for migration

The individual line-up budgets from the Statewide controller contract are as follows:

- McCain NEMA eX2 type 1 controller: $978.00
- McCain NEMA eX2 type 2 controller: $1324.00
- D4 Software: $750.00
- Bulk software discount for system wide upgrade 200 licenses for $120,000.

For Hampton to adopt the Statewide controller platform based on the available contract, it is recommended to use the McCain NEMA eX2 type 1 controller be utilized for locations with TS-2 cabinets (50%), and the type 2 controller for the locations with TS-1 cabinets (50%).

Since the breakeven for the bulk D4 software purchase occurs at 160 controllers, for Hampton the most cost-efficient strategy would be to pay the bulk D4 purchase ($120,000) for all its signals and accommodate room to grow. Based on the Statewide Controller contract pricing, the probable cost for migrating 95 controllers to the McCain eX2 type 1 controller and 95 controllers to the type 2 controller would be approximately $220,000 based on self-installation by the City. When applying a 15% contingency, this equates to an approximate upgrade of ***$390,000***.

Hampton: Controller Estimate Per Region/City			
Item	Unit	Qty.	Extended
• 2070LXN2 Controllers:	$1,397.00	0	$0.00
• McCain NEMA eX2 type 1 controller:	$978.00	95	$92,910.00
• McCain NEMA eX2 type 2 controller:	$1,324.00	95	$125,780.00
D4 Software: per intersection	$750.00	0	$0.00
• Bulk software discount for system wide upgrade 100 licenses for $60,000.	$60,000.00	0	$0.00
• Bulk software discount for system wide upgrade 150 licenses for $90,000.	$90,000.00	0	$0.00
• Bulk software discount for system wide upgrade 200 licenses for $120,000.	$120,000.00	1	$120,000.00
• Bulk software discount for system wide upgrade 300 licenses for $175,000.	$175,000.00	0	$0.00
• Bulk software discount for system wide upgrade 400 licenses for $225,000.	$225,000.00	0	$0.00
		Subtotal	$ 338,690.00
		15% Contingency	$ 50,803.50
		Total	$ 389,493.50

3.3 City of Newport News

A. Existing System Summary

The City of Newport News upgraded their system within the last few years and is running an Econolite platform with their Centracs central system software. The City recently renewed their software maintenance agreement for five (5) years. During the Citywide upgrade, Newport News deployed TS-2 controller cabinets throughout the City along with ASC/3 controllers. Since then, some controllers have been upgraded/replaced with newer Cobalt controllers. The City uses card-based detector rack systems in their cabinets, and employs logic statement programming for some intersections based on some of their detection devices. In short:

System	Econolite Centracs
Cabinet type(s)	NEMA TS-2
Controller type(s)	NEMA TS-2 type 1: Econolite ASC/3 and Cobalt ATC
Detection System in cabinets	Card/Rack-based
Other	Some special logic functions with other detection devices

B. Migration Implications

While the City has an existing familiarity with the Econolite family of controllers, the relatively minimal base of Cobalt controllers that support the D4 software would require a widespread replacement of most of the City's controllers to embrace the standard. To use the statewide contract to continue replacing ASC/3s with Cobalt controllers would cost almost double the statewide rate for McCain shown below.

The City renewed its maintenance support agreement for Centracs to extend for the next 5 years, and has not set aside funding for another major software purchase of its kind. The City of Newport News has over 260 traffic signals under their maintenance and control. The City extensively uses fiber optic communications with some limited use of wireless. The City has made use of traffic responsive along some corridors.

C. High-level opinion of probable cost for migration

The individual line-up budgets from the Statewide controller contract are as follows:

- McCain NEMA eX2 type 1 controller: $978.00
- D4 Software: $750.00
- Bulk D4 software discount for system wide upgrade 200 licenses for $120,000.

For Chesapeake to adopt the Statewide controller platform based on the available contract, it is recommended to use the McCain NEMA eX2 type 1 controller.

Since the breakeven for the bulk D4 software purchase occurs at 230 controllers, for Chesapeake the most cost-efficient strategy would be to pay the bulk D4 purchase ($175,000) for all its signals and accommodate room to grow. Based on the Statewide Controller contract pricing, the probable cost for migrating 260 controllers to the McCain eX2 type 1 controller would be approximately $255,000 based on self-installation by the City. When applying a 15% contingency, this equates to an approximate upgrade of ***$494,000***.

Newport News: Controller Estimate Per Region/City			
Item	Unit	Qty.	Extended
• 2070LXN2 Controllers:	$1,397.00	0	$0.00
• McCain NEMA eX2 type 1 controller:	$978.00	260	$254,280.00
• McCain NEMA eX2 type 2 controller:	$1,324.00	0	$0.00
D4 Software: per intersection	$750.00	0	$0.00
• Bulk software discount for system wide upgrade 100 licenses for $60,000.	$60,000.00	0	$0.00
• Bulk software discount for system wide upgrade 150 licenses for $90,000.	$90,000.00	0	$0.00
• Bulk software discount for system wide upgrade 200 licenses for $120,000.	$120,000.00	0	$0.00
• Bulk software discount for system wide upgrade 300 licenses for $175,000.	$175,000.00	1	$175,000.00
• Bulk software discount for system wide upgrade 400 licenses for $225,000.	$225,000.00	0	$0.00
		Subtotal	$ 429,280.00
		15% Contingency	$ 64,392.00
		Total	$ 493,672.00

3.4 City of Norfolk

A. Existing System Summary

The City of Norfolk has been operating the current Caltrans-based platform for approximately 20 years. It is a McCain platform with the QuicNet central system software, and a mixture of 170 and 2070 controllers running BiTran local controller software. The City has recently executed the cooperative agreement to purchase ATC controllers and D4 local controller software directly from the VDOT/VITA statewide contract, and has begun preliminary testing of them in a limited fashion. The City is currently operating over 310 traffic signals. Since only a handful are currently 2070ATC controllers, this number will be used for estimating upgrade costs. By the very nature of the Caltrans environment, the City uses card-based detector rack systems in their cabinets. In short:

System	McCain QuicNet
Cabinet type(s)	Caltrans 332, 336, and a few remaining NEMA TS-1
Controller type(s)	Caltrans 170 running BiTran, Caltrans 2070 ATC running 2070 BiTran Caltrans 2070 ATC running D4
Detection System in cabinets	Card/Rack-based
Other	Some special functions for Light Rail Transit (LRT)

B. Migration Implications

The City has extensive familiarity with the McCain Caltrans family of controllers, but has only recently begun deploying the 2070ATC variation on recent intersection upgrades. The City is embracing the use of the Statewide controller contract, and is preparing for replacement of the remaining 170 controllers with the standard 2070ATC and D4 software. The City has been operating the present platform for approximately 20 years. The City of Norfolk has over 310 traffic signals under their maintenance and control. Approximately 20 of the City's cabinets are still of the TS-1 standard variety. The City extensively uses communications systems made up of fiber optic networks.

The City is currently the only one in Hampton Roads that handles interoperation with a Light Rail Transit (LRT) system. As such, special logic functions may require additional effort to port over/configure into the new platform.

Remaining NEMA TS-1 cabinets should eventually be replaced, but have not been factored into the probable cost aside from the additional power supply adaptation.

C. High-level opinion of probable cost for migration

The individual line-up budgets from the Statewide controller contract are as follows:

- 2070ATC Controllers: $1496.00
- D4 Software: $750.00
- NEMA power supply $350.00
- Bulk software discount for system wide upgrade 400 licenses for $225,000.

For Norfolk to adopt the Statewide controller platform based on the available contract, it is recommended that the McCain 2070ATC controller be utilized. Aside from the few existing 2070ATCs in Norfolk most of the existing controllers need to be upgraded to the new standard. Approximately 310 new controllers would be needed, and approximately 20 with NEMA power supply modules until the remaining TS-1 cabinets can be upgraded in the City.

Since the breakeven for the bulk D4 software purchase occurs at 300 controllers, for Norfolk the most cost-efficient strategy would be to pay the bulk D4 purchase ($225,000) for all its signals and accommodate room to grow. Based on the Statewide Controller contract pricing, the probable cost for migrating 310 controllers to the McCain 2070ATC controller would be approximately $440,000 based on self-installation by the City. When applying a 15% contingency, this equates to an approximate upgrade of ***$765,000***.

Norfolk: Controller Estimate Per Region/City			
Item	Unit	Qty.	Extended
• 2070LXN2 Controllers:	$1,397.00	310	$433,070.00
• 2070LXN2 Controller NEMA Power Supply	$350.00	20	$7,000.00
• McCain NEMA eX2 type 1 controller:	$978.00	0	$0.00
• McCain NEMA eX2 type 2 controller:	$1,324.00	0	$0.00
D4 Software: per intersection	$750.00	0	$0.00
• Bulk software discount for system wide upgrade 100 licenses for $60,000.	$60,000.00	0	$0.00
• Bulk software discount for system wide upgrade 150 licenses for $90,000.	$90,000.00	0	$0.00
• Bulk software discount for system wide upgrade 200 licenses for $120,000.	$120,000.00	0	$0.00
• Bulk software discount for system wide upgrade 300 licenses for $175,000.	$175,000.00	0	$0.00
• Bulk software discount for system wide upgrade 400 licenses for $225,000.	$225,000.00	1	$225,000.00
	Subtotal		$ 665,070.00
	15% Contingency		$ 99,760.50
	Total		$ 764,830.50

3.5 City of Portsmouth

A. Existing System Summary

The City of Portsmouth upgraded their system within the last few years and is running an Econolite platform with their Centracs central system software. The City recently renewed their software maintenance agreement for the next two (2) years. During the past two phases of upgrades, Portsmouth has deployed TS-2 controller cabinets throughout the City along with ASC/3 controllers in approximately 125 locations. Since then, a limited few locations have been deployed with newer Cobalt controllers. The City uses card-based detector rack systems in their cabinets. In short:

System	Econolite Centracs
Cabinet type(s)	NEMA TS-2
Controller type(s)	NEMA TS-2 type 1: Econolite ASC/3 and Cobalt ATC (limited)
Detection System in cabinets	Card/Rack-based
Other	

B. Migration Implications

While the City has an existing familiarity with the Econolite family of controllers, the relatively minimal base of Cobalt controllers that support the D4 software would require a widespread replacement of most of the City's controllers to embrace the standard. To use the statewide contract to continue replacing ASC/3s with Cobalt controllers would cost almost double the statewide rate for McCain shown below.

The City renewed its maintenance support agreement for Centracs to extend for the next 2 years, and has not set aside funding for another major software purchase of its kind. The City of Portsmouth has over 120 traffic signals under their maintenance and control. The City uses a mixture of fiber optic and wireless communications. The City does not have much experience with ATC controllers, nor with McCain.

C. High-level opinion of probable cost for migration

The individual line-up budgets from the Statewide controller contract are as follows:

- McCain NEMA eX2 type 1 controller: $978.00
- D4 Software: $750.00
- Bulk software discount for system wide upgrade 150 licenses for $90,000.

For Portsmouth to adopt the Statewide controller platform based on the available contract, it is recommended to use the McCain NEMA eX2 type 1 controller.

Since the breakeven for the bulk D4 software purchase occurs at 120 controllers, for Portsmouth the most cost-efficient strategy would be to pay the bulk D4 purchase ($90,000) for all its signals and accommodate room to grow. Based on the Statewide Controller contract pricing, the probable cost for migrating 120 controllers to the McCain eX2 type 1 controller would be approximately $118,000 based on self-installation by the City. When applying a 15% contingency, this equates to an approximate upgrade of ***$240,000***.

Portsmouth: Controller Estimate Per Region/City			
Item	Unit	Qty.	Extended
• 2070LXN2 Controllers:	$1,397.00	0	$0.00
• McCain NEMA eX2 type 1 controller:	$978.00	125	$122,250.00
• McCain NEMA eX2 type 2 controller:	$1,324.00	0	$0.00
D4 Software: per intersection	$750.00	0	$0.00
• Bulk software discount for system wide upgrade 100 licenses for $60,000.	$60,000.00	0	$0.00
• Bulk software discount for system wide upgrade 150 licenses for $90,000.	$90,000.00	1	$90,000.00
• Bulk software discount for system wide upgrade 200 licenses for $120,000.	$120,000.00	0	$0.00
• Bulk software discount for system wide upgrade 300 licenses for $175,000.	$175,000.00	0	$0.00
• Bulk software discount for system wide upgrade 400 licenses for $225,000.	$225,000.00	0	$0.00
	Subtotal		$ 212,250.00
	15% Contingency		$ 31,837.50
	Total		$ 244,087.50

3.6 City of Suffolk

A. Existing System Summary

The City of Suffolk has a mixture of Peek and McCain controllers in their system and has been running the Peek Spinnaker central system software, but recently transitioned to McCain's Transparity TMS. Suffolk has deployed TS-2 controller cabinets throughout the City along with a mixture of Peek ATC-1000 and McCain eX2 (Omni) controllers. The City has approximately 125 traffic signals The City uses card-based detector rack systems in their cabinets. In short:

System	Peek Spinnaker -→ to McCain Transparity
Cabinet type(s)	NEMA TS-2
Controller type(s)	NEMA TS-2 type 1: Peek ATC-1000 and McCain eX2 type 1
Detection System in cabinets	Card/Rack-based
Other	Some use of special detection devices

B. Migration Implications

Since the City is using ATC controller types that already support D4 software, Suffolk has a relatively short path to adapting to the standard. In the near-term, Suffolk can simply purchase the D4 software for commonality throughout the region, and in the long-term continue its migration to all McCain controllers.

For the sake of showing the complete impact of establishing a common hardware and software platform, this report shows the cost of evolving all controllers to the eX2 type 1 controller even though the Peek ATC can support the D4 software. It is estimated that Suffolk has approximately 60% of its signals still on the Peek ATC-1000 hardware, and approximately 10 of those are in cabinets that are still of a TS-1 standard variety.

C. High-level opinion of probable cost for migration

The individual line-up budgets from the Statewide controller contract are as follows:

- McCain NEMA eX2 type 1 controller: $978.00
- McCain NEMA eX2 type 2 controller: $1324.00
- D4 Software: $750.00
- Bulk software discount for system wide upgrade 150 licenses for $90,000.

For Suffolk to adopt the Statewide controller platform based on the available contract, it is recommended to continue using the McCain NEMA eX2 type 1 controller, and replace the Peek ATC-1000s for consistency.

Since the breakeven for the bulk D4 software purchase occurs at 120 controllers, for Suffolk the most cost-efficient strategy would be to pay the bulk D4 purchase ($90,000) for all its signals and accommodate room to grow. Based on the Statewide Controller contract pricing, the probable cost for migrating the City's remaining 75 controllers to the McCain eX2 type 1 and Type 2 controllers would be approximately

$77,000 based on self-installation by the City. When applying a 15% contingency, this equates to an approximate upgrade of ***$192,000***.

Suffolk: Controller Estimate Per Region/City			
Item	Unit	Qty.	Extended
• 2070LXN2 Controllers:	$1,397.00	0	$0.00
• McCain NEMA eX2 type 1 controller:	$978.00	65	$63,570.00
• McCain NEMA eX2 type 2 controller:	$1,324.00	10	$13,240.00
D4 Software: per intersection	$750.00	0	$0.00
• Bulk software discount for system wide upgrade 100 licenses for $60,000.	$60,000.00	0	$0.00
• Bulk software discount for system wide upgrade 150 licenses for $90,000.	$90,000.00	1	$90,000.00
• Bulk software discount for system wide upgrade 200 licenses for $120,000.	$120,000.00	0	$0.00
• Bulk software discount for system wide upgrade 300 licenses for $175,000.	$175,000.00	0	$0.00
• Bulk software discount for system wide upgrade 400 licenses for $225,000.	$225,000.00	0	$0.00
		Subtotal	$ 166,810.00
		15% Contingency	$ 25,021.50
		Total	$ 191,831.50

3.7 City of Virginia Beach

A. Existing System Summary

The City of Virginia Beach has been running a Naztec/Trafficware platform with their ATMS.NOW central system software for the better part of the last 15+ years. The City is using NEMA TS-2 controller cabinets throughout with a mixture of Series 900 and ATC controllers from Trafficware. The City uses card-based detector rack systems in their cabinets. Recently the City has deployed Trafficware's SynchroGreen adaptive system software in a subsection of Virginia Beach. In short:

System	Trafficware ATMS.NOW
Cabinet type(s)	NEMA TS-2
Controller type(s)	NEMA TS-2 type 1: Naztec Series 900 and ATC Controllers
Detection System in cabinets	Card/Rack-based
Other	Naztec/Trafficware SynchroGreen for some adaptive corridors

B. Migration Implications

The City has an existing familiarity with the Trafficware/Naztec family of controllers, which do not support the D4 software and would require a widespread replacement of the City's controllers to embrace the standard. The City, however, has been running this platform for the better part of the past 15 years. The City of Virginia Beach has over 380 traffic signals under their maintenance and control. The City extensively uses communications systems made up of fiber optic networks.

The City recently implemented a traffic adaptive corridor, which would require manipulation to fit into a regional standard, or to await completion of the Statewide software procurement to incorporate adaptive into a regional central software system.

C. High-level opinion of probable cost for migration

The individual line-up budgets from the Statewide controller contract are as follows:

- McCain NEMA eX2 type 1 controller: $978.00
- D4 Software: $750.00
- Bulk software discount for system wide upgrade 400 licenses for $225,000.

For Virginia Beach to adopt the Statewide controller platform based on the available contract, it is recommended that the McCain NEMA eX2 type 1 controller be utilized.

Since the breakeven for the bulk D4 software purchase occurs at 300 controllers, for Virginia Beach the most cost-efficient strategy would be to pay the bulk D4 purchase ($225,000) for all its signals and accommodate room to grow. Based on the Statewide Controller contract pricing, the probable cost for migrating 380 controllers to the McCain eX2 type 1 controller would be approximately $372,000 based on self-installation by the City. When applying a 15% contingency, this equates to an approximate upgrade of ***$687,000***.

Virginia Beach: Controller Estimate Per Region/City			
Item	Unit	Qty.	Extended
• 2070LXN2 Controllers:	$1,397.00	0	$0.00
• McCain NEMA eX2 type 1 controller:	$978.00	380	$371,640.00
• McCain NEMA eX2 type 2 controller:	$1,324.00	0	$0.00
D4 Software: per intersection	$750.00	0	$0.00
• Bulk software discount for system wide upgrade 100 licenses for $60,000.	$60,000.00	0	$0.00
• Bulk software discount for system wide upgrade 150 licenses for $90,000.	$90,000.00	0	$0.00
• Bulk software discount for system wide upgrade 200 licenses for $120,000.	$120,000.00	0	$0.00
• Bulk software discount for system wide upgrade 300 licenses for $175,000.	$175,000.00	0	$0.00
• Bulk software discount for system wide upgrade 400 licenses for $225,000.	$225,000.00	1	$225,000.00
		Subtotal	$ 596,640.00
		15% Contingency	$ 89,496.00
		Total	$ 686,136.00

3.8 Virginia Department of Transportation – Hampton Roads District

VDOT is already in the process of migrating its signals over to the statewide standard and will be using the 2070ATC throughout the District. VDOT has approximately 180 signals that they operate and maintain throughout the Eastern Region. Since VDOT's migration will occur regardless of the decisions made by the municipalities, the migration implications will not be discussed herein. However, if the region elects to collaborate on a regional purchase of D4 controller software, VDOT could also stand to benefit along with the rest of the municipalities. The region could save approximately $360,000 by sharing a bulk D4 license purchase. The following table summarizes the information above showing the purchase of hardware and software in the left column for all municipalities (and D4 software only for VDOT). The right column shows the potential difference if the Hampton Roads region collaborated in purchasing a higher volume discount for D4 software.

	Purchased individually		Probable Cost if S/W purchased as a Region	
Chesapeake	$ 329,199.00		$ 166,260.00	
Hampton	$ 389,493.50		$ 218,690.00	
Newport News	$ 493,672.00		$ 254,280.00	
Norfolk	$ 764,830.50		$ 440,070.00	
Portsmouth	$ 244,087.50		$ 122,250.00	
Suffolk	$ 191,831.50		$ 76,810.00	
Virginia Beach	$ 686,136.00		$ 371,640.00	
VDOT HptRds	$ 138,000.00		$ -	
Bulk license for 1900 signals			$845,000	
			$374,250	15% contingency
	$ 3,237,250.00		$ 2,869,250.00	

3.9 Central Signal Software

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.

Chesapeake's CSS is provided by a third-party integrator (as opposed to the controller manufacturer), and would better allow them the opportunity to directly integrate the Statewide common controller standard into their CSS. The other municipalities in Hampton Roads are all running CSSs that are provided by the hardware manufacturer, which would present potential migration issues prior to establishing a regional CSS.