Final Report
Federal Earmark ITS-9851(003)

Virginia Department of Transportation
Northern Virginia Smart Traffic Center Video Quality Improvement Program

August 2005

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I. Background

The Virginia Department of Transportation (VDOT) operates several traffic management centers, including one in the Northern Virginia District. The Northern Virginia District of VDOT encompasses the counties of Arlington, Fairfax, Prince William and Loudoun.

The VDOT Northern Virginia Smart Traffic Center (NOVA STC) provides a number of operational services in the region including:

- System management
- Incident management
- HOV reversible lane management
- Safety service patrols
- Computerized signal system management
- Traveler information

The NOVA STC has a wealth of ITS field devices including changeable message signs, highway advisory radio, truck rollover warning, HOV lane gate control, imbedded loop sensors, 511 and CCTV cameras. The CCTV subsystem is comprised of over 125 cameras located along I-95, I-395, I-495, I-66 and the Dulles Toll Road.

Like many freeway traffic management systems around the country, the NOVA STC system was implemented in phases over a period of years. As a result, some field components had reached their maximum life cycle, including a portion of the CCTV subsystem.

VDOT retained the services of a team of private sector experts (TrafficLand and Digital Traffic Systems) to review CCTV imagery quality and determine the issues affecting system performance and solutions to improve the quality of the video imagery. This report details the results of that effort.

II. Assessment of CCTV Subsystem

The goal of the Project was to develop and implement a CCTV Quality Improvement Program for the Northern Virginia Smart Traffic Center. The objective was to assess the quality of all CCTV field devices and to identify a subset of field devices experiencing diminishing image quality and recurring operational problems. Once the analysis was conducted, VDOT and the Project Team would work together to identify options for improving the quality of the worst performing field devices. The result of the work will be an improvement in performance for this critical ITS subsystem.

Baseline CCTV Field Device Inventory

VDOT provided the Project Team with information on the CCTV field devices from the Northern Virginia ITS Asset Inventory (Table 1).

In July 2004, the Project Team performed an evaluation of CCTV imagery coming into the VDOT Northern Virginia Smart Traffic Center. This evaluation identified a number of issues impacting the CCTV subsystem. These problems included:

- Poor image quality
- Lack of pan, tilt, zoom (PTZ) control
- Improper PTZ control functions
- Lack of video signal from field devices
- Improper lense function
- Video interference during PTZ control functions

Table 2 illustrates the quality issues discovered during the baseline CCTV evaluation.

Table 1: Baseline CCTV Asset Inventory Information

ID	MILEPOST	CABINET_ID	CCTV	ADDR	CAB_ID	PROTCL	ROUTE	RT_DIR	CLST_RT	CLST_INT	NXT_RT	NXT_INT	CONDITN	CONNECT	STATUS
CCTV40	50.1	C424W	4	81	C424W	Vicon	I-66	EB	RT 29	Lee Hwy	Compton Rd	Lee Hwy	New	Fiber	Existing
CCTV190	62.6	C533E	19	56	C533E	Vicon	I-66	EB	RT 243	Nutley St	RT 243	Nutley St	New	Fiber	Existing
CCTV220	64.2	C622E	22	53	C622E	Vicon	I-66	EB	I-495	Capital Beltway	Gallows Rd	Capital Beltway	New	Fiber	Existing
CCTV230	64.8	C13	23	27	C13	Vicon	I-66	EB	I-495	Capital Beltway	I-495	Capital Beltway	Old	Fiber	Existing
CCTV250	0.0	C82	25	39	C82	Vicon	I-66	EB	NA	Arlington Bvld	T R Bridge	Arlington Bvld	Old	Fiber	Existing
CCTV260	74.7	C76	26	38	C76	Vicon	I-66	WB	RT 29	Lee Hwy	Lynn St	Lee Hwy/Rte 29	Old	Fiber	Existing
CCTV270	0.0	C79	27	37	C79	Vicon	I-66	WB	RT 29	Lee Hwy	Westbound	Rosslynn Tunnel	Old	Fiber	Existing
CCTV280	0.0	C74	28	36	C74	Vicon	I-66	WB	RT 29	Lee Hwy	Eastbound	Rosslynn Tunnel	Old	Fiber	Existing
CCTV430	0.0	C588W	44	76	C588W	Vicon	I-66	West	RT 28	Sully Rd	RT 28	Sully Rd	New	T-1	Existing
CCTV460	151.1	B169	47	111	B169	Vicon	I-95	NB	RT 619	Fuller Rd	RT 234	Dumfries Rd	New	Fiber	Existing
CCTV470	0.0	B115	48	102	B115	Vicon	I-95	NB	RT 3000	Prince William Pkwy	RT 123	Gordon Blvd	New	Fiber	Existing
CCTV530	0.0	C186	54	2	C186	Vicon	I-395	NB	RT 644	Franconia Rd	RT 644	Franconia Rd	New	Fiber	Existing
CCTV535	0.0		55	86	-1	Vicon	I-95	NB	644	Hilton Building	I-495	Capital Beltway	New	Fiber	Existing; Replace old CCTV-770
CCTV540*	0.0	B210	56	90	Old B210 B011	Vicon	I-95	NB	RT 644	Old Keene Mill Rd.	RT 644	Old Keene Mill Rd.	New	Fiber	Existing
CCTV550*	0.0	C176 orB217	57	4	C176 -STC or B217	Vicon	I-395	NB	I-495	Capital Beltway	I-495	Capital Beltway	Old	Fiber	Existing
CCTV560	0.0	C174	58	5	C174	Vicon	I-395	NB	I-495	Capital Beltway	I-495	Capital Beltway	Old	Fiber	Existing
CCTV570	0.0	C172	59	6	C172	Vicon	I-395	NB	I-495	Capital Beltway	I-495	Capital Beltway	Old	Fiber	Existing
CCTV640	0.0	C145	66	13	C145	Vicon	I-395	NB	RT 420	Seminary Rd	RT 420	Seminary Rd	Old	Fiber	Existing
CCTV650	0.0	C139	67	14	C139	Vicon	I-395	NB	RT 420	Seminary Rd	RT 420	Seminary Rd	Old	Fiber	Existing
CCTV660	0.0	C137	68	15	C137	Vicon	I-395	NB	RT 7	Leesburg Pike	RT 420	Seminary Rd	Old	Fiber	Existing
CCTV670	5.5	C132	69	16	C132	Vicon	I-395	NB	RT 7	Leesburg Pike	RT 7	Leesburg Pike	Old	Fiber	Existing
CCTV680	0.0	C128	70	17	C128	Vicon	I-395	NB	NA	Quaker Lane	NA	Quaker Lane	Old	Fiber	Existing
CCTV740	0.0	C94	76	22	C94	Vicon	I-395	SB	RT 27	Washington Blvd	RT 27	Washington Blvd	Old	Fiber	Existing
CCTV765*	0.0		79	88	-1	Vicon	I-95	SB	RT 644	Old Keene Mill Rd.	RT 644	Old Keene Mill Rd.	New	Fiber	Existing
CCTV766*	0.0	B210	80	89	-1	Vicon	I-95	SB	RT 644	Old Keene Mill Rd.	RT 644	Old Keene Mill Rd.	New	Fiber	Existing
CCTV800	163.1	B078	83	96	B078	Vicon	I-95	SB	RT 1	Richmond Hwy	RT 1	Richmond Hwy	New	Fiber	Existing
CCTV830	160.7	B092	86	100	B092	Vicon	I-95	SB	RT 123	Gordon Blvd	RT 123	Gordon Blvd	New	Fiber	Existing
CCTV840	159.7	B104	87	101	B104	Vicon	I-95	SB	RT 123	Gordon Blvd	RT 3000	Prince William Pkwy	New	Fiber	Existing
CCTV870	156.3	B130	90	105	B130	Vicon	I-95	SB	RT 784	Dale Blvd	RT 234	Dumfries Rd	New	Fiber	Existing
CCTV890	154.5	B150	92	107	B150	Vicon	I-95	SB	RT 234	Dumfries Rd	RT 234	Dumfries Rd	New	Fiber	Existing
CCTV930	0.0	C90	96	23	C90	Vicon	RT 27	SB	I-395	NA	I-395	NA	Old	Fiber	Existing
CCTV950	0.0	NA	99	45	NA	Vicon	I-95	NB	I-295	Anacostia Freeway	I-295	Wilson Bridge/Md Side	Old	Twisted Pair/Fib	Existing
CCTV960	0.0	NA	100	47	NA	Vicon	I-95	NB	RT 210	Indian Head Hwy	RT 210	Indian Head Hwy	Old	Twisted Pair/Fib	Existing
CCTV970	4.0	249	101	48	NA	Vicon	I-95	SB	RT 210	Indian Head Hwy	RT 414	Saint Barnabas Rd	Old	Twisted Pair/Fib	Existing
CCTV980	0.0	239	102	46	NA	Vicon	I-295	SB	I-495	Capital Beltway	I-295	Anacostia Freeway	Old	Twisted Pair/Fib	Existing
CCTV50	50.8	C461W	5	80	C461W	Vicon	I-66	EB	RT 29	Lee Hwy	Compton Rd	Lee Hwy	New	Fiber	Existing
CCTV360	0.0	C521E	36	57	C521E	Vicon	I-66	WB	RT 243	Nutley St	Vienna Metro	Chain Bridge Rd	New	Fiber	Existing
CCTV500	0.0	B053	51	92	B053	Vicon	I-95	NB	RT 617	Fairfax Co. Pkwy	RT 617	Fairfax Co. Pkwy	New	Fiber	Existing
CCTV510	0.0	B047	52	91	B047	Vicon	I-95	NB	RT 617	Backlick Rd	RT 617	Backlick Rd	New	Fiber	Existing
CCTV520	0.0	C190	53	1	C190	Vicon	I-395	NB	RT 644	Franconia Rd	RT 644	Franconia Rd	New	Fiber	Existing
CCTV620	0.0	C150	64	11	C150	Vicon	I-395	NB	RT 236	Duke St	RT 236	Duke St	Old	Fiber	Existing
CCTV630	0.0	C147	65	12	C147	Vicon	I-395	NB	RT 236	Duke St	RT 236	Duke St	Old	Fiber	Existing
CCTV700	0.0	C117	72	19	C117	Vicon	I-395	NB	RT 27	Washington Blvd	RT 27	Washington Blvd	Old	Fiber	Existing
CCTV760	0.0	C115	78	20	C115	Vicon	I-395	SB	RT 27	Washington Blvd	RT 27	Washington Blvd	Old	Fiber	Existing
CCTV850	0.0	B120	88	103	B120	Vicon	I-95	SB	RT 3000	Prince William Pkwy	RT 784	Dale Blvd	New	Fiber	Existing
CCTV10	46.9	C254W	1	85	C254W	Vicon	I-66	EB	RT 234	Sudley Rd	RT 234	Sudley Rd	New	Fiber	Existing
CCTV20	48.0	C307W	2	83	C307W	Vicon	I-66	EB	RT 234	Sudley Rd	West Bull Run	Lee Hwy	New	Fiber	Existing
CCTV30	48.8	C352W	3	82	C352W	Vicon	I-66	EB	RT 234	Sudley Rd	Rest Area	Lee Hwy	New	Fiber	Existing
CCTV60	52.3	C525W	6	78	C525W	Vicon	I-66	EB	RT 29	Lee Hwy	RT 29	Lee Hwy	New	Fiber	Existing
CCTV70	0.0	C574W	7	77	C574W	Vicon	I-66	EB	RT 28	Sully Rd	RT 28	Sully Rd	New	Fiber	Existing
CCTV80	0.0	C589W	8	75	C589W	Vicon	I-66	EB	RT 28	Sully Rd	RT 28	Sully Rd	New	Fiber	Existing
CCTV90	0.0	C133E	9	70	C133E	Vicon	I-66	EB	RT 7100	Fairfax Co. Pkwy	N Stringfellow Rd	NA	New	Fiber	Existing
CCTV100	55.5	C176E	10	69	C176E	Vicon	I-66	EB	RT 7100	Fairfax Co. Pkwy	RT 7100	Ffx Co Pkwy West	New	Fiber	Existing
CCTV110	55.8	C187E	11	68	C187E	Vicon	I-66	EB	RT 7100	Fairfax Co. Pkwy	FFX Co Pkwy East Side	Rte 50	New	Fiber	Existing

Table 1: Baseline CCTV Asset Inventory Information (continued)

ID	MILEPOST	CABINET_ID	CCTV	ADDR	CAB_ID	PROTCL	ROUTE	RT_DIR	CLST_RT	CLST_INT	NXT_RT	NXT_INT	CONDITN	CONNECT	STATUS
CCTV120	56.9	C244E	12	66	C244E	Vicon	I-66	EB	RT 50	Lee Jackson Mem Hwy	West Ox Rd	Rte 50	New	Fiber	Existing
CCTV130	0.0	C276E	13	65	C276E	Vicon	I-66	EB	RT 50	Lee Jackson Mem Hwy	Monument Dr	Rte 50	New	Fiber	Existing
CCTV140	0.0	C299E	14	63	C299E	Vicon	I-66	EB	RT 50	Lee Jackson Mem Hwy	On WB Rte 50	I-66	New	Fiber	Existing
CCTV150	0.0	C386E	15	61	C386E	Vicon	I-66	EB	RT 123	Chain Bridge Rd	Jermantown Rd	Chain Bridge Rd	New	Fiber	Existing
CCTV160	0.0	C397E	16	60	C397E	Vicon	I-66	EB	RT 123	Chain Bridge Rd	RT 123	Chain Bridge Rd	New	Fiber	Existing
CCTV170	0.0	C450E	17	59	C450E	Vicon	I-66	EB	RT 123	Chain Bridge Rd	RT 123 East of	Chain Bridge Rd	New	Fiber	Existing
CCTV180	0.0	C488E	18	58	C488E	Vicon	I-66	EB	RT 123	Chain Bridge Rd	Blake Lane	Chain Bridge Rd	New	Fiber	Existing
CCTV200	0.0	C556E	20	55	C556E	Vicon	I-66	EB	RT 243	Nutley St	East of Nutley	Capital Beltway	New	Fiber	Existing
CCTV210	63.6	C593E	21	54	C593E	Vicon	I-66	EB	RT 243	Nutley St	Cedar Lane	Nutley St	New	Fiber	Existing
CCTV240	0.0	C51	24	31	C51	Vicon	I-66	EB	NA	George Mason Dr.	NA	George Mason Dr.	Old	Coax	Existing
CCTV290	0.0	C69	29	34	C69	Vicon	I-66	WB	RT 29	Lee Hwy	Lee Hwy	NA	Old	Fiber	Existing
CCTV300	0.0	C67A	30	35	C67A	Vicon	I-66	WB	RT 29	Lee Hwy	Scott Street	NA	Old	Fiber	Existing
CCTV310	0.0	C65A	31	33	C65A	Vicon	I-66	WB	RT 29	Lee Hwy	Spout Run	NA	Old	Fiber	Existing
CCTV320	0.0	C59	32	32	C59	Vicon	I-66	WB	RT 120	Glebe Rd	RT 120	Glebe Rd	Old	Fiber	Existing
CCTV330	0.0	C45A	33	30	C45A	Vicon	I-66	WB	RT 237	Washington Blvd	Sycamore	NA	Old	Fiber	Existing
CCTV340	0.0	C35	34	29	C35	Vicon	I-66	WB	RT 693	WBmoreland St	RT 693	Westmoreland /Wash Blvd	Old	Fiber	Existing
CCTV350	0.0	C20	35	28	C20	Vicon	I-66	WB	RT 7	Leesburg Pike	RT 7	Leesburg Pike	Old	Fiber	Existing
CCTV370	0.0	C331E	37	62	C331E	Vicon	I-66	WB	RT 50	Lee Jackson Mem Hwy	Waples Mill Rd	Rte 50	New	Fiber	Existing
CCTV380	0.0	C298E	38	64	C298E	Vicon	I-66	WB	RT 50	Lee Jackson Mem Hwy	RT 50	Lee Jackson Mem Hwy	New	Fiber	Existing
CCTV390	0.0	C220E	39	67	C220E	Vicon	I-66	WB	RT 7100	Fairfax Co. Pkwy	West Ox Rd	Fairfax Co. Pkwy	New	Fiber	Existing
CCTV400	0.0	C132E	40	71	C132E	Vicon	I-66	WB	RT 7100	Fairfax Co. Pkwy	South Stringfellow Rd	Sully Rd	New	Fiber	Existing
CCTV410	54.9	C134E	41	72	C134E	Vicon	I-66	WB	RT 7100	Fairfax Co. Pkwy	East of RT 28	Sully Rd	New	Fiber	Existing
CCTV420	0.0	C84E	43	74	C84E	Vicon	I-66	WB	RT 28	Sully Rd	RT 28	Sully Rd	New	Fiber	Existing
CCTV440	0.0	C531W	45	79	C531W	Vicon	I-66	WB	RT 29	Lee Hwy	RT 29	Lee Hwy	New	Fiber	Existing
CCTV450	0.0	C280W	46	84	C280W	Vicon	I-66	WB	RT 234	Sudley Rd	RT 234	Sudley Rd	New	Fiber	Existing
CCTV480	0.0	B091	49	98	B091	Vicon	I-95	NB	RT 1	Richmond Hwy	RT 1	Richmond Hwy	New	Fiber	Existing
CCTV490	0.0	B065	50	93	B065	Vicon	I-95	NB	RT 617	Fairfax Co. Pkwy	RT 617	Fairfax Co. Pkwy	New	Fiber	Existing
CCTV580	0.0	C168	60	7	C168	Vicon	I-395	NB	I-495	Capital Beltway	RT 648	Edsall Rd	Old	Fiber	Existing
CCTV590	0.0	C164	61	8	C164	Vicon	I-395	NB	RT 648	Edsall Rd	RT 648	Edsall Rd	Old	Fiber	Existing
CCTV600	2.0	C160	62	9	C160	Vicon	I-395	NB	RT 648	Edsall Rd	RT 236	Duke St	Old	Fiber	Existing
CCTV610	0.0	C157	63	10	C157	Vicon	I-395	NB	RT 236	Duke St	RT 236	Duke St	Old	Fiber	Existing
CCTV690	0.0	C122	71	18	C122	Vicon	I-395	NB	RT 120	SB Glebe Rd	RT 120	SB Glebe Rd	Old	Fiber	Existing
CCTV710	0.0	C107	73	24	C107	Vicon	I-395	NB	NA	Army Navy Dr	RT 27	Washington Blvd	Old	Fiber	Existing
CCTV720	0.0	C96A	74	26	C96A	Vicon	I-395	NB	NA	Boundary Dr	NA	Boundary Dr	Old	Fiber	Existing
CCTV730	0.0	C99	75	25	C99	Vicon	I-395	SB	NA	Boundary Dr	NA	Army Navy Dr	Old	Fiber	Existing
CCTV750	0.0	C113	77	21	C113	Vicon	I-395	SB	RT 27	Washington Blvd	RT 27	Washington Blvd	Old	Fiber	Existing
CCTV780	0.0	B070	81	94	B070	Vicon	I-95	SB	RT 642	Lorton Rd	RT 642	Lorton Rd	New	Fiber	Existing
CCTV790	0.0	B072	82	95	B072	Vicon	I-95	SB	RT 642	Lorton Rd	RT 642	Lorton Rd	New	Fiber	Existing
CCTV810	0.0	B082	84	97	B082	Vicon	I-95	SB	RT 1	Richmond Hwy	RT 1	Richmond Hwy	New	Fiber	Existing
CCTV820	0.0	B090	85	99	B090	Vicon	I-95	SB	RT 1	Richmond Hwy	RT 1	Furnace Rd	New	Fiber	Existing
CCTV860	0.0	B122	89	104	B122	Vicon	I-95	SB	RT 784	Dale Blvd	RT 784	Dale Blvd	New	Fiber	Existing
CCTV880	0.0	B136	91	106	B136	Vicon	I-95	SB	RT 784	Dale Blvd	RT 234	Dumfries Rd	New	Fiber	Existing
CCTV900	0.0	B156	93	108	B156	Vicon	I-95	SB	RT 234	Dumfries Rd	RT 234	Dumfries Rd	New	Fiber	Existing
CCTV910	0.0	B164	94	109	B164	Vicon	I-95	SB	RT 234	Dumfries Rd	RT 619	Fuller Rd	New	Fiber	Existing
CCTV920	0.0	B166	95	110	B166	Vicon	I-95	SB	RT 234	Dumfries Rd	RT 619	Fuller Rd	New	Fiber	Existing
CCTV940	0.0	NA	97	40	NA	Vicon	I-95	NB	RT 613	VAN DORN ST	i-395/495/95	INTERCHANGE	Old	Twisted Pair/Fib	Existing
CCTV990	0.0	NA	103	44	NA	Vicon	I-95	SB	RT 1	Richmond Hwy	RT 1	Richmond Hwy	Old	Twisted Pair/Fib	Existing
CCTV1000	0.0	NA	104	43	NA	Vicon	I-95	SB	RT 611	Telegraph Rd	RT 611	Telegraph Road	Old	Twisted Pair/Fib	Existing
CCTV1010	174.0	NA	105	42	NA	Vicon	I-95	SB	RT 611	Eisenhower Avenue	613	Eisenhower Avenue	Old	Twisted Pair/Fib	Existing
CCTV1020	0.0	NA	106	41	NA	Vicon	I-95	NB	RT 613	VAN DORN ST	RT 613	Van Dorn Street	Old	Twisted Pair/Fib	Existing
CCTV1040	0.0		108	117	-1	Vicon	I-495	SB	Gallows	Gallows Rd	Rt 50	Arlington Blvd	New	T-1	Existing
CCTV1050	44.3		110	119	-1	Vicon	I-495	SB	RT 738	Old Dominion	738	Old Dominion	New	T-1	Existing
CCTV1030	0.0		107	116	-1	Vicon	I-495	SB	I-95	Springfield	Braddock Rd	Braddock Rd	New	T-1	Existing
CCTV1060	43.5	None	112	121	-1	Vicon	I-495	SB	RT 193	Georgetown Pike	River Oaks	GW Parkway	New	T-1	Existing
CCTV1055	0.0		111	120	-1	Vicon	I-495	NB	GW Parkway	GW Parkway	-1	RTE 193, GeorgeTown Pike	New	T-1	Existing
CCTV1070	0.0		113	122	-1	Vicon	I-495	NB	GW Parkway	GW Parkway	-1	American Legion Bridge	New	T-1	Existing
CCTV1080	7.0		114	123	-1	Vicon	DTR	EB	RT 645	Hunter Mill	-1	Wiehle Ave	New	T-1	Existing
CCTV1090	0.0		115	124	-1	Vicon	DTR	WB	RT 28	SULLY RD	RT 28	RT 28	New	T-1	Existing
CCTV1045	0.0		109	118	-1	Vicon	I-495	SB	Lewinsville	Lewinsville Rd	DTR	Dulles Toll Road	New	T-1	Existing
CCTV945	0.0		98	115	-1	Vicon	I-495	SB	Rte 613	Van Dorn	Rte 613	Van Dorn St	Old	T-1	Existing
CCTV415	0.0		42	73	Cell Tower	Vicon	I-66	EB	Rt. 28	Rt. 28	West of 7100	Ffx Co Pkwy	New	T-1	Existing
	0.0		116		TBD	Vicon	Rt. 236	Ramp F	I-495	Ramp F	I-495	Capital Beltway	New	T1 Modem	Existing
	0.0		117	0	TBD	Vicon	Rt. 236	Medium	I-495	Little River Turnpike Me	I-495	Capital Beltway	New	T1 Modem	Existing

Table 2: Initial Video Quality Assessment (as of July 21/22, 2005)

Matrix In/VDOT List	Camera Num	Description from VDOT LIST	Server Num/Input	VDS System	Dist Amp/Input	Camera Housing			Equipment Make & Model Numbers				Lens Iris Wiring			Discrepancies from 7/21 &7/22 2004
						Dome	Pressurized	standard	Camera	Lens	PTZ Unit	Reciever Driver Unit	Auto	Manual	Both	
85	10	ROUTE 234, SUDLEY RD	01/1		1/01		X		VC2820	Fujinon C10x16	Vicon V390-APT	V1311R			X	Lines running through video while panning and tilting
83	20	WEST BULL RUN, LEE HWY	20/2	yes	5/02		X		VC2820	Fujinon C10x16	Vicon V390-APT	V1311R			X	Focus Button also controls Iris - Near will close Iris & Far will open iris
82	30	REST AREA, LEE HWY					X		VC2820	Fujinon C10x16	Vicon V390-APT	V1311R			X	Focus Button also controls Iris - Near will close Iris & Far will open iris
81	40	COMPTON RD, LEE HWY	20/3	yes	5/03		X		VC2820	Fujinon C10x16	Vicon V390-APT	V1311R			X	
80	50	COMPTON RD, LEE HWY	01/2		1/02		X		VC2820	Fujinon C10x16	Vicon V390-APT	V1311R			X	
78	60	ROUTE 29, LEE HWY	01/3	yes	1/03		X		VC2820	Fujinon C10x16	Vicon V390-APT	V1311R			X	Lines running through video while panning and tilting, Focus Button also controls Iris - Near will close Iris & Far will open iris
77	70	ROUTE 28, SULLY RD	01/4		1/04		X		VC2820	Fujinon C10x16	Vicon V390-APT	V1311R			X	Focus Button also controls Iris - Near will close Iris & Far will open iris
75	80	ROUTE 28, SULLY RD	11/2	yes	3/10		X		VC2820	Fujinon C10x16	Vicon V390-APT	V1311R			X	
70	90	N. STRINGLFELLOW ROAD	02/1		1/05		X		VC2820	Fujinon C10x16	Vicon V390-APT	V1311R			X	
69	100	RT. 7100 FFX CO. PKWY WEST	19/1	yes	5/05		X		VC2820	Fujinon C10x16	Vicon V390-APT	V1311R			X	Lines running through video while panning and tilting
68	110	FFX CO. PKWY EAST SIDE, RTE 50					X		VC2820	Fujinon C10x16	Vicon V390-APT	V1311R			X	Focus Button also controls Iris - Near will close Iris & Far will open iris
66	120	WEST OX RD, RTE 50	02/2	yes	1/06		X		VC2820	Fujinon C10x16	Vicon V390-APT	V1311R			X	Focus Button also controls Iris - Near will close Iris & Far will open iris, Video coloring distorted Green Tint
65	130	MONUMENT DR, RTE 50	11/3		3/11		X		VC2820	Fujinon C10x16	Vicon V390-APT	V1311R			X	Focus & Zoom Buttons also controls Iris - Near/In will close Iris & Far/Out will open Iris
63	140	ON WD RTE 50, I-66	02/3	yes	1/07		X		VC2820	Fujinon C10x16	Vicon V390-APT	V1311R			X	
61	150	JERMANTOWN RD, CHAIN BRIDGE RD	02/4		1/08		X		VC2820	Fujinon C10x16	Vicon V390-APT	V1311R			X	
60	160	RT 123, CHAIN BRIDGE RD	11/4	yes	3/12		X		VC2820	Fujinon C10x16	Vicon V390-APT	V1311R			X	
59	170	RT 123 EAST of CHAIN BRIDGE RD	03/1		1/09		X		VC2820	Fujinon C10x16	Vicon V390-APT	V1311R			X	Focus Button also controls Iris - Near will close Iris & Far will open iris
58	180	BLAKE LANE, CHAIN BRIDGE RD	03/2	yes	1/10		X		VC2820	Fujinon C10x16	Vicon V390-APT	V1311R			X	Focus & Zoom Buttons also controls Iris - Near/In will close Iris & Far/Out will open Iris
56	190	RT 243, NUTLEY ST	12/1		3/13		X		VC2820	Fujinon C10x16	Vicon V390-APT	V1311R			X	No Control
55	200	EAST OF NUTLEY, I-495	12/2	yes	3/14		X		VC2820	Fujinon C10x16	Vicon V390-APT	V1311R			X	Focus Button also controls Iris - Near will close Iris & Far will open iris
54	210	I-66 CEDAR LANE, NUTLEY ST		yes			X		VC2820	Fujinon C10x16	Vicon V390-APT	V1311R			X	Focus & Zoom Buttons also controls Iris - Near/In will close Iris & Far/Out will open Iris
53	220	GALLOWS ROAD, CAPITAL BELTWAY					X		VC2820	Fujinon C10x16	Vicon V390-APT	V1311R			X	Lines running through video while panning and tilting (Very bad), Auto Iris won't allow lens to open picture dark
27	230	I-495, CAPITAL BELTWAY	03/3		1/11	X			S2-RW23	N/A	Dome S2-PR	V1311R			X	Interference in video faint scrolling lines, no controls
31	240	GEORGE MASON DR.	19/2		5/06	X			S2-RW23	N/A	Dome S2-PR	V1311R			X	No Control
39	250	T R BRIDGE, ARLINGTON BLVD	03/4	yes	1/12	X			S2-RW23	N/A	Dome S2-PR	V1311R			X	
38	260	LYNN ST, LEE HWY/RTE 29	12/3	yes	3/15	X			S2-RW23	N/A	Dome S2-PR	V1311R			X	
37	270	WESTBOUND, ROSSLYN TUNNEL	04/1		1/13	X			S2-RW23	N/A	Dome S2-PR	V1311R			X	No Video
36	280	EASTBOUND, ROSSYLN TUNNEL	12/4	yes	3/16	X			S2-RW23	N/A	Dome S2-PR	V1311R			X	Doesn't tilt down & No Iris or Zoom Controls
34	290	LEE HIGHWAY	14/3	yes	4/07	X			S2-RW23	N/A	Dome S2-PR	V1311R			X	No Control
35	300	SCOTT STREET	04/2	yes	1/14	X			S2-RW23	N/A	Dome S2-PR	V1311R			X	
33	310	SPOUT RUN	14/4	yes	4/08	X			S2-RW23	N/A	Dome S2-PR	V1311R			X	
32	320	RT 120, GLEBE ROAD	04/3	yes	1/15	X			S2-RW23	N/A	Dome S2-PR	V1311R			X	
30	330	SYCAMORE				X			S2-RW23	N/A	Dome S2-PR	V1311R			X	
29	340	WESTMORELAND / WASH BLVD	15/1	yes	4/09	X			S2-RW23	N/A	Dome S2-PR	V1311R			X	No Control
28	350	RT 7, LEESBURG PIKE	04/4	yes	1/16	X			S2-RW23	N/A	Dome S2-PR	V1311R			X	
57	360	VIENNA METRO, CHAIN BRIDGE RD	15/2	yes	4/10		X		VC2820	Fujinon C10x16	Vicon V390-APT	V1311R			X	No Video
62	370	WAPLES MILL RD, RTE 50	05/1	yes	2/01		X		VC2820	Fujinon C10x16	Vicon V390-APT	V1311R			X	Focus & Zoom Buttons also controls Iris - Near/In will close Iris & Far/Out will open Iris, Video coloring distorted Green Tint
64	380	RT 50, LEE JACKSON MEM HWY	15/3	yes	4/11		X		VC2820	Fujinon C10x16	Vicon V390-APT	V1311R			X	***EXCELLENT CONTROL***
67	390	WEST OX RD, FAIRFAX CO. PKWY	05/2		2/02		X		VC2820	Fujinon C10x16	Vicon V390-APT	V1311R			X	Focus Button also controls Iris - Near will close Iris & Far will open iris
71	400	SOUTH STRINGFELLOW RD, SULLY RD					X		VC2820	Fujinon C10x16	Vicon V390-APT	V1311R			X	Focus & Zoom Buttons also controls Iris - Near/In will close Iris & Far/Out will open Iris
72	410	EAST OF RT 28, SULLY RD	21/4	yes	6/16		X		VC2820	Fujinon C10x16	Vicon V390-APT	V1311R			X	Focus & Zoom Buttons also controls Iris - Near/In will close Iris & Far/Out will open Iris
73	415	WEST OF 7100, FFX CO PKWY	15/4	yes	4/12	X			S2-RW23	N/A	Dome S2-PR	V1311R			X	Focus Button also controls Iris - Near will close Iris & Far will open iris, Out of Focus (Back Focus)
74	420	RT 28, SULLY RD	16/3	yes	4/15		X		VC2820	Fujinon C10x16	Vicon V390-APT	V1311R			X	Focus & Zoom Buttons also controls Iris - Near/In will close Iris & Far/Out will open Iris, Lines running through video while panning and tilting
76	430	RT 28, SULLY RD					X		VC2820	Fujinon C10x16	Vicon V390-APT	V1311R			X	Control Response issues - Starts and doesn't stop
79	440	RT 29, LEE HWY	16/2		4/14		X		VC2820	Fujinon C10x16	Vicon V390-APT	V1311R			X	Focus Button also controls Iris - Near will close Iris & Far will open iris, Out of Focus (Back Focus)
84	450	RT 234, SUDLEY RD	18/3	yes	5/11		X		VC2820	Fujinon C10x16	Vicon V390-APT	V1311R			X	No Video
111	460	RT 619, FULLER RD	24/4	yes	6/04		X		VC2820	Fujinon C10x16	Vicon V390-APT	V1311R			X	Focus & Zoom Buttons also controls Iris - Near/In will close Iris & Far/Out will open Iris, dirty lens cover
102	470	PR WM PKWY	24/3	yes	6/03		X		VC2820	Fujinon C10x16	Vicon V390-APT	V1311R			X	Focus & Zoom Buttons also controls Iris - Near/In will close Iris & Far/Out will open Iris
98	480	RT 1, RICHMOND HWY	24/2	yes	6/02		X		VC2820	Fujinon C10x16	Vicon V390-APT	V1311R			X	Focus & Zoom Buttons also controls Iris - Near/In will close Iris & Far/Out will open Iris
93	490	RT 617, FAIRFAX CO. PKWY	18/2		5/10		X		VC2820	Fujinon C10x16	Vicon V390-APT	V1311R			X	Focus & Zoom Buttons also controls Iris - Near/In will close Iris & Far/Out will open Iris
92	500	RT 617, FAIRFAX CO. PKWY	18/1		5/09		X		VC2820	Fujinon C10x16	Vicon V390-APT	V1311R			X	Focus & Zoom Buttons also controls Iris - Near/In will close Iris & Far/Out will open Iris
91	510	RT 617, BACKLICK RD	24/1	yes	6/01		X		VC2820	Fujinon C10x16	Vicon V390-APT	V1311R			X	Focus & Zoom Buttons also controls Iris - Near/In will close Iris & Far/Out will open Iris
1	520	RT 644, FRANCONIA RD					X		VC2820	Fujinon C10x16	Vicon V390-APT	V1311R			X	Lens Functions wrong - Iris and Zoom controls switched
2	530	FSP, SOUTH TERMINAL					X		VC2820	Fujinon C10x16	Vicon V390-APT	V1311R			X	Focus & Zoom Buttons also controls Iris - Near/In will close Iris & Far/Out will open Iris
86	535	HOV, ROUTE 644					X		VC2820	Fujinon C10x16	Vicon V390-APT	V1311R			X	***EXCELLENT CONTROL***
90	540	RT 644, OLD KEENE MILL RD					X		VC2820	Fujinon C10x16	Vicon V390-APT	V1311R			X	Focus & Zoom Buttons also controls Iris - Near/In will close Iris & Far/Out will open Iris
4	550	COMMERCE ST, I-495					X		VC2820	Fujinon C10x16	Vicon V390-APT	V1311R			X	No Control
	562					X			S2-RW23	N/A	Dome S2-PR	V1311R			X	No Control
	564					X			S2-RW23	N/A	Dome S2-PR	V1311R			X	No Control
5	560	I-495, CAPITAL BELTWAY	14/2	yes	4/06	X			S2-RW23	N/A	Dome S2-PR	V1311R			X	
6	570	I-495, CAPITAL BELTWAY	05/3		2/03			X	VC2820	Fujinon C10x16	Pleco Housing	V1200	X			
7	580	RT 648, EDSALL RD	05/4	yes	2/04			X	VC2820	Fujinon C10x16	Pleco Housing	V1200	X			
8	590	RT 648, EDSALL RD	06/1	yes	2/05			X	VC2820	Fujinon C10x16	Pleco Housing	V1200	X			
9	600	RT 236, DUKE ST	14/1	yes	4/05			X	VC2820	Fujinon C10x16	Pleco Housing	V1200	X			Video coloring distorted Blue Tint, wiper in the screen, and no iris controls

Table 2: Initial Video Quality Assessment (continued) (as of July 21/22, 2005)

Matrix In/VDOT List	Camera Num	Description from VDOT LIST	Server Num/Input	VDS System	Dist Amp/Input	Camera Housing			Equipment Make & Model Numbers				Lens Iris Wiring			Discrepancies from 7/21 &7/22 2004
						Dome	Pressurized	standard	Camera	Lens	PTZ Unit	Reciever Driver Unit	Auto	Manual	Both	
10	610	RT 236, DUKE ST	06/2		2/06			X	VC2820	Fujinon C10x16	Pleco Housing	V1200	X			No Focus or Iris Controls
11	620	RT 236, DUKE ST	06/3	yes	2/07			X	VC2820	Fujinon C10x16	Pleco Housing	V1200	X			No Lens Functions, PTZ Control is very touchy and Very Poor Video
12	630	RT 236, DUKE ST	13/4		4/04			X	VC2820	Fujinon C10x16	Pleco Housing	V1200	X			Lines running through video while panning and tilting, no focus or irsis control
13	640	RT 420, SEMINARY RD						X	VC2820	Fujinon C10x16	Pleco Housing	V1200	X			No Focus or Iris Controls
14	650	RT 420, SEMINARY RD	13/3	yes	4/03			X	VC2820	Fujinon C10x16	Pleco Housing	V1200	X			No Lens Functions - Out of Focus (Back Focus)
15	660	SEMINARY RD, KING ST	06/4	yes	2/08			X	VC2820	Fujinon C10x16	Pleco Housing	V1200	X			No Focus or Iris Controls
16	670	RT 7, KING STREET						X	VC2820	Fujinon C10x16	Pleco Housing	V1200	X			No Video
17	680	SHIRLINGTON	07/1		2/09			X	VC2820	Fujinon C10x16	Pleco Housing	V1200	X			No Focus or Iris Controls, Video coloring distorted Blue Tint
18	690	RT 120, SB GLEBE RD	21/2	yes	6/14			X	VC2820	Fujinon C10x16	Pleco Housing	V1200	X			No Iris Controls
19	700	RT 27, WASHINGTON BLVD						X	VC2820	Fujinon C10x16	Pleco Housing	V1200	X			No Focus or Iris Controls, Video coloring distorted Blue Tint, Dirty Lens
24	710	RT 27, WASHINGTON BLVD	21/3	yes	6/15			X	VC2820	Fujinon C10x16	Pleco Housing	V1200	X			Video Interference while using focus buttons, no iris controls
26	720	BOUNDRY DR	13/2	yes	4/02			X	VC2820	Fujinon C10x16	Pleco Housing	V1200	X			No Focus or Iris Controls, Zoom in/out buttons reversed
25	730	ARMY NAVY DR	07/2	yes	2/10			X	VC2820	Fujinon C10x16	Pleco Housing	V1200	X			No Video
22	740	RT 27, WASHINGTON BLVD	07/3		2/11			X	VC2820	Fujinon C10x16	Pleco Housing	V1200	X			No Focus or Iris Controls
21	750	RT 27, WASHINGTON BLVD						X	VC2820	Fujinon C10x16	Pleco Housing	V1200	X			No Auto Iris, nor iris control
20	760	RT 27, WASHINGTON BLVD						X	VC2820	Fujinon C10x16	Pleco Housing	V1200	X			No Iris Controls
88	765	RTE. 644, OLD KEENE MILL RD	07/4	yes	2/12			X	VC2820	Fujinon C10x16	Pleco Housing	V1200	X			Focus & Zoom Buttons also controls Iris - Near/In will close Iris & Far/Out will open Iris
89	766	RTE. 644, OLD KEENE MILL RD						X	VC2820	Fujinon C10x16	Pleco Housing	V1200	X			Focus & Zoom Buttons also controls Iris - Near/In will close Iris & Far/Out will open Iris
94	780	RT 642, LORTON RD	13/1	yes	4/01		X		VC2820	Fujinon C10x16	Vicon V390-APT	V1311R			X	Focus & Zoom Buttons also controls Iris - Near/In will close Iris & Far/Out will open Iris
95	790	RT 642, LORTON RD	08/1		2/13		X		VC2820	Fujinon C10x16	Vicon V390-APT	V1311R			X	No Pan tilt Control
96	800	RT 1, RICHMOND HWY	21/1	yes	6/13		X		VC2820	Fujinon C10x16	Vicon V390-APT	V1311R			X	Focus & Zoom Buttons also controls Iris - Near/In will close Iris & Far/Out will open Iris
97	810	RT 1, RICHMOND HWY	08/2		2/14		X		VC2820	Fujinon C10x16	Vicon V390-APT	V1311R			X	Focus & Zoom Buttons also controls Iris - Near/In will close Iris & Far/Out will open Iris
99	820	RT 1, FURNACE RD	08/3	yes	2/15		X		VC2820	Fujinon C10x16	Vicon V390-APT	V1311R			X	Focus button will slowly move zoom
100	830	RT 123, GORDON BLVD		yes			X		VC2820	Fujinon C10x16	Vicon V390-APT	V1311R			X	Focus & Zoom Buttons also controls Iris - Near/In will close Iris & Far/Out will open Iris
101	840	RT 3000, PRINCE WILLIAM PKWY		yes			X		VC2820	Fujinon C10x16	Vicon V390-APT	V1311R			X	No Focus or Iris Controls
103	850	RT 784 DALE BLVD					X		VC2820	Fujinon C10x16	Vicon V390-APT	V1311R			X	Focus & Zoom Buttons also controls Iris - Near/In will close Iris & Far/Out will open Iris
104	860	RT 784 DALE BLVD	08/4		2/16		X		VC2820	Fujinon C10x16	Vicon V390-APT	V1311R			X	While panning left or down camera moves left & Down simultaneously
105	870	RT 234, DUMFRIES RD		yes			X		VC2820	Fujinon C10x16	Vicon V390-APT	V1311R			X	No Control
106	880	RT 234, DUMFRIES RD	09/1		3/01		X		VC2820	Fujinon C10x16	Vicon V390-APT	V1311R			X	Focus Button also controls Iris - Near will close Iris & Far will open iris, Video coloring distorted Blue Tint
107	890	WEIGH STATION	09/2		3/02		X		VC2820	Fujinon C10x16	Vicon V390-APT	V1311R			X	Focus & Zoom Buttons also controls Iris - Near/In will close Iris & Far/Out will open Iris
108	900	RT 234, DUMFRIES RD		yes			X		VC2820	Fujinon C10x16	Vicon V390-APT	V1311R			X	Focus Button also controls Iris - Near will close Iris & Far will open iris
109	910	RT 234	20/1	yes	5/01		X		VC2820	Fujinon C10x16	Vicon V390-APT	V1311R			X	No Control
110	920	MINE RD					X		VC2820	Fujinon C10x16	Vicon V390-APT	V1311R			X	No Iris Controls
23	930	I-395	11/1	yes	3/09			X	VC2820	Fujinon C10x16	Pleco Housing	V1200			X	No Focus or Iris Controls, Video Interference
40	940	I-395/495/95, INTERCHANGE	22/4	yes	6/12	X			S2-RW23	N/A	Dome S2-PR	V1311R			X	No Video
115	945	RTE 613, VAN DORN ST	09/3		3/03	X			S2-RW23	N/A	Dome S2-PR	V1311R			X	
45	950	I-295, WILSON BRIDGE / MD SIDE						X	VC2820	Fujinon C10x16	Pleco Housing	V1200	X			No Video
47	960	RT 210, INDIAN HEAD HWY	09/4	yes	3/04			X	VC2820	Fujinon C10x16	Pleco Housing	V1200	X			No Video
48	970	RT 414, SAINT BARNABUS RD	22/3	yes	6/11			X	VC2820	Fujinon C10x16	Pleco Housing	V1200	X			No Video
46	980	I-295, ANACOSTIA FREEWAY	18/4	yes	5/12			X	VC2820	Fujinon C10x16	Pleco Housing	V1200	X			No Video
44	990	RT 1, RICHMOND HWY	10/1		3/05			X	VC2820	Fujinon C10x16	Pleco Housing	V1200	X			No Video
140	993	RTE 241, TELEGRAPH RD	22/2	yes	6/10			X	VC2820	Fujinon C10x16	Pleco Housing	V1200	X			
141	995	RTE 1, RICHMOND HWY	25/4	yes	7/16 Not Installed			X	VC2820	Fujinon C10x16	Pleco Housing	V1200	X			New Dome with bad video
142	997	I-95 WILSON BRIDGE/VA SIDE	10/2		3/06			X	VC2820	Fujinon C10x16	Pleco Housing	V1200	X			Very dirty bubble
43	1000	RT 613, TELEGRAPH ROAD		yes				X	VC2820	Fujinon C10x16	Pleco Housing	V1200	X			No Iris Controls, Out of Focus (Back Focus)
42	1010	RT 613, EISENHOWER AVE	22/1	yes	6/09			X	VC2820	Fujinon C10x16	Pleco Housing	V1200	X			Interference in video rooling white lines, No Focus or Iris Controls
41	1020	RT 613, VAN DORN STREET	19/3	yes	5/07			X	VC2820	Fujinon C10x16	Pleco Housing	V1200	X			No Iris Controls, Lost video while panning & very dirty bubble
116	1030	RTE 620, BRADDOCK RD				X			S2-RW23	N/A	Dome S2-PR	V1311R			X	No Control, Digital Signal (T-1 ?) quality "fair"
112	1035	RT 236, LITTLE RIVER TURNPIKE	10/3		3/07	X			S2-RW23	N/A	Dome S2-PR	V1311R			X	
113	1037	RT 236, LITTLE RIVER TURNPIKE	23/4		6/08	X			S2-RW23	N/A	Dome S2-PR	V1311R			X	
117	1040	RT 50, ARLINGTON BLVD	25/3	yes	7/15 Not Installed	X			S2-RW23	N/A	Dome S2-PR	V1311R			X	No Control, Digital Signal (T-1 ?) quality "fair"
118	1045	RTE 267, DULLES TOLL RD	23/3	yes	6/07	X			S2-RW23	N/A	Dome S2-PR	V1311R			X	Scratched Dirty Bubble
119	1050	RTE 738, OLD DOMINION	25/2	yes	7/14 Not Installed	X			S2-RW23	N/A	Dome S2-PR	V1311R			X	
120	1055	RT 193, GEORGETOWN PIKE	25/1	yes	7/13 Not installed	X			S2-RW23	N/A	Dome S2-PR	V1311R			X	
121	1060	RIVER OAKS, GW PARKWAY	23/2	yes	6/06	X			S2-RW23	N/A	Dome S2-PR	V1311R			X	Digital Signal (T-1 ?) quality "fair"
122	1070	AMERICAN LEGION BRIDGE	10/4	yes	3/08	X			S2-RW23	N/A	Dome S2-PR	V1311R			X	Digital Signal (T-1 ?) quality "fair"
123	1080	WIEHLE AVE, HUNTER MILL	19/4	yes	5/08	X			S2-RW23	N/A	Dome S2-PR	V1311R			X	No Control, Digital Signal (T-1 ?) quality "fair"
124	1090	RTE 28, SULLY RD	23/1		6/05	X			S2-RW23	N/A	Dome S2-PR	V1311R			X	No Video

In addition, TrafficLand staff performed an evaluation of the CCTV control equipment located inside the Northern Virginia Smart Traffic Center. This included an evaluation of the VICON Matrix Switch and the video handling and communications hardware in the center.

Matrix Switch Assessment

The Vicon Matrix Switch located at the NOVA STC is currently configured for a maximum of 160 "Camera" Inputs by a maximum of 128 Selectable "Monitor" Outputs (160 X 128). This means that any of the 160 cameras can be displayed on any of the 128 Monitor Outputs.

The system consists of multiple Vicon Matrix 66 Card Cages, each card cage contains up to 8 video switcher cards that accept 32 camera inputs each, for a total capacity of 256 camera inputs and 16 monitor outputs. In the NOVA STC system, 8 card cages are stacked to support 128 monitor outputs and the 160 camera inputs are looped through each of the bays and terminated at the last.

The current Vicon Central Processor Unit (CPU) was modified previously to accommodate for all the pan tilt zoom cameras "PTZ" that were transmitting over the 600 baud coaxial cable. Recently the coaxial cable system was upgraded to a fiber optic network. This fiber optic network should allow the PTZ cameras to operate at a much higher baud rate and alleviate any need to modify a new CPU.

Due to the advanced age of the current VICON matrix, the lack of manufacturer support, and the difficulty in finding spares for the unit, VDOT asked the Project Team to evaluate several options for addressing the Matrix Switch portion of the CCTV subsystem.

Option #1 - Purchase (1) additional Vicon V1300 CPU as backup.
Option #2 - Purchase a new Vicon V1500 CPU w/Automatic built in Redundancy.
Option #3 - Upgrade Matrix from 160 camera inputs to 256 camera inputs.
Option #4 – Remove and replace the Vicon Matrix with a new Matrix.

The purpose of the four options is to help the NOVA STC understand the current and future costs associated with expanding the Vicon Matrix, versus replacing the matrix with a newer fully supportable system. The electronics industry is always a changing environment and in many cases older equipment is declared obsolete with no regard for supportability or for compatibility issues.

Option #1 Purchase (1) additional Vicon V1300 CPU as backup.

The V1300 CPU has been discontinued by Vicon but Trafficland, at the request of the NOVA STC, was able to locate a used unit. The used V1300 needs to be sent to a factory authorized service center for reconditioning and or repairs. This unit should then replace the current operating unit which will be sent back for reconditioning.

In order for either unit to work properly after reconditioning, all of the PTZs and/or receivers/drivers currently running on a 600 baud rate will need to be modified to 4800 prior to installation of the CPU.

In addition, there will be no automated hot swapping of the V1300 CPUs and a technician will be required to manually remove, replace and update the programming should a CPU fail.

This approach is just a temporary fix and does not address the discontinued CPU issue and supportability of this mission-critical equipment. There are also no guarantees that an off the shelf CPU will work properly with the current Lockheed Martin Control Room Software or for how long. Generally used/reconditioned equipment is sold as is or with a minimal warranty period. In this case, ninety (90) days is the expected warranty period.

The cost associated with this option is approximately $1,000 - $2,000.

Option #2 Purchase a new Vicon V1500 CPU w/Automatic built in Redundancy.

This option removes and replaces the old Vicon V1300 CPU with a redundant “Factory New” Vicon V1500 CPU. The V1500 is a two-piece system consisting of a CPU which stores all system configuration information and CDU “Communication Distribution Unit” that communicates to all of the non-network products such as matrix card cages, keyboards and cameras.

The system will consist of twoV1500 CPU’s attached to a network hub operating simultaneously and one CDU cage configured with a redundant network card, power supply, serial card, and video card. The CDU will also contain one non-redundant time date title card.

This option addresses the discontinued CPU issue, but there still maybe some issues with an off the shelf product working properly with the current Lockheed Martin Control Room Software.

The cost associated with this option is approximately $25,000 - $30,000.

Option #3 Upgrade Matrix from 160 camera inputs to 256 camera inputs

This option shows the costs associated with expanding the current matrix card cages from 160 camera inputs to 256 camera inputs. Under this option, VDOT would need to be very certain up front that their camera input needs would not exceed 256. In that event, the 257th camera added to the system will require a doubling of the current number of matrix card cages. This will also require the addition of more racks, resulting in significant increased costs.

The cost associated with this option is approximately $35,000 - $40,000.

Option #4 Purchase and Install New Matrix Switch

This Option is offered as a value-added alternative to the previous Options. Based upon the comparative cost to expand the existing matrix (Options 2 or 3 above), as well as lack of supportability of the older system versus a new two (2) year factory warranty, we have conducted an assessment of the market and would recommend the removal and replacement of the Vicon Matrix with a new Matrix Switch.

This option shows the costs associated with replacing the current Vicon Matrix with a new Synectics Matrix. The Matrix will be a one-chassis unit configured for 256 camera inputs by 128 monitor outputs (Looping) and will fit in one equipment rack. The system will control the existing Vicon PTZ cameras (Plus numerous others) and readily integrate with the Lockheed Martin Control Room Software.

The cost associated with this option is approximately $150,000 - $200,000.

Telecommunications Equipment Assessment

Like other subsystems in the NOVA STC architecture, the telecommunications system has evolved over time. The last major overhaul converted the field communications system on I-395 inside the Capital Beltway from coaxial cable to fiber optic cable.

As part of the NOVA STC Video Quality Improvement Program, the Project Team made observations of the telecommunications aspects of the CCTV subsystem. These observations took place over numerous periods during the project and may shed light on some of the continuing CCTV communication and control issues that were observed both prior to and after the replacement of the 25 CCTV field devices.

During the initial video quality assessment (see Table 2), the Project Team identified a variety of camera communication and control problems throughout the entire CCTV subsystem. These issues included:

- No focus control
- No iris control
- No PTZ control
- Focus control also controlling iris function
- Focus and zoom control also controlling iris function
- No video control at all

Since the VQIP project focused on the replacement of 25 cameras that were not sending video imagery back to the NOVA STC, these communication and control problems remain for much of the rest of the CCTV system.

In addition, the Project Team identified a number of potential issues affecting CCTV communication and control. These issues include:

- Multiple RS 422 – RS232 – RS422 conversions of the camera control signal between STC workstations and the field cameras themselves.

- Inconsistent wiring of data cables from Vicon Data Units to RS422 – RS 232 converters.

- Reducing the baud rate in the field from 4800 baud to 600 baud to accommodate daisy chain design of field comm. architecture

- Improperly wired jumper cables in CCTV field cabinets between local control cables and fiber optic patch panel.

At this point it is hard to determine the effect of the issues identified above. VDOT should conduct a thorough analysis of the existing communication equipment and wiring to determine if these issues are contributing to diminished CCTV system performance.

III. CCTV Field Device Improvement

In Phase II of the Work, TrafficLand worked with VDOT staff to determine the CCTV field devices in greatest need of improvement based on the initial survey results. The cameras that were not sending video back to the Smart Traffic Center were selected as the highest priority. This initial group included 25 CCTV field devices.

Table 3 identifies the cameras selected for remediation under this project.

Table 3: Cameras Selected for Quality Improvement Program

Number	Camera	Name
1	**160**	I-66 (E/W)- Chain Bridge Rd.
2	**270**	I-66 W- Rossyln Tunnel W
3	**280**	I-66 E- Rossyln Tunnel E
4	**470**	I-95 (N/S)- Pr. William Pky. (N/S)
5	**520**	I-95 (N/S)- Franconia Rd.
6	**590**	I-395 (N/S)- Edsall Rd.
7	**600**	I-395 (N/S)- Duke St.
8	**610**	I-395 (N/S)- Duke St.
9	**620**	I-395 (N/S)- Duke ST.
10	**630**	I-395 (N/S)- Duke St.
11	**640**	I-395 (N/S)- Seminary Rd. (N/S)
12	**650**	I-395 (N/S)- Seminary Rd.
13	**660**	I-395 (N/S)- King St.
14	**670**	I-395 (N/S)- King St.
15	**680**	I-395 (N/S)- Shirlington Rd.
16	**690**	I-395 (N/S)- Glebe Rd.
17	**700**	I-395 (N/S)- Washington Blvd.
18	**710**	I-395 (N/S) Washington Blvd.
19	**720**	I-395 (N/S)- Boundry Channel Dr.
20	**730**	I-395 (N/S)- Boundry Channel Dr.
21	**740**	Washington Blvd. (E/W) -; I395
22	**750**	I-395 (N/S)- Boundry Channel Dr.
23	**760**	I-395 (N/S)- Boundry Channel Dr.
24	**930**	Washington Blvd. (E/W) -; I395
25	**1080**	Dulles Toll Rd. (E/W) - Hunter Mill Rd.

VDOT conducted a thorough analysis of various camera manufacturers and products. VDOT evaluated Pelco, COHU and Vicon cameras. VDOT selected the COHU 3925-3100-PEND dome camera for use in this project.

Post-Installation Quality Assessment

After all improvements and/or CCTV field device replacements were completed, the Project Team conducted a post installation quality assessment to determine the level of quality improvement on the CCTV subsystem and to develop a benchmark for future maintenance of the system (Figure 4).

The field device remediation phase demonstrated a number of difficulties in working with an aging CCTV system. Some of the issues encountered in the field include:

- Interior of camera poles blocked with debris
- Incompatible bolt patterns between old and new camera mounts
- Difficulty in removing old video cable
- Difficulty in pulling new video cable through CCTV poles

As Table 4 shows, once installation of new cameras was accomplished, a second set of issues arose.

- Cameras that had no video before had no video after installation of new camera
- The need to program cameras to interface with different encoders in the field
- Intermittent video being transmitted from field to operations center
- Difficulty controlling camera speed from operations center

Table 4: Initial Post-Installation Analysis

ID	CABINET ID	CAMERA ADDRESS	RTE	DIR	STATUS	POST INSTALATION ISSUES	COMPLETION DATE
CCTV1080	N/A	123	DTR	EB	COMPLETED	STC HAS VIDEO BUT NO CONTROL; ENCODER ISSUE	12/15/04
CCTV160	C397E	60	I-66	EB	COMPLETED	INTERMITTENT VIDEO	11/02/04
CCTV270	C79	37	I-66	WB	COMPLETED	QUALITY GOOD	12/07/04
CCTV280	C74	36	I-66	WB	COMPLETED	QUALITY GOOD	12/07/04
CCTV470	B115	102	I-95	NB	COMPLETED	QUALITY GOOD	12/07/04
CCTV520	C190	1	I-395	NB	COMPLETED	STC HAS VIDEO BUT NO CONTROL	12/14/04
CCTV590	C164	8	I-395	NB	COMPLETED	QUALITY GOOD	12/08/04
CCTV600	C160	9	I-395	NB	COMPLETED	QUALITY GOOD	11/16/04
CCTV610	C157	10	I-395	NB	COMPLETED	QUALITY GOOD	12/08/04
CCTV620	C150	11	I-395	NB	COMPLETED	QUALITY GOOD	11/17/04
CCTV630	C147	12	I-395	NB	COMPLETED	QUALITY GOOD	12/14/04
CCTV640	C145	13	I-395	NB	COMPLETED	QUALITY GOOD	12/09/04
CCTV650	C139	14	I-395	NB	COMPLETED	POLE BLOCKED	12/09/04

CCTV660	C137	15	I-395	NB	COMPLETED	QUALITY GOOD	12/09/04
CCTV670	C132	16	I-395	NB	COMPLETED	QUALITY GOOD	12/14/04
CCTV680	C128	17	I-395	NB	COMPLETED	QUALITY GOOD	12/14/04
CCTV690	C122	18	I-395	NB	COMPLETED	QUALITY GOOD	11/18/04
CCTV700	C117	19	I-395	NB	COMPLETED	ADJUST INSTALLATION ANGLE	12/07/04
CCTV710	C107	24	I-395	NB	COMPLETED	CAMERA REPORTS ADJUST BALANCE	12/07/04
CCTV720	C96A	26	I-395	NB	COMPLETED	QUALITY GOOD	11/18/04
CCTV730	C99	25	I-395	SB	COMPLETED	QUALITY GOOD	11/16/04
CCTV740	C94	22	US-27	SB	COMPLETED	QUALITY GOOD	11/16/04
CCTV750	C113	21	I-395	SB	COMPLETED	CAMERA REPORTS TEMP AND PRESSURE	12/17/04
CCTV760	C115	20	I-395	SB	COMPLETED	QUALITY GOOD	12/09/04
CCTV930	C90	23	I-395	SB	COMPLETED	STC HAS VIDEO BUT NO CONTROL; ENCODER ISSUE	12/14/04

Final Quality Assessment

After reviewing the immediate post-installation issues with VDOT staff, the Project Team redeployed into the field to address the remaining quality issues. After this second round of field work, the Project Team conducted a final quality assessment of the cameras included in the Video Quality Improvement Project. The results of that final quality assessment are illustrated in Table 5.

Upon completion of the final quality assessment, a few nagging issues remained. These primarily focused on camera control speed and the possibility of a defective camera at Camera 1080 on the Dulles Toll Road.

Initially, the new cameras were set at the maximum speed of Level 15. That speed was ultimately lowered to Level 5 through field testing and control from the NOVA STC control room. NOVA STC operators indicated that the control speed for the new cameras was different depending on whether the camera was being controlled from the integration software or directly from the camera system control keyboard. At the time this report was written, the consensus among those involved in the project was that the issue was likely the result of inconsistent communication protocols inherent in the field architecture such as differing communication baud rates and a multitude of control signal switching points.

These issues would best be addressed by a separate work effort focused on the CCTV system hardware in the operations center and the communication architecture between that hardware and the CCTV field devices.

Table 5: Final Video Quality Assessment

Final Review Date		Text Title Set by Ray	Text Title per Meeting with Marlowe on 6/1/05	PAN	TILT	ZOOM	AUTO FOCUS	IRIS	FLIP	Day/ Night	Remaining Issues	Final Issues
6/1/2005	**160**	I-66 EAST CHAIN BRIDGE R	I-66 E CHAIN BRIDGE RD	OK	OK	OK	OK	OK	OK	*	No Auto Focus, Dome Dirty	Dirty dome is outside the scope of task order.
6/1/2005	**270**	I-66 WEST ROSSYLN TUNNEL	I-66 W ROSSYLN TUNNEL	OK	OK	OK	OK	OK	OK	*	Dome Dirty	Dirty dome is outside the scope of task order.
6/1/2005	**280**	I-66 EAST ROSSYLN TUNNEL	I-66 E ROSSYLN TUNNEL	OK	OK	OK	OK	OK	OK	*		
6/1/2005	**470**	I-95 NORTH PR. WILLIAM P	I-95 N. PR. WILLIAM PKY	OK	OK	OK	OK	OK	OK	*	No Auto Focus	
6/1/2005	**520**	I-95 NORTH FRANCONIA RD	I-95 N. FRANCONIA RD	OK	OK	OK	OK	OK	OK	*	Video too bright at STC- works fine at camera site- comm problem? Per Gerry, not a camera problem- have Marlowe check switch input or gain control on fiber converter	Gerry Amato to work with Marlowe on video brightness issue.
6/1/2005	**590**	I-395 NORTH EDSALL RD	I-395 N EDSALL RD	OK	OK	OK	OK	OK	OK	*	Speed- too fast	
6/1/2005	**600**	I-395 NORTH DUKE ST.	I-395 N DUKE ST	OK	OK	OK	OK	OK	OK	*	Speed- too fast	
6/1/2005	**610**	I-395 NORTH DUKE ST.	I-395 N DUKE ST	OK	OK	OK	OK	OK	OK	*	Speed- too fast	
6/1/2005	**620**	I-395 NORTH DUKE ST.	I-395 N DUKE ST	OK	OK	OK	OK	OK	OK	*	Speed- too fast	
6/1/2005	**630**	I-395 NORTH DUKE ST.	I-395 N DUKE ST	OK	OK	OK	OK	OK	OK	*	Speed- too fast	
6/1/2005	**640**	I-395 NORTH SEMINARY RD.	I-395 N SEMINARY RD	OK	OK	OK	OK	OK	OK	*	Speed- too fast	
6/1/2005	**650**	I-395 NORTH SEMINARY RD.	I-395 N SEMINARY RD	OK	OK	OK	OK	OK	OK	*	Speed- too fast	
6/1/2005	**660**	I-395 NORTH KING ST.	I-395 N KING ST	OK	OK	OK	OK	OK	OK	*	Speed- too fast	
6/1/2005	**670**	I-395 NORTH KING ST.	I-395 N KING ST	OK	OK	OK	OK	OK	OK	*	Speed- too fast	
6/1/2005	**680**	I-395 NORTH SHIRLINGTON	I-395 N SHIRLINGTON	OK	OK	OK	OK	OK	OK	*	Speed- too fast	
6/1/2005	**690**	I-395 NORTH GLEBE RD.	I-395 N GLEBE RD	OK	OK	OK	OK	OK	OK	*	Speed- too slow	
6/1/2005	**700**	I-395 NORTH WASHINGTON	I-395 N WASHINGTON BLVD	OK	OK	OK	OK	OK	OK	*	Speed- too fast	
6/1/2005	**710**	I-395 NORTH PENTAGON	I-395 N PENTAGON	OK	OK	OK	OK	OK	OK	*	Speed- too fast. Adjust C38 to Balance message. Per Gerry, this is an eroneous text title	
6/1/2005	**720**	I-395 NORTH 14 ST BRIDGE	I-395 N 14 ST BRIDGE	OK	OK	OK	OK	OK	OK	*	Speed- too fast	
6/1/2005	**730**	I-395 NORTH BOUNDRY CHAN	I-395 N BOUNDRY CHANNEL	OK	OK	OK	OK	OK	OK	*		
6/1/2005	**740**	I-395 WEST WASHINGTON BL	WASHINGTON BLVD E-I-395	OK	OK	OK	OK	OK	OK	*		
6/1/2005	**750**	I-395 BOUNDRY CHANNEL DR	I-395 N WASHINGTON BLVD	OK	OK	OK	OK	OK	OK	*	Speed- too fast. Pressure & temp on video. Per Gerry, need to turn Maintenance Mode off.	
6/1/2005	**760**	I-395 NORTH BOUNDRY CHAN	I-395 N WASHINGTON BLVD	OK	OK	OK	OK	OK	OK	*	Speed- too fast	
6/1/2005	**930**	I-395 EASTWASHINGTON BLV	WASHINGTON BLVD EAST - I-395	OK	OK	OK	OK	OK	OK	*	Speed- too slow	
6/1/2005	**1080**	DULLES TOLL RD. EAST - HUNTER MILL	DULLES TOLL RD. E. - HUNTER MILL							*	Inconsistent video- comm problem? Per Gerry, need to replace camera	Camera tested ok in field- does not appear to be a bad camera. Data communications problem still exists- outside scope of task. Felix said he would change the Core Tec to see if that corrects the problem.

IV. System Maintenance Issues

As new CCTV field devices are deployed under this program, it is essential to address the issue of system maintenance to ensure proper operation of the new devices.

Equipment Warranty and Warranty Service

The COHU cameras used in this remediation program are available with either a two (2) or three (3) year factory warranty. VDOT elected to go with the three (3) year warranty.

Warranty service is provided through the COHU regional sales representative, who is responsible for accepting any defective or malfunctioning equipment and relaying that to COHU for repair or replacement.

One excellent strategy is to purchase additional cameras as spares. If a field device experiences problems, that device can be immediately swapped out for one of the spares. This allows the field technician to determine if in fact the camera was the problem, or if the problem was caused by another component of the system. If the camera is found to be the problem, the DOT experiences minimal downtown for that camera location.

The problem camera unit is then sent back to the manufacturer for repair or replacement. By policy, COHU replaces any defective camera unit with a new unit.

Good Maintenance Practices

The COHU cameras installed under this project are essentially maintenance-free. One good practice, however, is to periodically clean the glass domes and apply an anti-rain product such as Rain-X ™. This will keep the rain from accumulating on the dome and improve visibility.

As the COHU cameras require nothing in the way of specialized maintenance, these units can easily be maintained by DOT staff.

V. Summary

The VDOT Northern Virginia Video Quality Improvement Program was commissioned as an effort to troubleshoot an aging CCTV subsystem and provide lessons-learned to other DOTs on the issues that they might encounter under a similar effort with their systems.

The assessment and remediation program identified a variety of issues – some addressed under this program, some reserved for future VDOT study.

Some of the lessons learned include:

- Clearly define the work scope and areas of responsibility
    - Who is responsible for issues that may arise outside of the defined scope of work, i.e. issues with the field comm. network?
    - What defines the "end" of the remediation activity?
    - How is quality improvement defined or measured?
    - Who does final acceptance testing?
    - Who is responsible for addressing any problems within the equipment warranty period?

- Set-up weekly technical progress meetings to discuss unexpected issues that arise during field work.
    - Regular communication can help avoid misunderstandings regarding expectations.

- Determine how old field devices will be returned to the agency and taken out of inventory.
    - Most DOTs have inventory control systems and the old CCTV field devices need to be catalogued as they come in from the field and taken out of inventory.
    - How and when does this hand-over of equipment happen?

- Identify any special equipment needs, such as a 45' bucket truck, to reach higher camera installations.
    - During certain periods of the year, larger bucket trucks are harder to lease, for example, after a major hurricane on the eastern seaboard.