STATE OF VERMONT
AGENCY OF TRANSPORTATION

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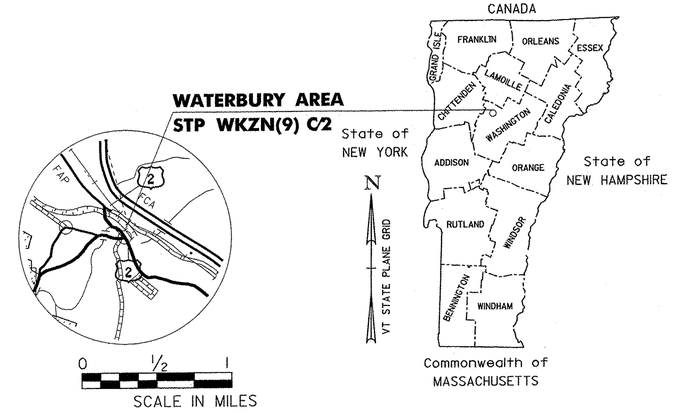
PROPOSED IMPROVEMENT
TOWN OF MORETOWN
COUNTY OF WASHINGTON
US ROUTE 2 & VT ROUTE 100
MINOR ARTERIAL

PROJECT LOCATION: AT THE INTERSECTION OF US-2 AND VT-100 IN THE TOWN OF MORETOWN

PROJECT INFORMATION: THE PROJECT SHALL CONSIST OF THE INSTALLATION OF A TRAFFIC CONTROL SIGNAL SYSTEM AND RELATED IMPROVEMENTS INCLUDING SIGNING AND STRIPING AND A DRIVEWAY RELOCATION.



RECORD PLANS

CONTRACTOR: DON WESTON EXCAVATING,INC. – WILLISTON, VT

RESIDENT ENGINEER: TOM MANCINI

CONSTRUCTION BEGAN: MARCH 16, 2015

CONSTRUCTION COMPLETE: MAY 6, 2015

RECORD PLANS BY: TOM MANCINI & CRAIG PIERCE

I HEREBY CERTIFY THAT ALL THE CONSTRUCTION REQUIRED BY THIS SET OF DRAWINGS HAS BEEN ACCOMPLISHED AS INDICATED HEREIN.

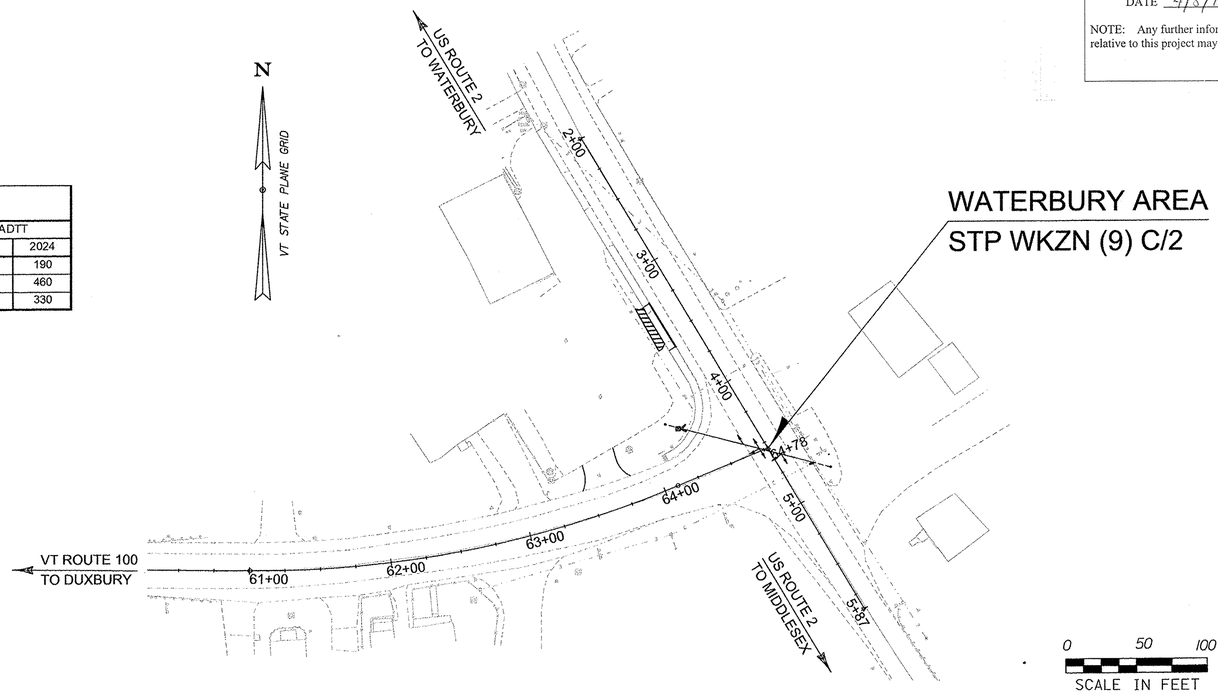
BY _____ RESIDENT ENGINEER

DATE 4/8/16

NOTE: Any further information concerning final quantities, amounts or other details relative to this project may be found at Central Files in the electronic archives.

TRAFFIC DATA: US-2 & VT-100

APPROACH	AADT		DHV		% T		% D		ADTT	
	2014	2024	2014	2024	2014	2024	2014	2024	2014	2024
US-2 EAST	3,800	3,900	430	440	1.3	1.7	50	50	140	190
US-2 WEST	8,600	8,800	960	980	1.1	1.5	54	54	330	460
VT-100 SOUTH	5,800	5,900	660	670	1.0	1.3	56	56	240	330



CONSTRUCTION IS TO BE CARRIED ON IN ACCORDANCE WITH THESE PLANS AND THE STANDARD SPECIFICATIONS FOR CONSTRUCTION DATED 2011, AS APPROVED BY THE FEDERAL HIGHWAY ADMINISTRATION ON JULY 20, 2011 FOR USE ON THIS PROJECT, INCLUDING ALL SUBSEQUENT REVISIONS AND SUCH REVISED SPECIFICATIONS AND SPECIAL PROVISIONS AS ARE INCORPORATED IN THESE PLANS.

QUALITY ASSURANCE PROGRAM : LEVEL 3

SURVEYED BY : VTRANS

SURVEYED DATE : 2014

DATUM

VERTICAL NAVD 88

HORIZONTAL NAD 83 (2011)

DIRECTOR OF PROJECT DELIVERY

APPROVED _____ DATE 10/21/2014

PROJECT MANAGER : PATRICIA COBURN, PE

PROJECT NAME : WATERBURY AREA

PROJECT NUMBER : STP WKZN(9) C/2

SHEET 1 OF 13 SHEETS

GENERAL INFORMATION

SYMBOLOGY LEGEND NOTE

THE SYMBOLOGY ON THIS SHEET IS INTENDED TO COVER STANDARD CONVENTIONAL SYMBOLOGY. THE SYMBOLOGY IS USED FOR EXISTING & PROPOSED FEATURES WITH HEAVIER LINEWEIGHT, IN COMBINATION WITH PROJECT ANNOTATION, AS NOTED ON PROJECT PLAN SHEETS. THIS LEGEND SHEET COVERS THE BASICS. SYMBOLOGY ON PLANS MAY VARY, PLAN ANNOTATIONS AND NOTES SHOULD BE USED TO CLARIFY AS NEEDED.

R.O.W. ABBREVIATIONS (CODES) & SYMBOLS

POINT	CODE	DESCRIPTION
	CH	CHANNEL EASEMENT
	CONST	CONSTRUCTION EASEMENT
	CUL	CULVERT EASEMENT
	D&C	DISCONNECT & CONNECT
	DIT	DITCH EASEMENT
	DR	DRAINAGE EASEMENT
	DRIVE	DRIVEWAY EASEMENT
	EC	EROSION CONTROL
	I&M	INSTALL & MAINTAIN EASEMENT
	LAND	LANDSCAPE EASEMENT
	R&RES	REMOVE & RESET
	R&REP	REMOVE & REPLACE
	SR	SLOPE RIGHT
	UE	UTILITY EASEMENT
	(P)	PERMANENT EASEMENT
	(T)	TEMPORARY EASEMENT
■	BNDNS	BOUND SET
⧈	BNDNS	BOUND TO BE SET
●	IPNS	IRON PIN SET
◎	IPNS	IRON PIN TO BE SET
⊠	CALC	EXISTING ROW POINT
○	PROW	PROPOSED ROW POINT
[LENGTH]		LENGTH CARRIED ON NEXT SHEET

COMMON TOPOGRAPHIC POINT SYMBOLS

POINT	CODE	DESCRIPTION
	APL	BOUND APPARENT LOCATION
	BM	BENCH MARK
	BND	BOUND
	CB	CATCH BASIN
	COMB	COMBINATION POLE
	DITHR	DROP INLET THROATED DNC
	EL	ELECTRIC POWER POLE
	FPOLE	FLAGPOLE
	GASFIL	GAS FILLER
	GP	GUIDE POST
	GSO	GAS SHUT OFF
	GUY	GUY POLE
	GUYW	GUY WIRE
	GV	GATE VALUE
	H	TREE HARDWOOD
	HCTRL	CONTROL HORIZONTAL
	HVCTRL	CONTROL HORIZ. & VERTICAL
	HYD	HYDRANT
	IP	IRON PIN
	IPIPE	IRON PIPE
	LI	LIGHT - STREET OR YARD
	MB	MAILBOX
	MH	MANHOLE (MH)
	MM	MILE MARKER
	PM	PARKING METER
	PMK	PROJECT MARKER
	POST	POST STONE/WOOD
	RRSIG	RAILROAD SIGNAL
	RRSL	RAILROAD SWITCH LEVER
	S	TREE SOFTWOOD
	SAT	SATELLITE DISH
	SHRUB	SHRUB
	SIGN	SIGN
	STUMP	STUMP
	TEL	TELEPHONE POLE
	TIE	TIE
	TSIGN	SIGN W/DOUBLE POST
	VCTRL	CONTROL VERTICAL
	WELL	WELL
	WSO	WATER SHUT OFF

THESE ARE COMMON VAOT SURVEY POINT SYMBOLS FOR EXISTING FEATURES, ALSO USED FOR PROPOSED FEATURES WITH HEAVIER LINEWEIGHT, IN COMBINATION WITH PROPOSED ANNOTATION.

PROPOSED GEOMETRY CODES

CODE	DESCRIPTION
PC	POINT OF CURVATURE
PI	POINT OF INTERSECTION
CC	CENTER OF CURVE
PT	POINT OF TANGENCY
PCC	POINT OF COMPOUND CURVE
PRC	POINT OF REVERSE CURVE
POB	POINT OF BEGINNING
POE	POINT OF ENDING
STA	STATION PREFIX
AH	AHEAD STATION SUFFIX
BK	BACK STATION SUFFIX
D	CURVE DEGREE OF (100FT)
R	CURVE RADUIS OF
T	CURVE TANGENT LENGTH
L	CURVE LENGTH OF
E	CURVE EXTERNAL DISTANCE

UTILITY SYMBOLOGY

UNDERGROUND UTILITIES

- UT — TELEPHONE
- UE — ELECTRIC
- UC — CABLE (TV)
- UEC — ELECTRIC+CABLE
- UET — ELECTRIC+TELEPHONE
- UCT — CABLE+TELEPHONE
- UECT — ELECTRIC+CABLE+TELEP.
- G — GAS LINE
- W — WATER LINE
- S — SANITARY SEWER (SEPTIC)

ABOVE GROUND UTILITIES (AERIAL)

- T — TELEPHONE
- E — ELECTRIC
- C — CABLE (TV)
- EC — ELECTRIC+CABLE
- ET — ELECTRIC+TELEPHONE
- AER E&T — ELECTRIC+TELEPHONE
- CT — CABLE+TELEPHONE
- ECT — ELECTRIC+CABLE+TELEP.
- UTILITY POLE GUY WIRE

PROJECT CONSTRUCTION SYMBOLOGY

PROJECT DESIGN & LAYOUT SYMBOLOGY

- CZ — CLEAR ZONE
- PLAN LAYOUT MATCHLINE

PROJECT CONSTRUCTION FEATURES

- TOP OF CUT SLOPE
- TOE OF FILL SLOPE
- STONE FILL
- BOTTOM OF DITCH L
- CULVERT PROPOSED
- STRUCTURE SUBSURFACE
- PDF — PDF — PROJECT DEMARCATION FENCE
- BF — BF — BARRIER FENCE
- TREE PROTECTION ZONE (TPZ)
- STRIPING LINE REMOVAL
- SHEET PILES

CONVENTIONAL BOUNDARY SYMBOLOGY

BOUNDARY LINES

- TOWN LINE — TOWN BOUNDARY LINE
- COUNTY LINE — COUNTY BOUNDARY LINE
- STATE LINE — STATE BOUNDARY LINE
- PROPOSED STATE L.A.R.O.W.
- PROPOSED STATE R.O.W.
- STATE ROW (LIMITED ACCESS)
- STATE ROW
- TOWN ROW
- PERMANENT EASEMENT LINE (P)
- TEMPORARY EASEMENT LINE (T)
- SURVEY LINE
- P. P. P. — PROPERTY LINE (P/L)
- SR SR SR — SLOPE RIGHTS
- 6f — 6f — 6F PROPERTY BOUNDARY
- 4f — 4f — 4F PROPERTY BOUNDARY
- HAZ — HAZ — HAZARDOUS WASTE

EPSC LAYOUT PLAN SYMBOLOGY

EPSC MEASURES

- FILTER CURTAIN
- SILT FENCE
- SILT FENCE WOVEN WIRE
- CHECK DAM
- DISTURBED AREAS REQUIRING RE-VEGETATION
- EROSION MATTING

ENVIRONMENTAL RESOURCES

- WETLAND BOUNDARY
- RIPARIAN BUFFER ZONE
- WETLAND BUFFER ZONE
- SOIL TYPE BOUNDARY
- THREATENED & ENDANGERED SPECIES
- HAZ — HAZ — HAZARDOUS WASTE AREA
- AG — AGRICULTURAL LAND
- HABITAT — FISH & WILDLIFE HABITAT
- FLOOD PLAIN — FLOOD PLAIN
- OHW — ORDINARY HIGH WATER (OHW)
- STORM WATER
- USDA FOREST SERVICE LANDS
- WILDLIFE HABITAT SUIT/CONN

ARCHEOLOGICAL & HISTORIC

- ARCH — ARCHEOLOGICAL BOUNDARY
- HISTORIC DIST — HISTORIC DISTRICT BOUNDARY
- HISTORIC — HISTORIC AREA
- (H) HISTORIC STRUCTURE

CONVENTIONAL TOPOGRAPHIC SYMBOLOGY

EXISTING FEATURES

- ROAD EDGE PAVEMENT
- ROAD EDGE GRAVEL
- DRIVEWAY EDGE
- DITCH
- FOUNDATION
- FENCE (EXISTING)
- FENCE WOOD POST
- FENCE STEEL POST
- GARDEN
- ROAD GUARDRAIL
- RAILROAD TRACKS
- CULVERT (EXISTING)
- STONE WALL
- WALL
- WOOD LINE
- BRUSH LINE
- HEDGE
- BODY OF WATER EDGE
- LEDGE EXPOSED

PROJECT NAME: WATERBURY
PROJECT NUMBER: NHG SGNL(43)

FILE NAME: t13b018frm.dgn
PROJECT LEADER: P. COBURN
DESIGNED BY: I. DEGUTIS
CONVENTIONAL SYMBOLOGY LEGEND SHEET

PLOT DATE: 12/31/2013
DRAWN BY: I. DEGUTIS
CHECKED BY: M. LaCROIX
SHEET 2 OF 17

STATE OF VERMONT
AGENCY OF TRANSPORTATION
MATERIALS & RESEARCH SECTION
SUBSURFACE INFORMATION

BORING LOG

WATERBURY
NHG SGNL(43)
I-89 & VT-100 EXIT #10

Boring No.: **B-101**
Page No.: 1 of 1
Pin No.: 13B018
Checked By: LAR

Boring Crew: GARROW, SALISBURY, DAIGNEAULT
Date Started: 3/25/13 Date Finished: 3/25/13
VTSPG NAD83: N 672184.97 ft E 1575013.29 ft
Station: 26+44 Offset: -3.00
Ground Elevation: 499.84 ft

	Casing	Sampler
Type:	WB	SS
I.D.:	4 in	1.5 in
Hammer Wt:	N.A.	140 lb.
Hammer Fall:	N.A.	30 in.
Hammer/Rod Type:	Auto/AWJ	
Rig:	CME 55 TRACK	C_e = 1.46

Groundwater Observations

Date	Depth (ft)	Notes
		None Taken.

Depth (ft)	Strata (1)	CLASSIFICATION OF MATERIALS (Description)	Run (Dip deg.)	Core Rec. % (RQD %)	Drill Rate minute/ft	Blows/6" (N Value)	Moisture Content %	Gravel %	Sand %	Fines %
		Asphalt Pavement, 0.0 ft - 1.2 ft								
		A-1-a, SaGr, gry, MTW, Rec. = 5.3 ft				13-22-25-R (47)	5.3	65.6	26.3	8.1
2.5		Field Note:, NXDC, Cleaned out casing								
		A-1-b, SaGr, gry, MTW, Rec. = 1.2 ft, Soft & Pulverized Ledge Cut Fill				11-26-17-16 (43)	11.4	46.0	34.8	19.2
5.0		A-1-b, SiGrSa, gry, MTW, Rec. = 0.7 ft, Soft & Pulverized Ledge Cut Fill				10-R@5.0" (R)	12.3	39.9	40.0	20.1
		Field Note:, NXDC, Cleaned out casing								
7.5		Field Note:, BXMDC, Rec. = 0.3', Soft & Pulverized Ledge Cut Fill								
10.0		Field Note:, NXDC, Cleaned out casing								
12.5		A-1-b, SiSaGr, gry, MTW, Rec. = 0.6 ft, Soft & Pulverized Ledge Cut Fill				38-R@1.0" (R)	9.8	44.8	35.1	20.1
15.0		14.0 ft - 17.0 ft, Laminated dark-gray to black, Carbonaceous to highly graphitic Phyllite, and white quartz. Moderately hard, Unweathered, Fair rock, BXMDC, RMR = 50	1 (70)	80 (77)	5 5 5	Top of Bedrock @ 14.0 ft				
17.5		17.0 ft - 19.0 ft, Laminated dark-gray to black, Carbonaceous to highly graphitic Phyllite, and white quartz. Moderately hard, Unweathered, Fair rock, BXMDC, RMR = 46	2 (70)	100 (70)	4 4					
20.0		Hole stopped @ 19.0 ft								
22.5										

Notes:
1. Stratification lines represent approximate boundary between material types. Transition may be gradual.
2. N Values have not been corrected for hammer energy. C_e is the hammer energy correction factor.
3. Water level readings have been made at times and under conditions stated. Fluctuations may occur due to other factors than those present at the time measurements were made.

BORING LOG 2 WATERBURY NHG SGNL(43).GPJ VERMONT AOT.GDT 4/15/13

STATE OF VERMONT
AGENCY OF TRANSPORTATION
MATERIALS & RESEARCH SECTION
SUBSURFACE INFORMATION

BORING LOG

WATERBURY
NHG SGNL(43)
I-89 & VT-100 EXIT #10

Boring No.: **B-102**
Page No.: 1 of 1
Pin No.: 13B018
Checked By: LAR

Boring Crew: DAIGNEAULT, GARROW, SALISBURY
Date Started: 3/26/13 Date Finished: 3/26/13
VTSPG NAD83: N 672144.29 ft E 1575062.79 ft
Station: 26+80 Offset: 50.00
Ground Elevation: 497.66 ft

	Casing	Sampler
Type:	WB	SS
I.D.:	4 in	1.5 in
Hammer Wt:	N.A.	140 lb.
Hammer Fall:	N.A.	30 in.
Hammer/Rod Type:	Auto/AWJ	
Rig:	CME 55 TRACK	C_e = 1.46

Groundwater Observations

Date	Depth (ft)	Notes
03/27/13	6.8	See Remarks.

Depth (ft)	Strata (1)	CLASSIFICATION OF MATERIALS (Description)	Run (Dip deg.)	Core Rec. % (RQD %)	Drill Rate minute/ft	Blows/6" (N Value)	Moisture Content %	Gravel %	Sand %	Fines %
		A-1-b, SiGrSa, Dk/brn, Moist, Rec. = 1.4 ft				WH-4-7-10 (11)	14.1	32.8	47.0	20.2
2.5		Visual Description:, GrSa with Broken Rock, Dk/gry, Moist, Rec. = 0.3 ft Field Note:, NXDC, Possible Ledge Cut Fill				R@3.5"	8.4			
5.0		4.0 ft - 7.5 ft, Laminated dark-gray to black, Carbonaceous to highly graphitic Phyllite, and white quartz. Moderately hard, Unweathered, Poor rock, BXMDC, Unknown Dip. RMR = 36	1 (?)	11 (0)	2 3 7	Top of Bedrock @ 4.0 ft				
7.5		7.5 ft - 9.5 ft, Laminated dark-gray to black, Carbonaceous to highly graphitic Phyllite, and white quartz. Moderately hard, Unweathered, Poor rock, BXMDC, Unknown Dip. RMR = 36	2 (?)	40 (0)	2 9					
10.0		9.5 ft - 11.1 ft, Laminated dark-gray to black, Carbonaceous to highly graphitic Phyllite, and white quartz. Moderately hard, Unweathered, Fair rock, BXMDC, Unknown Dip. RMR = 46	3 (?)	100 (63)	6 9					
12.5		11.1 ft - 14.0 ft, Laminated dark-gray to black, Carbonaceous to highly graphitic Phyllite, and white quartz. Moderately hard, Unweathered, Fair rock, BXMDC, RMR = 41	4 (45)	90 (31)	2 6					
15.0		14.0 ft - 16.6 ft, Laminated dark-gray to black, Carbonaceous to highly graphitic Phyllite, and white quartz. Moderately hard, Unweathered, Fair rock, BXMDC, RMR = 50	5 (45)	85 (82)	1 9					
17.5		Hole stopped @ 16.6 ft								
20.0		Remarks: Hole collapsed at 6.8 ft.								
22.5										

Notes:
1. Stratification lines represent approximate boundary between material types. Transition may be gradual.
2. N Values have not been corrected for hammer energy. C_e is the hammer energy correction factor.
3. Water level readings have been made at times and under conditions stated. Fluctuations may occur due to other factors than those present at the time measurements were made.

BORING LOG 2 WATERBURY NHG SGNL(43).GPJ VERMONT AOT.GDT 4/15/13

PROJECT NAME: WATERBURY
PROJECT NUMBER: NHG SGNL(43)

FILE NAME: t13b018geo.dgn
PROJECT LEADER: P. COBURN
DESIGNED BY: I. DEGUTIS
BORING DATA SHEET 1

PLOT DATE: 12/31/2013
DRAWN BY: I. DEGUTIS
CHECKED BY: M. LaCROIX
SHEET 3 OF 17

STATE OF VERMONT
AGENCY OF TRANSPORTATION
MATERIALS & RESEARCH SECTION
SUBSURFACE INFORMATION

BORING LOG

WATERBURY
NHG SGNL(43)
I-89 & VT-100 EXIT #10

Boring No.: **B-103**
Page No.: 1 of 1
Pin No.: 13B018
Checked By: LAR

Boring Crew: DAIGNEAULT, GARROW, SALISBURY
Date Started: 3/27/13 Date Finished: 3/27/13
VTSPG NAD83: N 672240.06 ft E 1575065.88 ft
Station: 27+10 Offset: -41.00
Ground Elevation: 497.3 ft

	Casing	Sampler
Type:	WB	SS
I.D.:	4 in	1.5 in
Hammer Wt:	N.A.	140 lb.
Hammer Fall:	N.A.	30 in.
Hammer/Rod Type:	Auto/AWJ	
Rig: CME 55 TRACK		C_e = 1.46

Groundwater Observations

Date	Depth (ft)	Notes
03/27/13	3.1	Casing was pulled.

Depth (ft)	Strata (1)	CLASSIFICATION OF MATERIALS (Description)	Run (Dip deg.)	Core Rec. % (RQD %)	Drill Rate minutes/ft	Blows/6" (N Value)	Moisture Content %	Gravel %	Sand %	Fines %
		A-1-b, SiGrSa, Dk/brn, Moist, Rec. = 0.8 ft				WH-1-2-1 (3)	16.1	33.2	44.6	22.2
2.5		A-2-4, GrSiSa, Dk/brn, Moist, Rec. = 0.4 ft				3-10-R@6.0" (R)	15.1	27.6	42.9	29.5
		A-1-b, SaGr, gry, Moist, Rec. = 0.7 ft, Lab Note: Sample was mostly Broken & Pulverized Rock.					2.4	50.8	32.0	17.2
		Field Note:, NXDC								
5.0		Field Note:, NXDC, Possible Ledge Cut Fill								
7.5		7.0 ft - 9.0 ft, Laminated dark-gray to black, Carbonaceous to highly graphitic Phyllite, and white quartz. Moderately hard, Unweathered, Poor rock, BXMDC, RMR = 36	1 (70)	85 (0)	6 12	Top of Bedrock @ 7.0 ft				
10.0		9.0 ft - 14.0 ft, Laminated dark-gray to black, Carbonaceous to highly graphitic Phyllite, and white quartz. Moderately hard, Unweathered, Poor rock, BXMDC, RMR = 36	2 (70)	38 (0)	6 5 5 6 9					
12.5										
15.0		Hole stopped @ 14.0 ft								
17.5		Remarks: Hole collapsed at 5.4 ft.								
20.0										
22.5										

Notes:
1. Stratification lines represent approximate boundary between material types. Transition may be gradual.
2. N Values have not been corrected for hammer energy. C_e is the hammer energy correction factor.
3. Water level readings have been made at times and under conditions stated. Fluctuations may occur due to other factors than those present at the time measurements were made.

BORING LOG 2 WATERBURY NHG SGNL(43).GPJ VERMONT AOT.GDT 4/15/13

PROJECT NAME: WATERBURY
PROJECT NUMBER: NHG SGNL(43)

FILE NAME: t13b018geo.dgn
PROJECT LEADER: P. COBURN
DESIGNED BY: I. DEGUTIS
BORING DATA SHEET 2

PLOT DATE: 12/31/2013
DRAWN BY: I. DEGUTIS
CHECKED BY: M. LaCROIX
SHEET 4 OF 17

STATE OF VERMONT
AGENCY OF TRANSPORTATION

QUANTITY SHEET

SUMMARY OF ESTIMATED QUANTITIES

ROADWAY	EROSION CONTROL	FULL C.E. ITEMS	GRAND TOTAL	FINAL	UNIT	ITEMS	ITEM NUMBER	ROUND
1			1		CY	TRENCH EXCAVATION OF EARTH, EXPLORATORY (N.A.B.I.)	204.22	-
80			80		HR	UNIFORMED TRAFFIC OFFICERS	630.10	EST.
240			240		HR	FLAGGERS	630.15	EST.
		1	1		LS	TESTING EQUIPMENT, CONCRETE	631.16	-
1			1		LS	MOBILIZATION/DEMOBILIZATION	635.11	-
1			1		LS	TRAFFIC CONTROL	641.10	
500			500		LF	DURABLE 4 INCH WHITE LINE, POLYUREA	646.404	19
110			110		LF	DURABLE 24 INCH STOP BAR, POLYUREA	646.484	2
39			39		EACH	DURABLE LETTER OR SYMBOL, POLYUREA	646.494	-
1150			1150		SF	REMOVAL OF EXISTING PAVEMENT MARKINGS	646.85	4
	5		5		LB	SEED	651.15	EST.
	0.3		0.3		TON	HAY MULCH	651.25	EST.
	10		10		CY	TOPSOIL	651.35	EST.
14			14		SF	TRAFFIC SIGNS, TYPE A	675.20	-
75			75		LF	SQUARE TUBE SIGN POST AND ANCHOR	675.341	EST.
23			23		EACH	REMOVING SIGNS	675.50	-
20			20		EACH	ERECTING SALVAGED SIGNS	675.60	-
3			3		EACH	SETTING SALVAGED POSTS	675.61	-
1			1		EACH	TRAFFIC CONTROL SIGNAL SYSTEM, INTERSECTION (VT 100 @ I-89 EXIT 10 NB OFF-RAMP)	678.15	-
1			1		EACH	TRAFFIC CONTROL SIGNAL SYSTEM, INTERSECTION (VT 100 @ I-89 EXIT 10 SB OFF-RAMP)	678.15	-
1330			1330		LF	WIRED CONDUIT (2")(PVC)(SCH. 80)	678.23	17
3			3		EACH	PULL BOX, STANDARD	678.25	-
1			1		EACH	JUNCTION BOX	678.26	-
2			2		EACH	BRACKET ARM	679.47	-
2			2		EACH	SPECIAL PROVISION (LUMINAIRE, LED)	900.620	-
1			1		EACH	SPECIAL PROVISION (REMOVE EXISTING LIGHT POLE)	900.620	-
4			4		EACH	SPECIAL PROVISION (SOIL BEARING SLIP BASE)(2 1/2")	900.620	-
75			75		LF	SPECIAL PROVISION (HORIZONTAL DIRECTIONAL DRILLING)(12" CASING PIPE)	900.640	
1			1		LS	SPECIAL PROVISION (RETIMING OF SIGNAL CORRIDOR)	900.645	-

DETAILED SUMMARY OF QUANTITIES

QUANTITIES	UNIT	ITEMS

PROJECT NAME: WATERBURY
PROJECT NUMBER: NHG SGNL(43)

FILE NAME: t13b018frm.dgn
PROJECT LEADER: P. COBURN
DESIGNED BY: I. DEGUTIS
QUANTITY SHEET

PLOT DATE: 12/31/2013
DRAWN BY: I. DEGUTIS
CHECKED BY: M. LaCROIX
SHEET 5 OF 17

ALIGNMENT: VT ROUTE 100				
ELEMENT	POINT	STATION	NORTHING	EASTING
LINEAR	POB	24+00.00	672113.2110	1574780.0622
CURVE #1	PC	30+60.06	672299.5521	1575413.2742
	PI	33+55.70	672383.0147	1576596.8913
	PT	36+27.45	672628.5168	1575861.6135
LINEAR	POE	37+43.32	672724.7379	1575926.1740

ALIGNMENT: I-89 NB OFF RAMP (RAMP B)				
ELEMENT	POINT	STATION	NORTHING	EASTING
LINEAR	POB	111+00.0	671793.0777	1575207.3563
LINEAR	POE	115+28.02	672207.2760	1575101.4406

CURVE #1 DATA:	
RADIUS:	818'
Δ:	39° 44' 30.83"
Dc:	7° 00' 15.75" LT.
LENGTH:	567.39'
TANGENT:	295.64'
EXTERNAL:	51.79'

TRAFFIC SIGN, TYPE A
SEE TRAFFIC SIGN SUMMARY SHEET

SQUARE TUBE SIGN POST AND ANCHOR
SEE TRAFFIC SIGN SUMMARY SHEET

REMOVING SIGNS
23 EA. - AS SHOWN

ERECTING SALVAGED SIGNS
20 EA. - AS SHOWN

SETTING SALVAGED POSTS
3 EA. - AS SHOWN

SPECIAL PROVISION (SOIL BEARING SLIP BASE)(2½")
STA. 30+26 LT (2 EA.)
STA. 31+70 LT (2 EA.)

RET: STA 27+48 LT

N: STA 27+55 LT

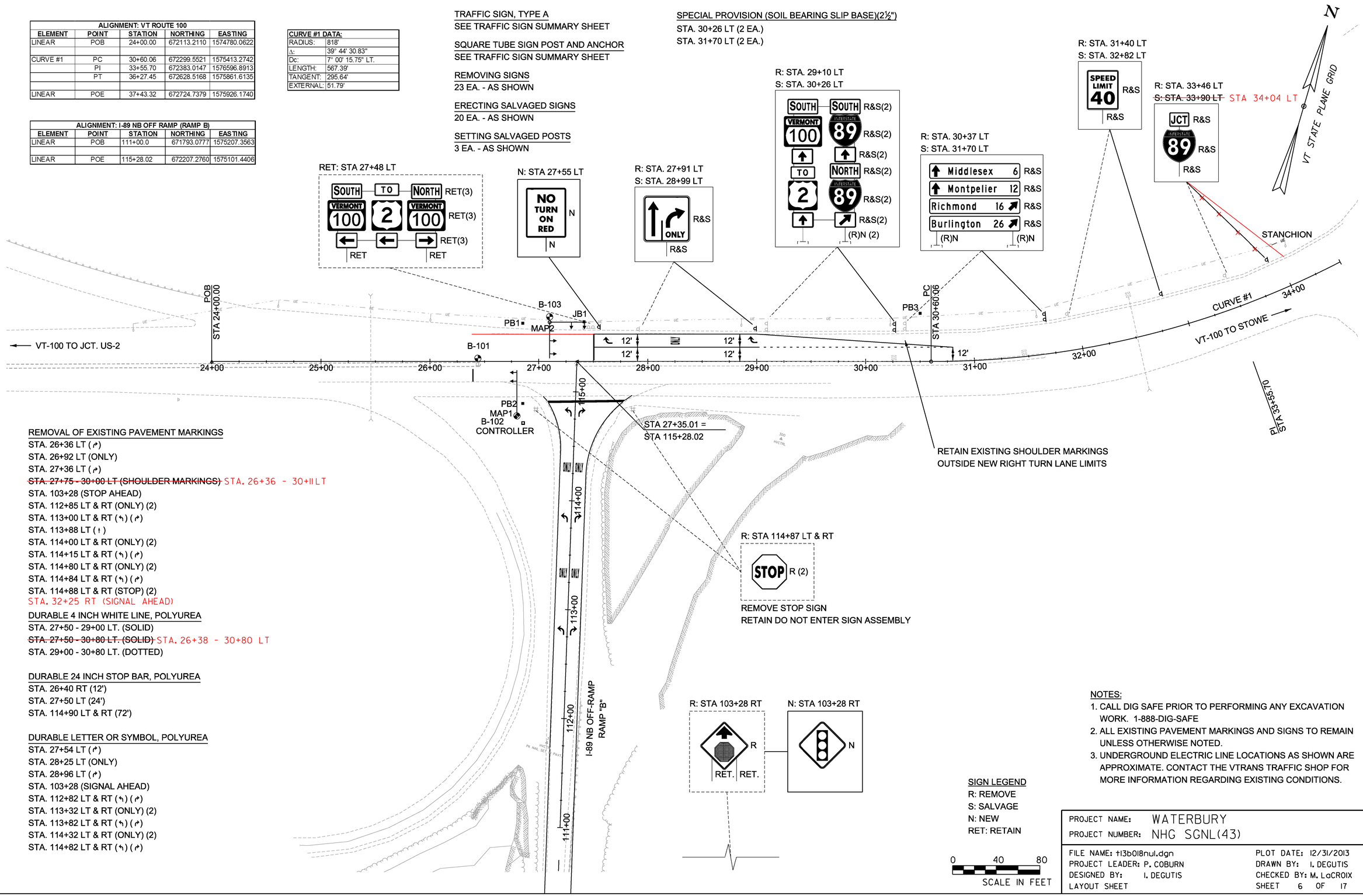
R: STA. 27+91 LT
S: STA. 28+99 LT

R: STA. 29+10 LT
S: STA. 30+26 LT

R: STA. 30+37 LT
S: STA. 31+70 LT

R: STA. 31+40 LT
S: STA. 32+82 LT

R: STA. 33+46 LT
~~S: STA. 33+90 LT~~ STA 34+04 LT



REMOVAL OF EXISTING PAVEMENT MARKINGS
STA. 26+36 LT (↱)
STA. 26+92 LT (ONLY)
STA. 27+36 LT (↱)
~~STA. 27+75 - 30+00 LT (SHOULDER MARKINGS)~~ STA. 26+36 - 30+11 LT
STA. 103+28 (STOP AHEAD)
STA. 112+85 LT & RT (ONLY) (2)
STA. 113+00 LT & RT (↰) (↱)
STA. 113+88 LT (↑)
STA. 114+00 LT & RT (ONLY) (2)
STA. 114+15 LT & RT (↰) (↱)
STA. 114+80 LT & RT (ONLY) (2)
STA. 114+84 LT & RT (↰) (↱)
STA. 114+88 LT & RT (STOP) (2)
STA. 32+25 RT (SIGNAL AHEAD)

DURABLE 4 INCH WHITE LINE, POLYUREA
STA. 27+50 - 29+00 LT. (SOLID)
~~STA. 27+50 - 30+80 LT. (SOLID)~~ STA. 26+38 - 30+80 LT
STA. 29+00 - 30+80 LT. (DOTTED)

DURABLE 24 INCH STOP BAR, POLYUREA
STA. 26+40 RT (12')
STA. 27+50 LT (24')
STA. 114+90 LT & RT (72')

DURABLE LETTER OR SYMBOL, POLYUREA
STA. 27+54 LT (↱)
STA. 28+25 LT (ONLY)
STA. 28+96 LT (↱)
STA. 103+28 (SIGNAL AHEAD)
STA. 112+82 LT & RT (↰) (↱)
STA. 113+32 LT & RT (ONLY) (2)
STA. 113+82 LT & RT (↰) (↱)
STA. 114+32 LT & RT (ONLY) (2)
STA. 114+82 LT & RT (↰) (↱)

SIGN LEGEND
R: REMOVE
S: SALVAGE
N: NEW
RET: RETAIN

0 40 80
SCALE IN FEET

NOTES:
1. CALL DIG SAFE PRIOR TO PERFORMING ANY EXCAVATION WORK. 1-888-DIG-SAFE
2. ALL EXISTING PAVEMENT MARKINGS AND SIGNS TO REMAIN UNLESS OTHERWISE NOTED.
3. UNDERGROUND ELECTRIC LINE LOCATIONS AS SHOWN ARE APPROXIMATE. CONTACT THE VTRANS TRAFFIC SHOP FOR MORE INFORMATION REGARDING EXISTING CONDITIONS.

PROJECT NAME: WATERBURY
PROJECT NUMBER: NHG SGNL(43)

FILE NAME: t13b018nul.dgn
PROJECT LEADER: P. COBURN
DESIGNED BY: I. DEGUTIS
LAYOUT SHEET

PLOT DATE: 12/31/2013
DRAWN BY: I. DEGUTIS
CHECKED BY: M. LaCROIX
SHEET 6 OF 17

STATE OF VERMONT
AGENCY OF TRANSPORTATION

TRAFFIC SIGN SUMMARY SHEET

MILEMARKER, STATION, OR SIGN NUMBER	SIGN LEGEND	SIGN DIMENSIONS			NEW & SALVAGED SIGNS				EXIST POST		NEW SIGN POSTS																		SIGN DETAIL	
		EA	WIDTH (in)	HEIGHT (in)	"A"	"B"	SALV SIGN	SALV TIS	RETAIN	SALVAGE	NO. OF POSTS	FLANGED CHANNEL lb/ft			SQUARE STEEL (in) lb/ft			ANCHOR	SLEEVE	TUBULAR ALUMINUM Ø (in) lb/ft			FOUNDATION	TUBULAR STEEL Ø (in) lb/ft				W-SHAPE STEEL FTG. SIZE		WEIGHT	POST SIZE	SIGN FRAME REQUIRED	REMARKS	DETAIL ON SHEET NUMBER	STD. SHEET NUMBER
															2.0	2.0	2.5			3.0	4.0	4.0 MOD		3.0	3.5	4.0	5.0	24"	30"						
												1.12	2.0	3.0	2.16	2.42	3.35			1.3	1.7	1.7		7.6	9.0	10.8	14.6								
	OPTION ITEMS																																		
27+55, LT	NO TURN ON RED	1	24	30	5.00						1					X		X															R10-11a	SHSM	
28+99, LT	ONLY	1					1			X	1																								
30+26, LT	SOUTH VERMONT 100 / SOUTH INTERSTATE 89 / TO 2 / NORTH INTERSTATE 89	2 2 2 2 2 2					2 2 2 2 2 2				2						X															X	SOIL BEARING SLIP BASES REQUIRED FOR POSTS		
31+70, LT	Middlesex 6 Montpelier 12 Richmond 16 Burlington 26	1 1 1 1					1 1 1 1				2						X															X	SOIL BEARING SLIP BASES REQUIRED FOR POSTS		
32+82, LT	SPEED LIMIT 40	1					1			X	1																								
~~33+90, LT~~ 34+04 LT	JCT INTERSTATE 89	1 1					1 1			X	1																								
103+28, RT		1	36	36	9.00				X		2																						W3-3 INSTALL NEW SIGN ON EXISTING POSTS	SHSM	
SHEET TOTALS		SF 14.00	SF	EA 20	SF							FT	FT	FT	FT	FT 15	FT ~~75~~ 60		EA	LB	LB	LB		LB	LB	LB	LB	EA	EA	LB					

SHSM = 2004 FHWA STANDARD HIGHWAY SIGNS & MARKINGS/2012 SUPP.
FYG = FLUORESCENT YELLOW GREEN

FINAL POST LENGTHS ARE TO BE DETERMINED IN THE FIELD. POST SIZES ARE COMPUTED BASED ON INFORMATION FURNISHED ON THE STANDARD SHEETS AND THE VTRANS "SIGN POST DESIGN GUIDELINE."

PROJECT NAME: WATERBURY
PROJECT NUMBER: NHG SGNL(43)

FILE NAME: t13b018striping signs.dgn
PROJECT LEADER: P. COBURN
DESIGNED BY: I. DEGUTIS
TRAFFIC SIGN SUMMARY SHEET

PLOT DATE: 12/31/2013
DRAWN BY: I. DEGUTIS
CHECKED BY: M. LaCROIX
SHEET 7 OF 17

LIST OF MAJOR EQUIPMENT

EQUIPMENT ITEM 678.15 (MS-636: VT 100 & I-89 EXIT 10 SB OFF-RAMP)	QUANTITY
ECONOLITE ASC/3-2100 TRAFFIC SIGNAL CONTROLLER (NEMA TS2) AND POWER SUPPLY	1
DIRECTIONAL WIRELESS INTERCONNECT ANTENNA	1
WIRELESS INTERCONNECT PROCESSOR CARD	1

NOTES:

1. ALL MAST ARMS, SIGNAL HEADS, VIDEO DETECTION CAMERAS AND OTHER POLE-MOUNTED EQUIPMENT TO REMAIN IN PLACE AND SHALL BE MADE TO FUNCTION PROPERLY WITH THE NEW CONTROLLER.
2. VIDEO PROCESSOR CARDS AND ALL OTHER NECESSARY EQUIPMENT TO REMAIN IN THE CABINET AND SHALL BE MADE TO FUNCTION WITH THE NEW CONTROLLER.
3. ALL CONNECTORS, WIRING, AND OTHER INCIDENTAL MATERIALS AND LABOR REQUIRED TO MAKE THE CONTROLLER FUNCTION WITH THE EXISTING CABINET AND SIGNAL EQUIPMENT SHALL BE INCIDENTAL TO ITEM 678.15 (MS-636: VT 100 & I-89 EXIT 10 SB OFF-RAMP)
4. CONTROLLER AND ALL OTHER SALVAGEABLE EQUIPMENT NOT TO BE REUSED TO REMAIN THE PROPERTY OF THE STATE. SEE SPECIAL PROVISIONS FOR ADDITIONAL INFORMATION AND REQUIREMENTS. CONTACT STEVE GUYETTE, OF VTRANS DISTRICT 5: 802-655-1580
5. SEE CORRIDOR COORDINATION SHEET FOR CONTROLLER TIMING DATA.

REMOVAL OF EXISTING PAVEMENT MARKINGS
RAMP "G" - (STOP)

	AM	OFF	PM
	162	200	293

AM	OFF	PM	
263	354	566	→
131	111	162	↘

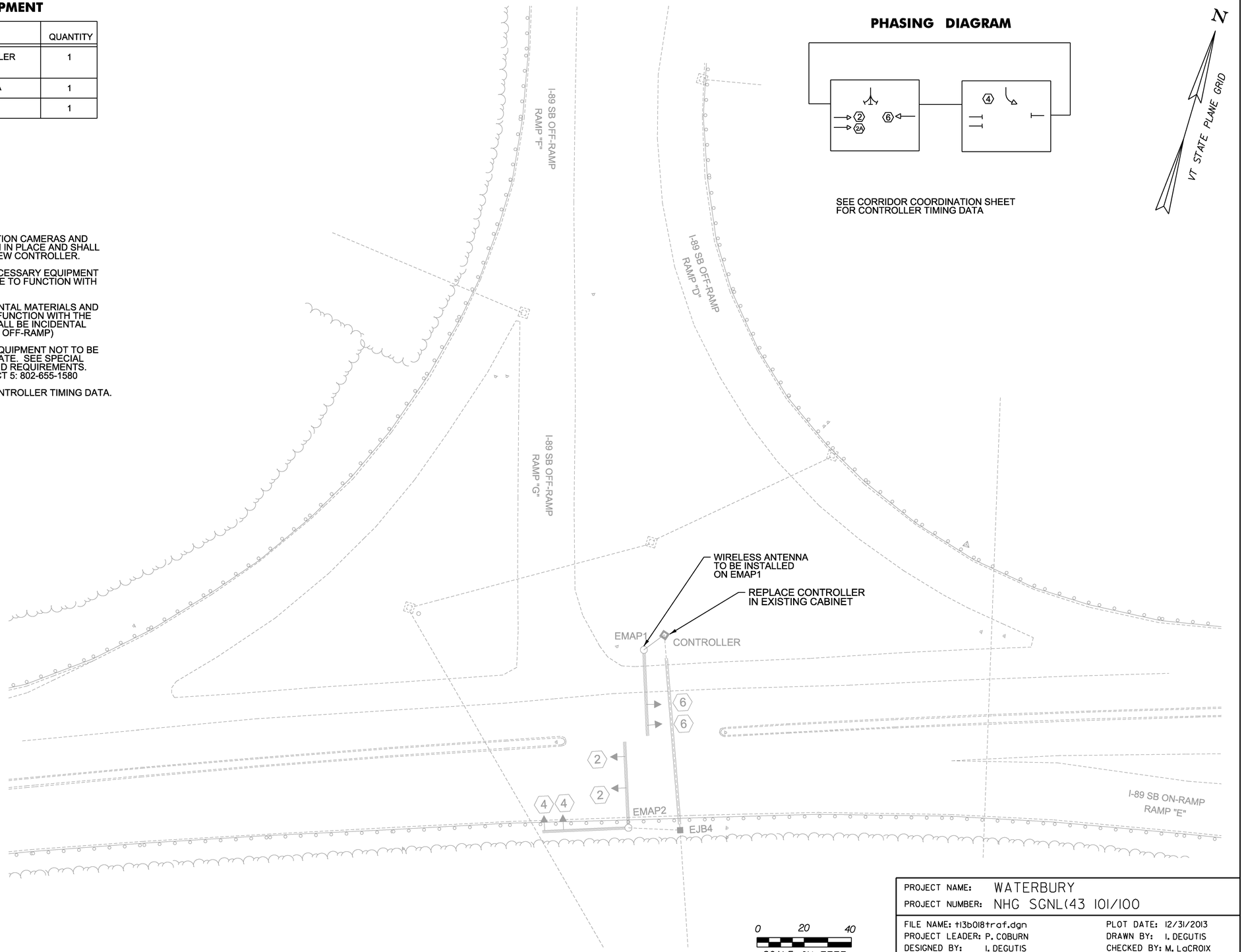
	AM	OFF	PM
←	263	354	475

VT ROUTE 100 &
I-89 SB EXIT 10 OFF RAMP
2014 DESIGN HOURLY VOLUMES

EXISTING	NEW	LEGEND
		UTILITY POLE
		LUMINAIRE
		LIGHT OR WOOD POLE
		STRAIN POLE
		CONTROLLER CABINET
		PULLBOX/JUNCTION BOX
		SIGNAL HEAD
EX		CONDUIT
		VIDEO DETECTION CAMERA
		VIDEO DETECTION ZONE
		STANCHION
		PREEMPTION STROBE
		OPTICAL PREEMPTION DETECTOR

PHASING DIAGRAM

SEE CORRIDOR COORDINATION SHEET
FOR CONTROLLER TIMING DATA



0 20 40
SCALE IN FEET

PROJECT NAME:	WATERBURY
PROJECT NUMBER:	NHG SGNL(43 101/100

FILE NAME: t13b018traf.dgn	PLOT DATE: 12/31/2013
PROJECT LEADER: P. COBURN	DRAWN BY: I. DEGUTIS
DESIGNED BY: I. DEGUTIS	CHECKED BY: M. LaCROIX
TRAFFIC SIGNAL LAYOUT SHEET SB RAMP	SHEET 8 OF 17

TRAFFIC CONTROL SIGNAL SYSTEM, INTERSECTION
(MS 637: VT 100 & I-89 NB OFF-RAMP)

MAST ARM POLE
STA 26+80, 50' RT
STA 27+10, 36' LT

CABINET/CONTROLLER
~~STA 26+86, 56' RT~~ STA 26+88, 57' RT

POWER STANCHION
~~STA 34+04, 43' LT~~ STA 34+01, 43' LT

PULL BOX, STANDARD
~~STA 26+85, 35' LT~~ STA 26+86 LT, 35' LT
~~STA 26+85, 39' RT~~ STA 26+64 RT, 46' RT
~~STA 30+50, 44' LT~~ STA 30+47 LT, 44' LT

JUNCTION BOX
STA 27+41, 36' LT

BRACKET ARM
STA 26+80 - 16' (SL1)
STA 27+10 - 12' (SL2)

SPECIAL PROVISION (LUMINAIRE, LED)
STA 26+80 (MAP1)
STA 27+10 (MAP2)

SPECIAL PROVISION (REMOVE EXISTING LIGHT POLE)
STA 27+41, 36' LT

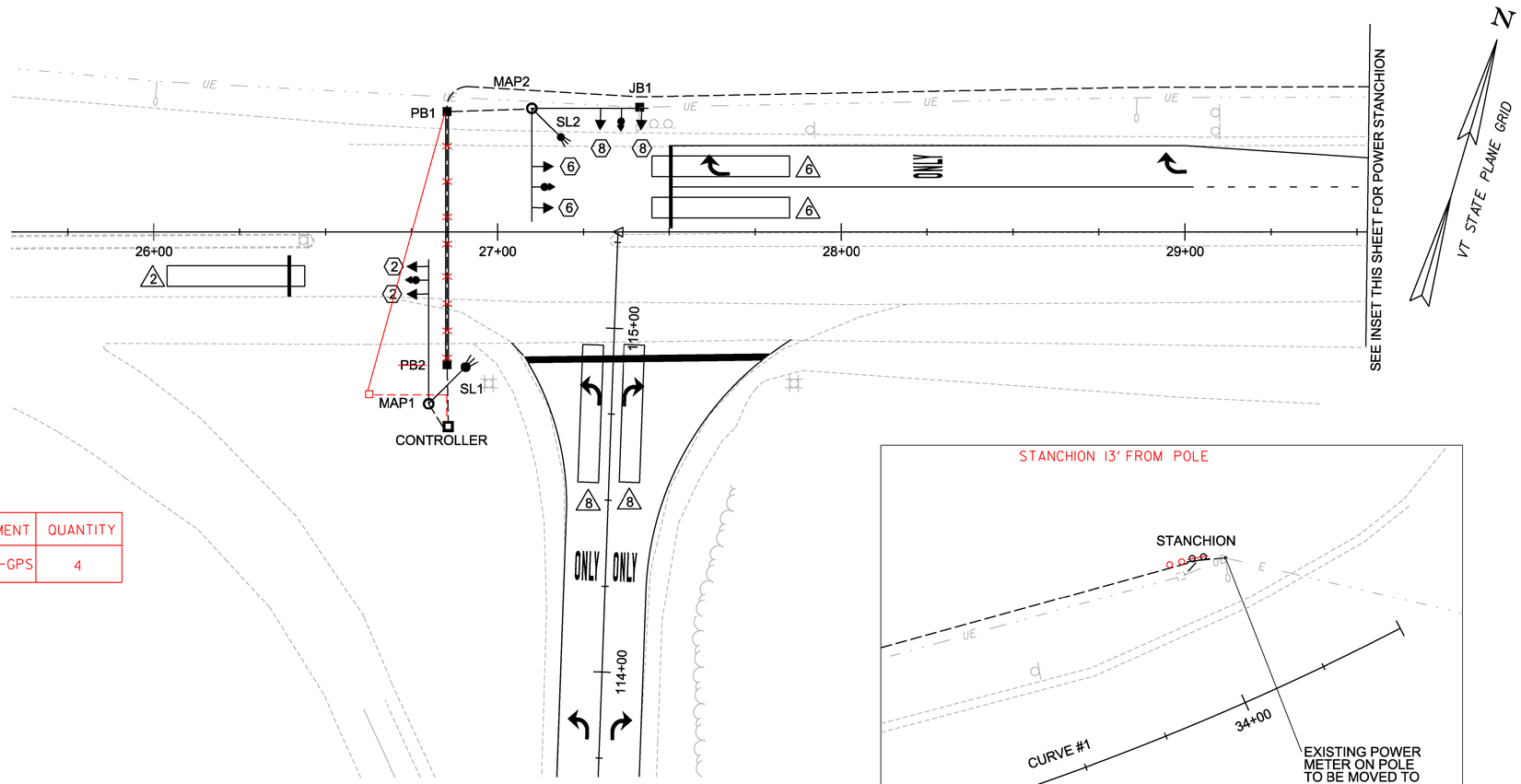
SPECIAL PROVISION (HORIZONTAL DIRECTIONAL DRILLING) (12" CASING PIPE)
~~STA 26+85 LT - STA 26+85 RT~~ STA 26+86 LT - 26+64 RT

LIST OF MAJOR EQUIPMENT

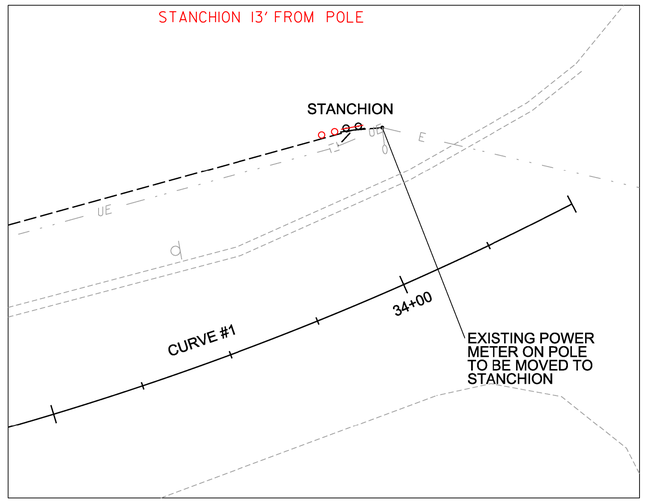
EQUIPMENT ITEM 678.15 (MS-637: VT 100 & I-89 EXIT 10 NB OFF-RAMP)	QUANTITY
POWER METER ON STANCHION	1
FOUR-BAY BREAKER PANEL ON STANCHION	1
ECONOLITE ASC/3-2100 TRAFFIC SIGNAL CONTROLLER (NEMA TS2)	1
NEMA "P44" BASE MOUNTED CONTROLLER CABINET WITH 15-INCH EXTENDED BASE ON A CONCRETE FOUNDATION, PAINTED FLAT BLACK WITH ANCILLARY CONTROL EQUIPMENT	1
FLAT BLACK PAINTED STEEL MAST ARM SIGNAL POLE WITH 42 FOOT MAST ARM (MAP1)	1
FLAT BLACK PAINTED STEEL MAST ARM SIGNAL POLE WITH 34 FOOT MAST ARM AND 31 FOOT MAST ARM (MAP2)	1
ONE WAY, 3-SECTION, 12-INCH POLYCARBONATE MAST ARM MOUNTED LED TRAFFIC SIGNAL HEAD WITH TUNNEL VISORS AND 5" LOUVERED BACKPLATES WITH ALL PIECES PAINTED FLAT BLACK	6
ASTRO-BRACKETS	6
BI-DIRECTIONAL WIRELESS INTERCONNECT ANTENNA	1
WIRELESS INTERCONNECT PROCESSOR CARD	1
CAMERA EXTENSION BRACKET	3
CAMERA ASSEMBLY	3
VIDEO DETECTION PROCESSOR CARD	3

ADDITIONAL EQUIPMENT	QUANTITY
ELTECH TIMESYNC I-GPS	4

EXISTING	NEW	LEGEND
		UTILITY POLE
		LUMINAIRE
		LIGHT OR WOOD POLE
		STRAIN POLE
		CONTROLLER CABINET
		PULLBOX/JUNCTION BOX
		SIGNAL HEAD
		CONDUIT
		VIDEO DETECTION CAMERA
		VIDEO DETECTION ZONE
		STANCHION
		PREEMPTION STROBE
		OPTICAL PREEMPTION DETECTOR



SEE CORRIDOR COORDINATION SHEET
FOR CONTROLLER TIMING DATA

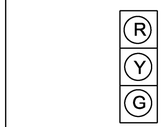


INSET: POWER DROP DETAILS AT BLUSH HILL ROAD INTERSECTION

678.23 - WIRED CONDUIT	CONDUIT SIZE 2"	CONDUIT SIZE 4"	DESCRIPTION
POWER TO STANCHION	22'		*POWER
STANCHION TO EPB1	16'		**POWER
STANCHION TO PB3	345'		POWER
PB3 TO PB1	376'		POWER
PB1 TO PB2	80'		POWER
PB2 TO CONTROLLER	24'		POWER
CONTROLLER TO MAP1	15'		SIGNAL/LIGHTING
CONTROLLER TO MAP1	15'		VIDEO
CONTROLLER TO MAP1	15'		FUTURE USE
CONTROLLER TO PB2	24'		SIGNAL/LIGHTING
CONTROLLER TO PB2	24'		VIDEO
CONTROLLER TO PB2	24'		FUTURE USE
PB2 TO PB1	80'		SIGNAL/LIGHTING
PB2 TO PB1	80'		VIDEO
PB2 TO PB1	80'		FUTURE USE
PB1 TO MAP2	31'		SIGNAL/LIGHTING
PB1 TO MAP2	31'		VIDEO
PB1 TO MAP2	31'		FUTURE USE
SUBTOTALS	1313'		
ROUNDING	17'		
TOTALS	~~1330'~~	1475.75	

* CONDUIT QUANTITY INCLUDES PVC RUN ON UTILITY POLE #1
** FOR EXISTING STREET LIGHTING

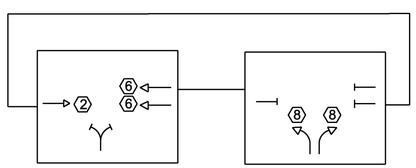
SIGNAL FACE ARRANGEMENT
LENS DIAMETER 12"



FACES 2,6,8

ALL HEADS TO BE LED'S

PHASING DIAGRAM



AM	OFF	PM
495	601	697

	AM	OFF	PM
	202	212	253
	525	495	606

	AM	OFF	PM
	86	101	111
	202	202	273

VT ROUTE 100 &
I-89 NB EXIT 10 OFF RAMP
2013 DESIGN HOURLY
VOLUMES

PROJECT NAME: WATERBURY
PROJECT NUMBER: NHG SGNL(43 101/100

FILE NAME: t13b018traf.dgn
PROJECT LEADER: P. COBURN
DESIGNED BY: I. DEGUTIS
TRAFFIC SIGNAL LAYOUT SHEET NB RAMP

PLOT DATE: 12/31/2013
DRAWN BY: I. DEGUTIS
CHECKED BY: M. LaCROIX
SHEET 9 OF 17

TRAFFIC SIGNAL NOTES

A. NEW SIGNAL EQUIPMENT

1. ALL SIGNAL HEADS SHALL BE 12" POLYCARBONATE. THE SIGNAL HEADS SHALL HAVE FLAT BLACK HOUSINGS AND VISORS.
2. ALL SIGNAL HEADS SHALL HAVE BLACK LOUVERED BACK PLATES.
3. THE TRAFFIC SIGNAL CONTROLLER AND RELATED EQUIPMENT SHALL BE AN ECONOLITE ASC/3-2100 (NEMA TS2) IN A NEMA P44 TRAFFIC CONTROL CABINET WITH 15" BASE EXTENSION INSTALLED AT THE LOCATION SHOWN ON PLANS. THE CONCRETE BASE FOR THE CONTROLLER CABINET SHALL HAVE A 18" X 12" OPENING FOR TRAFFIC SIGNAL CONDUIT LOCATED IN THE CENTER. THE OPENING SHALL BE FILLED WITH STONE AND UNUSED CONDUIT PLUGGED WITH STEEL WOOL BEFORE PLUG SEAL IS INSTALLED. TRAFFIC CONTROL CABINET SHALL BE ORIENTED SO THAT THE DOOR DOES NOT FACE THE ROADWAY.
4. ALL SIGNAL HEADS SHALL HAVE RED, YELLOW AND GREEN LED SIGNALS WITH A VISIBLE BEAM SPREAD OF 80 DEGREES OFF AXIS.
5. ALL SIGNAL EQUIPMENT SHALL BE PAINTED FLAT BLACK IN ACCORDANCE WITH THE SPECIAL PROVISIONS.
6. ALL SIGNAL EQUIPMENT AND MAST ARM SIGNS SHALL HAVE SAFETY CABLES.
7. A BYPASS SWITCH WILL BE REQUIRED ON THE METER SOCKET TO ALLOW FOR MAINTENANCE ON THE METER.
8. A DISCONNECT BREAKER FOR EACH CIRCUIT SHALL BE INSTALLED IN A RAINPROOF (NEMA 3R), LOCKED CABINET ON A STANCHION NEXT TO OR BELOW THE METER SOCKET. A SECONDARY DISCONNECT SHALL BE INSTALLED ON THE CONTROLLER CABINET FOR MAINTENANCE PURPOSES.

B. SIGNAL OPERATION

1. SWITCH-OVER TO NEW SIGNAL SYSTEM SHALL NOT BE DONE DURING PEAK TRAFFIC PERIODS. UNIFORMED TRAFFIC OFFICERS SHALL CONTROL TRAFFIC DURING SWITCH-OVER.
2. ALL SIGNALS SHALL DWELL ON THE VT 100 THRU MOVEMENT.
3. THE VT 100 THRU PHASE SHALL BE USED FOR THE START-UP PHASE FOLLOWING FLASHING OPERATION.
4. SIGNAL TIMING SHOWN ON THE PLANS MAY REQUIRE FINE-TUNING IN THE FIELD BASED ON TRAFFIC OBSERVATION AND/OR ADDITIONAL FIELD STUDIES. ADJUSTMENTS REQUESTED BY THE ENGINEER SHALL BE MADE WITHIN A 48 HOUR PERIOD AND PAYMENT SHALL BE INCIDENTAL TO ITEM 678.15. SIGNAL TIMING CHANGES INVOLVING THE EXISTING COORDINATED TRAFFIC SIGNALS SHALL BE MADE IN COLLABORATION WITH THE TRAFFIC DESIGN SECTION COORDINATED THROUGH THE ENGINEER.

C. PULLBOXES AND JUNCTION BOXES

1. PULLBOXES AND JUNCTION BOXES ARE DETAILED ON STANDARD E-173. MINIMUM JUNCTION BOX SIZE SHALL BE 18" x 12" x 12", OR LARGER AS REQUIRED BY THE ELECTRICAL CODE.
2. THE LOGO ON PULLBOXES AND JUNCTION BOXES SHALL BE "TRAFFIC SIGNAL" EXCEPT THE LOGO ON THE THE JUNCTION BOX AT STA 27+41 SHALL BE "STREET LIGHTING".
3. ALL PULLBOXES / JUNCTION BOXES SHALL BE INSTALLED IN ACCORDANCE WITH SECTION 678.

D. TRAFFIC SIGNAL CONDUIT

1. ALL TRAFFIC SIGNAL WIRED CONDUIT SHALL BE 2-INCH SCHEDULE 80 PVC.
2. WHEN CONDUIT IS PLACED BELOW THE ROADWAY OR ACROSS SIDE ROADS, IT SHALL BE PLACED IN A STEEL SLEEVE, SIZE AS SHOWN ON THE PLANS.
3. TRAFFIC SIGNAL WIRED CONDUIT SHALL ENTER THE CONTROLLER CABINET THROUGH THE OPENING IN THE CONCRETE BASE, CONDUIT SHALL NOT BE CAST IN CONCRETE.
4. ALL TRAFFIC SIGNAL CONDUIT WORK SHALL BE PERFORMED IN ACCORDANCE WITH SECTION 678.

E. VIDEO DETECTION CAMERAS

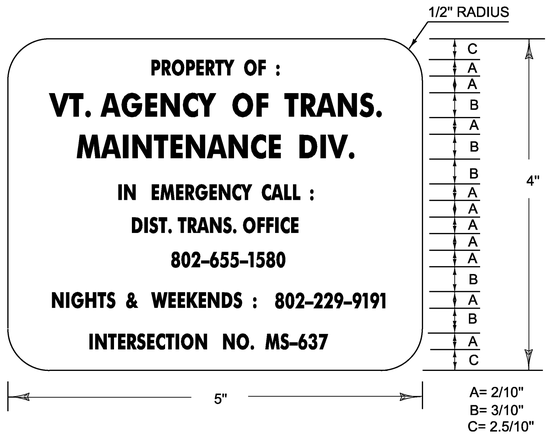
1. VIDEO VEHICLE DETECTORS SHALL BE PLACED SO THAT OCCLUSION IS MINIMIZED AND PHASING IS NOT AFFECTED.
2. VIDEO VEHICLE DETECTION AREAS SHALL EXTEND 5 FT PAST THE STOP BAR.
3. VIDEO VEHICLE DETECTION SYSTEM SHALL BE ECONOLITE AUTOSCOPE ENCORE OR ITERIS VERSICAM OR TRAFICON VIP SERIES.
4. VIDEO VEHICLE DETECTORS SHALL BE WIRED WITHOUT ANY SPLICES FROM THE CAMERA TO THE CONTROLLER.

F. MAST ARM FOUNDATIONS

1. SEE THE CONTRACT DOCUMENTS FOR THE GEOTECHNICAL ANALYSIS.

G. GENERAL

1. TRAFFIC SIGNAL HEADS SHALL BE SECURELY COVERED UNTIL THEY ARE FULLY OPERATIONAL.
2. THE CONTRACTOR SHALL ACQUIRE ALL THE NECESSARY PERMITS AND MAKE ALL NECESSARY ARRANGEMENTS WITH THE UTILITY COMPANY TO PROVIDE A PERMANENT POWER SUPPLY TO THE TRAFFIC SIGNAL EQUIPMENT, IF APPLICABLE. THE ROUTING OF POWER TO THE INTERSECTION SHALL BE SUCH THAT THE STATE HAS FULL RESPONSIBILITY FROM THE TRANSFORMER THROUGH THE SIGNAL. NO INTERVENING OWNERSHIP/ RESPONSIBILITY SHALL BE ALLOWED.
3. ALL ELECTRICAL WORK INCLUDING WIRING SHALL BE DONE BY A LICENSED ELECTRICIAN AND OVERSEEN BY A MASTER ELECTRICIAN.



CONTROLLER PLAQUE DETAIL

NOT TO SCALE

LEGEND: - BLACK (NON-REFL.) - STAMPED PRIOR TO PAINTING

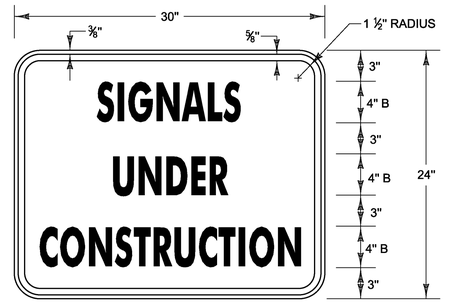
BACKGROUND: NATURAL ALUMINUM OR BRASS SURFACE

NOTES:

1.) THE PLAQUE SHALL BE MOUNTED ON ALL TRAFFIC SIGNAL CONTROLLER CABINETS. IT SHALL BE FASTENED TO THE CONTROLLER CABINET IN SUCH A MANNER AS TO BE NOT EASILY REMOVED, SUCH AS WELDED, RIVETED OR BOLTED WITH VANDAL PROOF BOLTS.

2.) THE LETTERS SHALL BE PUNCHED OR STAMPED, SUCH STAMPING SHALL PENETRATE AT LEAST 1/2 THE BASE MATERIAL THICKNESS.

3.) THE BASE MATERIAL FOR THE PLAQUE SHALL BE BRASS OR ALUMINUM WITH A MINIMUM THICKNESS OF 0.100 INCHES.



MATERIALS: SEE STD. E-144
COLORS: TEXT & BORDER - BLACK
BACKGROUND - ORANGE (RETROREFLECTIVE SHEETING)

CONSTRUCTION SIGN DETAIL

NOT TO SCALE

TO BE INSTALLED ON ROAD WORK AHEAD SIGN POSTS.

PROJECT NAME: WATERBURY	
PROJECT NUMBER: NHG SGNL(43)	
FILE NAME: t13b018traf.dgn	PLOT DATE: 12/31/2013
PROJECT LEADER: P. COBURN	DRAWN BY: I. DEGUTIS
DESIGNED BY: I. DEGUTIS	CHECKED BY: M. LaCROIX
TRAFFIC SIGNAL PROJECT NOTES I	SHEET 10 OF 17

TRAFFIC SIGNAL GENERAL NOTES

1. ALL MATERIALS AND CONSTRUCTION SHALL CONFORM TO THE STATE OF VERMONT, AGENCY OF TRANSPORTATION'S STANDARD SPECIFICATIONS FOR CONSTRUCTION, DATED 2011, AND ITS LATEST REVISIONS.

2. OVERHEAD SIGN/SIGNAL SUPPORTS SHALL CONFORM TO AASHTO'S PUBLICATION ENTITLED "STANDARD SPECIFICATIONS FOR STRUCTURAL SUPPORTS FOR HIGHWAY SIGNS, LUMINAIRES, AND TRAFFIC SIGNALS", DATED 2009 AND ITS LATEST REVISION.

3. THE DESIGN CALCULATIONS SHALL TAKE INTO ACCOUNT THE FOLLOWING CRITERIA:

   STRUCTURE CRITERIA
   DESIGN LIFE: 50 YEARS
   WIND LOAD - 90 MPH, UNLESS SPECIAL SITE CONDITIONS DICTATE
   ICE LOAD PER AASHTO'S PUBLICATION ENTITLED "STANDARD SPECIFICATIONS FOR STRUCTURAL SUPPORTS FOR HIGHWAY SIGNS, LUMINARES, AND TRAFFIC SIGNALS", DATED 2009 AND ITS LATEST REVISIONS

   FATIGUE CRITERIA
   FATIGUE CATEGORY:
   1 FOR MAST ARM SIGN STRUCTURES, 2 FOR SIGNAL MAST ARMS
   VORTEX SHEDDING: INCLUDE
   NATURAL WIND GUSTS: INCLUDE
   TRUCK INDUCED WIND GUSTS: INCLUDE FOR ROADWAYS WHERE SPEED LIMIT IS 40 MPH OR GREATER.
   GALLOPING: DO NOT INCLUDE IN DESIGN CALCULATIONS

   FOUNDATION CRITERIA
   CONCRETE: CONCRETE, HIGH PERFORMANCE CLASS B, STATE OF VERMONT, AGENCY OF TRANSPORTATION'S "STANDARD SPECIFICATIONS FOR CONSTRUCTION", DATED 2011, SECTION 501.
   REINFORCING STEEL: STATE OF VERMONT, AGENCY OF TRANSPORTATION'S "STANDARD SPECIFICATIONS FOR CONSTRUCTION", DATED 2011, SUBSECTION 713.01.
   ALLOWABLE BEARING CAPACITY: TO BE DETERMINED BY THE CONTRACTOR IN ACCORDANCE WITH MREI 10-01
   INTERNAL SOIL FRICTION ANGLE, Φ :TO BE DETERMINED BY THE CONTRACTOR IN ACCORDANCE WITH MREI 10-01

4. ANCHOR BOLTS

   FOUR STAINLESS STEEL ANCHOR BOLTS WITH TWO HEXAGON NUTS, ONE WASHER AND ONE LOCK WASHER PER BOLT SHALL BE FURNISHED WITH EACH POLE. ANCHOR BOLT PLATES, WHEN USED, SHALL ALSO BE STAINLESS STEEL. SEE SUBSECTION 714.09.

5. FLANGE BOLTS

   ALL FLANGE BOLTS AND HEX NUTS SHALL BE HIGH STRENGTH STEEL AND SHALL CONFORM TO ASTM A325. THE FLANGE BOLTS SHALL BE CAPABLE OF RESISTING 133% OF THE FULL DESIGN STRESS OF THE TUBE AT ITS YIELD STRENGTH STRESS.

6. HORIZONTAL AND VERTICAL MEMBERS

   STEEL TUBES SHALL BE FORMED AND WELDED WITH ONE CONTINUOUS LONGITUDINAL WELD ONLY. AFTER FORMING AND WELDING THEY SHALL BE COLD ROLLED TO ENSURE UNIFORMITY OF SIZE AND SMOOTHNESS OF WELD.THERE SHALL BE NO TRANSVERSE WELDING EXCEPT AT THE FLANGE CONNECTIONS AND POLE BASE PLATES, WHERE THE TUBES SHALL TELESCOPE THE FLANGES AND PLATES AND BE CONTINUOUSLY WELDED BOTH SIDES, INSIDE AND OUT TO WITHSTAND THE FULL TRANSFER OF THE BENDING STRENGTH TO THE BOLTS. OPTIONALLY, THE MEMBERS MAY BE A SERIES OF TWO OR THREE DIFFERENT DIAMETER PIPES WELDED TOGETHER. STEEL TUBES SHALL BE CONSTRUCTED FROM MATERIALS CONFORMING TO STATE OF VERMONT, AGENCY OF TRANSPORTATION'S "STANDARD SPECIFICATIONS FOR CONSTRUCTION", DATED 2011, SUBSECTION 752.02.

7. GALVANIZING

   ALL STEEL COMPONENTS, EXCEPT CONCRETE REINFORCING AND STAINLESS STEEL HARDWARE, ARE TO BE HOT DIPPED GALVANIZED AFTER FABRICATION. THE ASSEMBLIES SHALL BE DESIGNED AND FABRICATED TO PERMIT GALVANIZING ON ALL INTERIOR AND EXTERIOR SURFACES AND SHALL BE FREE OF POCKETS AND OTHER STRUCTURAL OBSTRUCTIONS THAT WILL NOT PERMIT PROPER DEPOSITION OF ZINC COATING. GALVANIZING SHALL BE IN ACCORDANCE WITH SUBSECTION 752.02.

8. WELDING

   A. WELDING SHALL BE PERFORMED PER SUBSECTION 506.10.

   B. ALL WELDS SHALL BE AT LEAST AS STRONG AS THE MATERIAL(S) BEING WELDED.

9. FOUNDATIONS

   A. FOUNDATIONS SHALL BE DESIGNED IN ACCORDANCE WITH THE STATE OF VERMONT, AGENCY OF TRANSPORTATION'S MATERIALS AND RESEARCH ENGINEERING INSTRUCTION - GEOTECHNICAL DESIGN PROCEDURES FOR MAST ARM AND OVERHEAD SIGN SUPPORT FOUNDATIONS (MREI 10-10), DATED MARCH 9, 2010, A COPY OF WHICH CAN BE FOUND ON THE AGENCY'S WEBSITE: WWW.AOT.STATE.VT.US

   B. FOUNDATIONS SHALL BE CONSTRUCTED IN ACCORDANCE WITH THE FOLLOWING NOTES:

      1. SPREAD FOOTINGS SHALL HAVE A MINIMUM EMBEDMENT OF FIVE FEET OR SHALL BEAR DIRECTLY ON LEDGE. THE EMBEDMENT SHALL BE MEASURED FROM THE GROUND SURFACE ELEVATION TO THE BOTTOM OF THE FOOTING ELEVATION.

      2. EXCEPT FOR THE UPPERMOST 2 FT OF SOIL, THE DRILLED SHAFT FOUNDATION SHALL BE POURED AGAINST UNDISTURBED MATERIAL; THE TOP 2 FT OF SOIL SHALL BE NEGLECTED FOR DESIGN PURPOSES. A DISPOSABLE CIRCULAR CONCRETE FORM, IF USED, SHALL NOT BE PLACED DEEPER THAN 2FT, IN ORDER NOT TO REDUCE THE FRICTION BETWEEN THE SOIL AND THE CONCRETE.

      3. AS AN ALTERNATIVE TO THE DRILLED HOLES, FOOTINGS MAY BE POURED IN EXCAVATED HOLES USING THE PROPER FORMS, WHICH MUST BE REMOVED. THE EXCAVATED HOLES SHALL BE AT LEAST TWO FEET CLEAR OF THE FOUNDATION SIDES AND ONE FOOT DEEPER THAN THE FOUNDATION. CARE SHOULD BE TAKEN TO AVOID EXCAVATING AROUND THE TOP OF THE FOUNDATION. THE BACKFILL MATERIAL SHALL BE COMPACTED AS DESCRIBED IN SUBSECTION 204.08. DESIGN LIMITS AS FOR AUGERED FOOTINGS APPLY.

      4. BACKFILL MATERIAL PLACED ADJACENT TO THE FOUNDATION SHALL MEET THE REQUIREMENTS FOR GRANULAR BACKFILL FOR STRUCTURES, SUBSECTION 704.08. BACKFILL MATERIAL SHALL BE COMPACTED AS DESCRIBED IN SUBSECTION 204.08.

      5. CONCRETE FOR THE FOUNDATION SHALL CONFORM TO THE REQUIREMENTS OF SECTION 501, HPC STRUCTURAL CONCRETE, CLASS B. IF DRILLED SHAFT FOUNDATIONS ARE REQUIRED, THE CONCRETE SPECIFICATIONS MAY NEED TO BE ADJUSTED FOR CONSTRUCTABILITY ISSUES. HOWEVER, IF REQUIRED, THE CONTRACTOR SHALL SUBMIT ANY CHANGES TO THE CONCRETE SPECIFICATION FOR REVIEW BY THE VTRANS PROJECT MANAGER.

      6. STEEL PILES SHALL MEET THE REQUIREMENTS SECTION 505.

      7. WHEN THE DESIGN DEPTH OF A FOUNDATION CANNOT BE OBTAINED DUE TO UNFORESEEN FIELD CONDITIONS, THE CONTRACTOR SHALL NOTIFY THE ENGINEER FOR THE MANUFACTURER TO OBTAIN A REVISED FOUNDATION DESIGN. SUCH A REVISION SHALL BE SUBMITTED TO THE ENGINEER FOR REVIEW BY THE AGENCY PROJECT MANAGER AND MAY REQUIRE UP TO A 4 WEEK REVIEW PERIOD BY VTRANS.

   C. SIGNALS/SIGNS SHALL BE INSTALLED AND LEVELED AND POLES SHALL BE PLUMB PRIOR TO PLACING GROUT UNDER POLE BASE. GROUT MATERIAL SHALL BE NON-SHRINKING MORTAR CONFORMING TO SUBSECTION 707.03, MORTAR TYPE IV.

10. EACH OVERHEAD TRAFFIC SIGNAL/SIGN SUPPORT SHALL BE GROUNDED. THE GROUND SHALL CONSIST OF:

    A. AN INTERNAL GROUND LUG OPPOSITE THE HAND HOLE.

    B. A #6 AWG (MIN.) SOFT DRAWN COPPER GROUNDING ELECTRODE CONDUCTOR.

    C. A 5/8 IN. X 8 FT (MIN) COPPER CLAD GROUNDING ELECTRODE. THE RESISTANCE TO GROUND SHALL BE 25 OHMS OR LESS. ADDITIONAL GROUNDING ELECTRODES MAY BE REQUIRED (MINIMUM SPACING SHALL BE 6 FT). WHEN A POWER SERVICE, METER AND DISCONNECT ARE ATTACHED TO A POLE, THERE SHALL BE A CONTINUOUS GROUNDING ELECTRODE CONDUCTOR FROM THE METER AND DISCONNECT WHICH MAY RUN INTERNAL TO THE UPRIGHT, THROUGH THE 1/2 IN. FLEXIBLE TUBING IN THE CONCRETE BASE TO THE REQUIRED GROUNDING ELECTRODE(S). THE GROUNDING ELECTRODE CONDUCTOR FROM THE POLE GROUNDING LUG, CONTROLLER CABINET AND/OR LUMINAIRE MAY ATTACH TO THIS CONTINUOUS GROUNDING ELECTRODE CONDUCTOR FROM THE SERVICE METER AND DISCONNECT. THE CONTRACTOR SHALL PERFORM A RESISTANCE TO GROUND TEST ON THE CONTINUOUS GROUNDING ELECTRODE CONDUCTOR FROM THE SERVICE METER AND DISCONNECT, AND PROVIDE A WRITTEN STATEMENT TO THE AREA ELECTRICAL INSPECTOR THAT THE GROUNDING ELECTRODE CONDUCTOR IS CONTINUOUS FROM THE SERVICE METER AND DISCONNECT AND THE RESISTANCE TO GROUND IS 25 OHMS OR LESS.

11. HORIZONTAL MEMBERS SHALL BE CAMBERED AND THE VERTICAL POLES BACK RAKED (WHERE APPLICABLE) TO THE ANTICIPATED DEAD LOAD DEFLECTION PLUS THE CAMBER, IF ANY, SPECIFIED ON THE PLANS.

12. AN EQUIVALENT ALTERNATE DESIGN MAY BE SUBSTITUTED FOR THE DETAILS AND MATERIALS SHOWN.

13. THE DETAILS OF DESIGN FOR THE STRUCTURE AND FOUNDATION ARE TO BE SUPPLIED BY THE CONTRACTOR AND/OR BY THE MANUFACTURER, THE STRUCTURE SHALL BE DESIGNED TO RESIST THE MAXIMUM LOADING AS OUTLINED IN THE AASHTO STANDARD SPECIFICATIONS (SEE NOTE 2). ALL DESIGN CALCULATIONS FOR THE STRUCTURE AND THE FOUNDATION SHALL BE CHECKED AND STAMPED BY A LICENSED PROFESSIONAL ENGINEER REGISTERED IN THE STATE OF VERMONT PRIOR TO SUBMITTAL OF THE FABRICATION DRAWINGS TO THE VERMONT AGENCY OF TRANSPORTATION.

14. THE CONTRACTOR SHALL SUBMIT THE DESIGN CALCULATIONS, IN A DIGITAL FORMAT, TO THE VERMONT AGENCY OF TRANSPORTATION, PROJECT MANAGER, SHOWING THE FOLLOWING INFORMATION FOR EACH OF THE VERTICAL AND HORIZONTAL COMPONENTS OF THE STRUCTURE AND FOUNDATION:

    A. THE DESIGN AXIAL AND SHEAR FORCES AND BENDING AND TORSIONAL MOMENTS ACTING AT THE TOP OF THE FOUNDATION.

    B. THE DESIGN AXIAL, BENDING AND SHEAR STRESSES AND THE COMBINED STRESS RATIO.

    C. VIBRATION AND FATIGUE CALCULATIONS AS SET FORTH IN SECTION 11 OF THE AASHTO PUBLICATION REFERENCED IN NOTE 2.

    D. THE ALLOWABLE AXIAL, BENDING, AND SHEAR STRESSES.

    E. ITEMS A, B, D SHALL BE SHOWN FOR EACH OF THE GROUP LOADINGS (I, II, III) AND FOR THE BASIC WIND LOAD APPLIED TO THE TWO CASES OUTLINED IN THE AASHTO STANDARD SPECIFICATIONS (SEE NOTE 2) SECTION 1.2.5(D)(4).

    F. FAILURE TO SUPPLY THE PROPER DESIGN INFORMATION SHALL BE CAUSE FOR REJECTION OF THE STRUCTURE.

    G. A MINIMUM OF FOUR (4) WEEKS SHALL BE REQUIRED FOR REVIEW BY THE VERMONT AGENCY OF TRANSPORTATION.

    H. EVERY MEMBER AND CONNECTION IN AN OVERHEAD TRAFFIC SIGNAL SUPPORT SHALL BE DESIGNED TO PROVIDE ADDITIONAL RESIDUAL CAPACITY FOR FUTURE MODIFICATION EQUIVALENT TO A 5-SECTION TRAFFIC SIGNAL HEAD WITH A 5 INCH LOUVERED BACKPLATE LOCATED ON THE OUTERMOST EXTENT OF THE MAST ARM.

15. FABRICATION DRAWINGS IN A DIGITAL FORMAT SHALL BE SUBMITTED TO THE STATE OF VERMONT, AGENCY OF TRANSPORTATION, PROJECT MANAGER FOR APPROVAL PRIOR TO FABRICATION. THE FABRICATION DRAWINGS SHALL INCLUDE THE FOLLOWING INFORMATION:

    A. DETAILED DRAWING OF EACH COMPONENT OF THE STRUCTURE.

    B. MATERIAL SPECIFICATION FOR EACH COMPONENT OF THE STRUCTURE, EITHER BY COMPLETE SPECIFICATION OR REFERENCE TO APPLICABLE ASTM STANDARDS.

    C. NOTATION OF PROJECT NAME, PROJECT NUMBER, ROUTE NUMBER, AND STRUCTURE STATIONING (TO BE INCLUDED ON EACH SHEET).

    D. DETAILS FOR LOCATION OF SIGNS/SIGNALS AND ATTACHMENT HARDWARE FOR THE SUPPORT STRUCTURE.

    E. ALL ELEVATIONS AND DIMENSIONS NECESSARY TO PROVIDE A COMPLETE SET OF RECORD PLANS.

    F. DEAD LOAD DEFLECTION AND CAMBER INFORMATION.

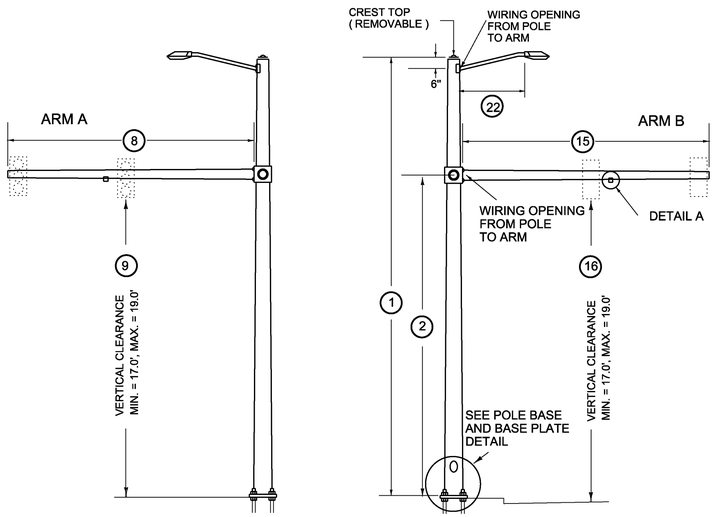
    G. WELDING DETAILS AND PROCEDURES ARE REQUIRED FOR ALL WELDS. PROCEDURES SHALL BE SUBMITTED FOR APPROVAL WITH REFERENCE TO EACH WELD IDENTIFIED ON THE FABRICATION DRAWINGS. (SEE SUBSECTION 506.10).

16. THE TRAFFIC SIGNALS SHALL BE MOUNTED TO THE ARM OR POLE USING A FIXED MOUNT SYSTEM, UNLESS OTHERWISE NOTED ON THE CROSS SECTION SHEET. FOR SIGNALS MOUNTED ON A MAST ARM, THE MAST ARM AND MOUNTING POINT SHALL BE IN THE MIDDLE OF THE SIGNAL HEAD.

17. BASE PLATES SHALL BE STAMPED WITH THE VERTICAL POLE DIAMETER, HEIGHT, YIELD STRENGTH, GAUGE AND THE HORIZONTAL MEMBER DIAMETER, LENGTH, YIELD STRENGTH, AND GAUGE. ALTERNATELY, THE INFORMATION MAY BE STAMPED ON A METAL TAG RIVETED TO THE POLE NEAR THE HAND HOLE.

18. SEE STANDARD E-171A FOR ADDITIONAL NOTES. SEE SHEETS 3-4 FOR BORING INFORMATION.

PROJECT NAME:	WATERBURY
PROJECT NUMBER:	NHG SGNL(43)
FILE NAME: t13b018traf.dgn	PLOT DATE: 12/31/2013
PROJECT LEADER: P. COBURN	DRAWN BY: I. DEGUTIS
DESIGNED BY: I. DEGUTIS	CHECKED BY: M. LaCROIX
TRAFFIC SIGNAL PROJECT NOTES 2	SHEET 11 OF 17



MAP1 & MAP2

POLE BASE DIAMETER (3)

POLE GAUGE (4)

POLE TAPER RATE (5)

ARM B DIAMETER (10)

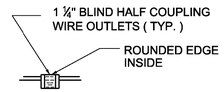
ARM B GAUGE (11)

ARM B TAPER RATE (12)

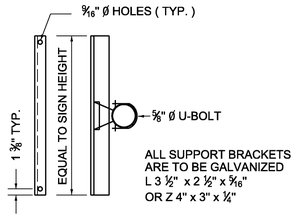
ARM A DIAMETER (17)

ARM A GAUGE (18)

ARM A TAPER RATE (19)



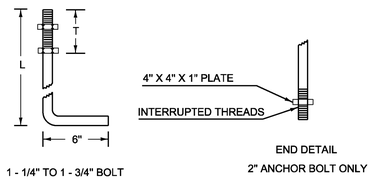
DETAIL A



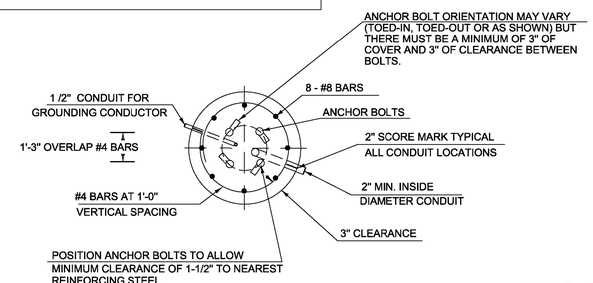
SIGN ON SINGLE
MAST ARM

SIGN BRACKET DETAILS

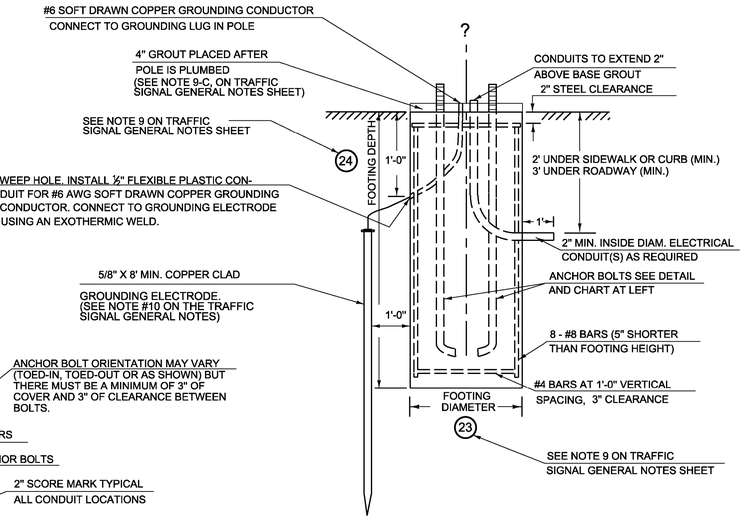
ANCHOR BOLT DETAIL		
SIZE	L (IN)	T (IN)
1 - 1/4" X 48"	42	8
1 - 1/2" X 60"	54	9
1 - 3/4" X 90"	84	9
2" X 96"	96	9



ANCHOR BOLT DETAIL



SECTION

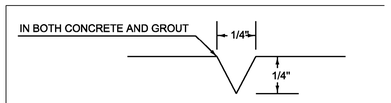


ELEVATION

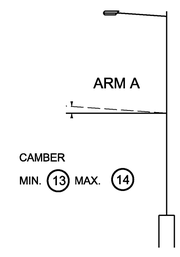
N.T.S. (TYP.)

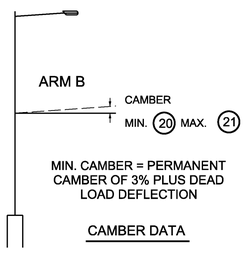
CANTILEVER FOOTING DETAIL

(DRILLED SHAFT)

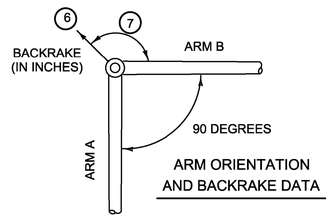


2" SCORE MARK DETAIL

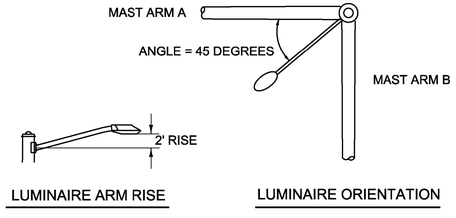




CAMBER DATA



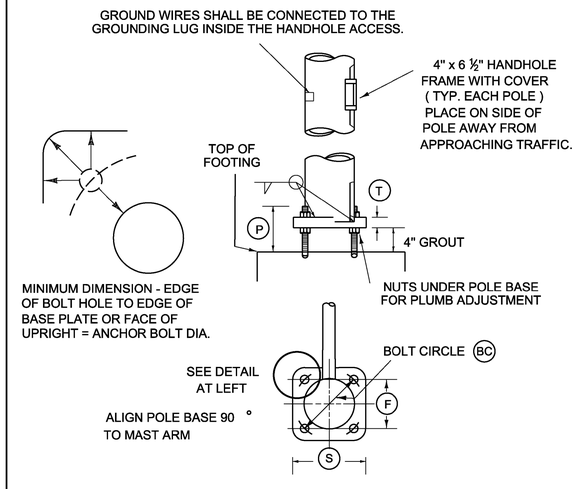
ARM ORIENTATION
AND BACKRAKE DATA



LUMINAIRE ARM RISE

LUMINAIRE ORIENTATION

STRUCTURE DIMENSIONS (IN FEET)																														
	POLE DATA							ARM DATA															FOOTING DATA		BASE PLATE / BOLT DATA						
POLE	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)	(BC)	(F)	(S)	(T)	(P)	ANCHOR BOLT SIZE
MAP1	30	20.5	1.083'	.0199251	.14'			42	17'8"													16	9'6"x9'6"	2'6"						
MAP2	30	20.5	1.083'	.0199251	.14'			31	17'4"						34	18'						12	13'x8'	3'6"						



POLE BASE AND BASE PLATE DETAIL

NOTE:
DETAILS
NTS

DOUBLE MAST ARM CANTILEVER FOOTING DETAIL SHEET

PROJECT NAME: WATERBURY

PROJECT NUMBER: NHG SGNL(43)

FILE NAME: t13b018traf.dgn
PROJECT LEADER: P. COBURN
DESIGNED BY: I. DEGUTIS
MAST ARM CANTILEVER FOOTING DETAILS

PLOT DATE: 12/31/2013
DRAWN BY: I. DEGUTIS
CHECKED BY: M. LaCROIX
SHEET 12 OF 17

CONTROLLER TIMING CHART

VT ROUTE 100 & I-89 EXIT #10 NB OFF-RAMP

		VT100		RAMP		VT100		
PHASE	1	2	3	4	5	6	7	8
TRAFFIC MOVEMENT		->		↓		<-		
MINIMUM GREEN		5		5		5		
MAXIMUM 1 GREEN		54		36		54		
MAXIMUM 2 GREEN		43		33		43		
MAXIMUM 3 GREEN		52		32		52		
YELLOW CLEARANCE		4.8		4.4		4.8		
ALL RED CLEARANCE		1.7		2.0		1.7		
VEH. EXTENSION		2		2		2		
RECALL MODE		SOFT		--		SOFT		

COORDINATION TIMING CHART – SPLITS

VT ROUTE 100 & I-89 EXIT #10 NB OFF-RAMP

	CYCLE	O/S		VT100		RAMP		VT100		
COS	LENGTH	SEC	%	1	2	3	4	5	6	7	8
1-1-1	102	1	1%		60		42		60		
2-1-1	88	77	88%		49		39		49		
3-1-1	96	22	23%		58		38		58		

Coordination Program Steps:

Step	Prog.	Step Begins	Pattern	Override
1	1	0000	FLASH	YES
2	1	0600	0	NO
3	1	0700	1	NO
4	1	0900	0	NO
5	1	1400	3	NO
6	1	1900	0	NO
7	1	2200	FLASH	YES

CONTROLLER TIMING CHART

VT ROUTE 100 & I-89 EXIT #10 NB OFF-RAMP

		VT100				VT100		RAMP
PHASE	1	2	3	4	5	6	7	8
TRAFFIC MOVEMENT		->				<-		↑
MINIMUM GREEN		5				5		5
MAXIMUM 1 GREEN		67				67		23
MAXIMUM 2 GREEN		54				54		22
MAXIMUM 3 GREEN		62				62		22
YELLOW CLEARANCE		4.4				4.4		4.4
ALL RED CLEARANCE		2.1				2.1		1.5
VEH. EXTENSION		2				2		2
RECALL MODE		SOFT				SOFT		-

COORDINATION TIMING CHART – SPLITS

VT ROUTE 100 & I-89 EXIT #10 NB OFF-RAMP

	CYCLE	O/S		VT100				VT100		RAMP
COS	LENGTH	SEC	%	1	2	3	4	5	6	7	8
1-1-1	102	1	1%		73				73		29
2-1-1	88	72	82%		60				60		28
3-1-1	96	7	7%		68				68		28

Coordination Program Steps:

Step	Prog.	Step Begins	Pattern	Override
1	1	0000	FLASH	YES
2	1	0600	0	NO
3	1	0700	1	NO
4	1	0900	0	NO
5	1	1400	3	NO
6	1	1900	0	NO
7	1	2200	FLASH	YES

CONTROLLER TIMING CHART

VT ROUTE 100 & BLUSH HILL RD/STOWE ST (TH #2)

	VT100	VT100		SS	VT100	VT100		BH
PHASE	1	2	3	4	5	6	7	8
TRAFFIC MOVEMENT	↗	<-		↑	↙	->		↓
MINIMUM GREEN	5	5		5	5	5		5
MAXIMUM 1 GREEN	6	64		13	6	64		13
MAXIMUM 2 GREEN	6	53		10	6	53		10
MAXIMUM 3 GREEN	6	59		12	6	59		12
YELLOW CLEARANCE	4.1	4.1		4.1	4.1	4.1		4.1
ALL RED CLEARANCE	2.0	2.0		2.9	2.0	2.0		2.9
VEH. EXTENSION	2	2		2	2	2		2
RECALL MODE	-	SOFT		-	-	SOFT		-

COORDINATION TIMING CHART – SPLITS

VT ROUTE 100 & BLUSH HILL RD/STOWE ST (TH #2)

	CYCLE	O/S		VT100	VT100		SS	VT100	VT100		BH
COS	LENGTH	SEC	%	1	2	3	4	5	6	7	8
1-1-1	102	80	78%	12	70		20	12	70		20
2-1-1	88	80	91%	12	59		17	12	59		17
3-1-1	96	79	82%	12	65		19	12	65		19

Coordination Program Steps:

Step	Prog.	Step Begins	Pattern	Override
1	1	0000	0	NO
2	1	0600	0	NO
3	1	0700	1	NO
4	1	0900	0	NO
5	1	1400	3	NO
6	1	1900	0	NO
7	1	2200	0	NO

CONTROLLER TIMING CHART

VT ROUTE 100 & SHAW'S

	VT100	VT100				VT100		SH
PHASE	1	2	3	4	5	6	7	8
TRAFFIC MOVEMENT	↙	->				<-		↑
MINIMUM GREEN	5	5				5		5
MAXIMUM 1 GREEN	7	59				72		19
MAXIMUM 2 GREEN	6	47				59		18
MAXIMUM 3 GREEN	5	57				59		17
YELLOW CLEARANCE	4.1	4.1				4.1		3.3
ALL RED CLEARANCE	2.0	2.0				2.0		2.0
VEH. EXTENSION	2	2				2		2
RECALL MODE	-	SOFT				SOFT		-

COORDINATION TIMING CHART – SPLITS

VT ROUTE 100 & SHAW'S

	CYCLE	O/S		VT100	VT100			VT100		SH
COS	LENGTH	SEC	%	1	2	3	4	5	6	7	8
1-1-1	102	0	0%	13	65				78		24
2-1-1	88	0	0%	12	53				65		23
3-1-1	96	0	0%	11	63				74		22

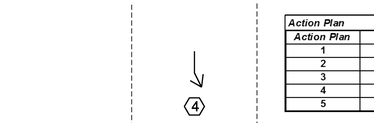
Coordination Program Steps:

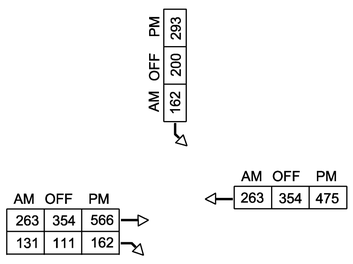
Step	Prog.	Step Begins	Pattern	Override
1	1	0000	FLASH	YES
2	1	0600	0	NO
3	1	0700	1	NO
4	1	0900	0	NO
5	1	1400	3	NO
6	1	1900	0	NO
7	1	2200	FLASH	YES

I-89 SB OFF-RAMP

Action Plan

Action Plan	Pattern	
1	1	MAX 1
2	2	MAX 2
3	3	MAX 3
4	FREE	FREE
5	FLASH	FLASH





VT ROUTE 100 &
I-89 SB EXIT 10 OFF RAMP
2014 DESIGN HOURLY VOLUMES

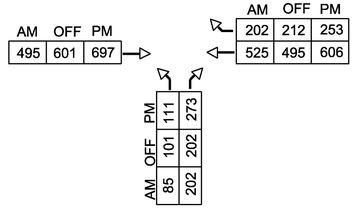
I-89 NB OFF-RAMP

Action Plan

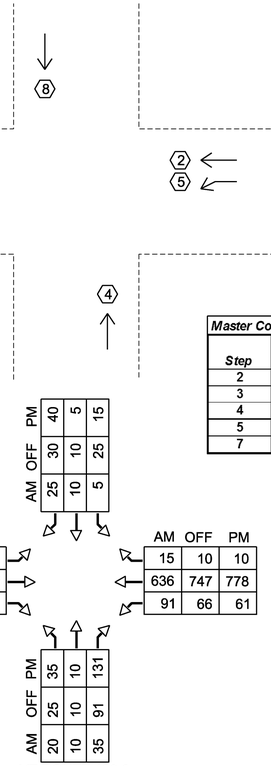
Action Plan	Pattern	
1	1	MAX 1
2	2	MAX 2
3	3	MAX 3
4	FREE	FREE
5	FLASH	FLASH

Time of Day Program Steps:

Step	Prog.	Step Begins	Enable
1	1	0000	MAX 1
2	1	0600	MAX 1
3	1	0700	MAX 2
4	1	0900	MAX 1
5	1	1400	MAX 3
6	1	1900	MAX 1
7	1	2200	MAX 1



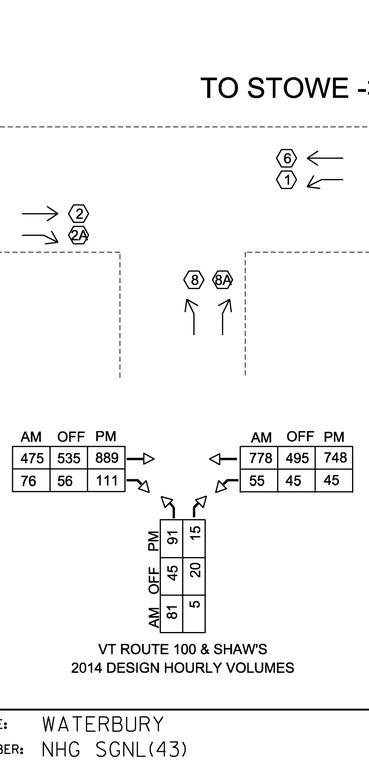
VT ROUTE 100 &
I-89 NB EXIT 10 OFF RAMP
2014 DESIGN HOURLY VOLUMES



VT ROUTE 100 &
STOWE ST./BLUSH HILL RD. (TH-2)
2014 DESIGN HOURLY VOLUMES

Master Controller TOD Program Steps:

Step	Prog.	Step Begins	Enable
2	1	0600	MAX 1
3	1	0700	MAX 2
4	1	0900	MAX 1
5	1	1400	MAX 3
7	1	1900	MAX 1



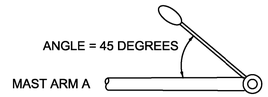
VT ROUTE 100 & SHAW'S
2014 DESIGN HOURLY VOLUMES

NOT TO SCALE

PROJECT NAME: WATERBURY
PROJECT NUMBER: NHG SGNL(43)

FILE NAME: t13b0l8traf.dgn
PROJECT LEADER: P. COBURN
DESIGNED BY: I. DEGUTIS
CORRIDOR COORDINATION SHEET

PLOT DATE: 12/31/2013
DRAWN BY: I. DEGUTIS
CHECKED BY: M. LaCROIX
SHEET 13 OF 17



LUMINAIRE ORIENTATION

NOTES :

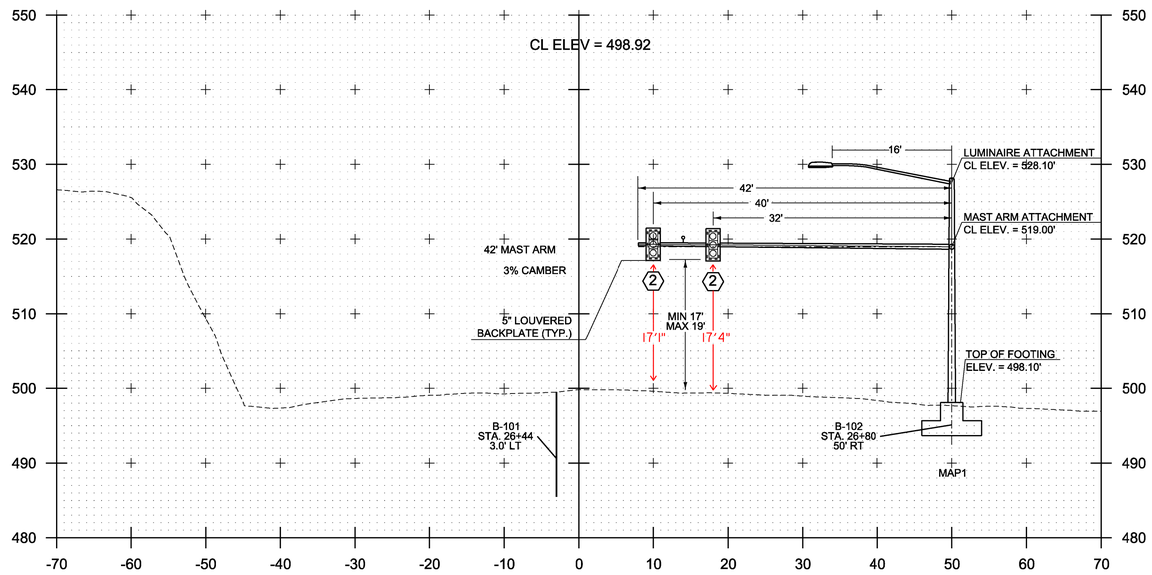
1. ALL MAST ARM FOOTINGS SHALL INCLUDE A 4" REVEAL. ELEVATIONS SHOWN IN CROSS-SECTIONS ARE APPROXIMATE FINAL GRADE ELEVATIONS FOR CONTRACTOR BIDDING PURPOSES ONLY. ACTUAL FOOTING ELEVATIONS SHALL BE DETERMINED BY THE CONTRACTOR PRIOR TO SUBMITTING WORKING DRAWINGS.

2. MAST ARM FOOTING SIZES ARE NOT TO SCALE. FOOTING DESIGNS SHALL BE DETERMINED BY THE CONTRACTOR IN ACCORDANCE WITH SOIL CONDITIONS AND ACTUAL MAST ARM LOADINGS TRANSMITTED TO THE TOP OF THE FOOTINGS.

3. PLEASE REFER TO SHEET 3-4 FOR BORING INFORMATION. FOR ADDITIONAL INFORMATION PLEASE REFER TO THE GEOTECHNICAL REPORT IN THE CONTRACT DOCUMENTS.

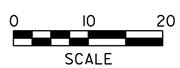
4. SIGNAL HEADS SHALL BE MOUNTED ON THE VERTICAL CENTER OF THE MAST ARM.

MAST ARM POLE #1
ARM A
LOOKING NORTH-EAST ON
VT 100 NORTH



26+80

NEW	LEGEND
	VIDEO DETECTION CAMERA
	PREEMPTION STROBE
	OPTICAL PREEMPTION DETECTOR

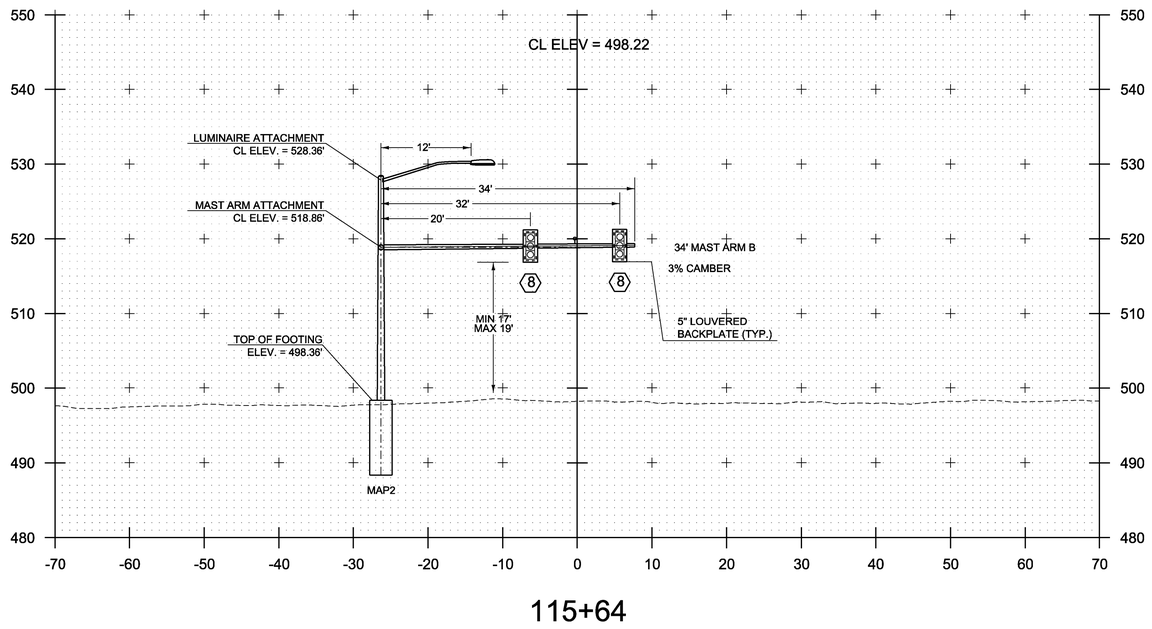


PROJECT NAME: WATERBURY
PROJECT NUMBER: NHG SGNL(43)

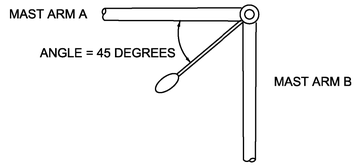
FILE NAME: t13b018traf.dgn
PROJECT LEADER: P. COBURN
DESIGNED BY: I. DEGUTIS
MAST ARM CROSS SECTION SHEET 1

PLOT DATE: 12/31/2013
DRAWN BY: I. DEGUTIS
CHECKED BY: M. LaCROIX
SHEET 14 OF 17

MAST ARM POLE #2
ARM B
LOOKING NORTH-WEST ON
I-89 NB EXIT 10 OFF-RAMP



115+64



LUMINAIRE ORIENTATION

NOTES :

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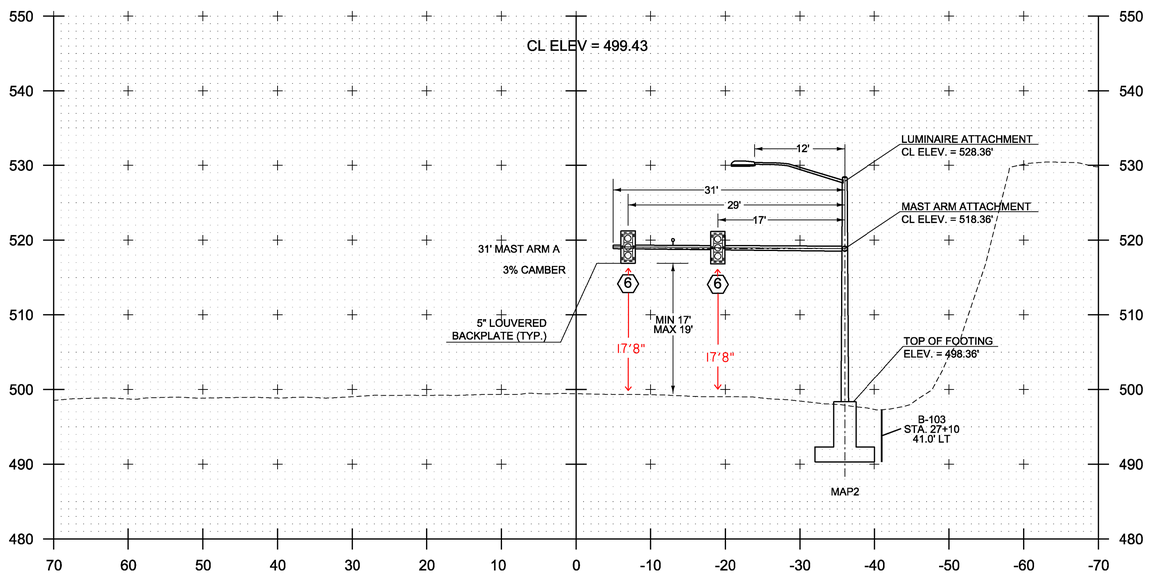
MAST ARM POLE #2
ARM A
LOOKING SOUTH-WEST ON
VT 100 SOUTH



27+10

NEW	LEGEND
	VIDEO DETECTION CAMERA
	PREEMPTION STROBE
	OPTICAL PREEMPTION DETECTOR

0 10 20
SCALE

PROJECT NAME: WATERBURY
PROJECT NUMBER: NHG SGNL(43)

FILE NAME: t13b018traf.dgn
PROJECT LEADER: P. COBURN
DESIGNED BY: I. DEGUTIS
MAST ARM CROSS SECTION SHEET 2

PLOT DATE: 12/31/2013
DRAWN BY: I. DEGUTIS
CHECKED BY: M. LaCROIX
SHEET 15 OF 17

STREET LIGHTING GENERAL NOTES

CONCRETE BASES

WHEN CONCRETE BASES ARE INSTALLED IN SLOPING GROUND, THE GREATEST EXPOSED HEIGHT TO KEEP ALL OF THE TOP ABOVE GROUND MUST BE DOUBLED AND THEN ADDED TO THE MINIMUM DEPTH FOR THE TOTAL BASE DEPTH.

CARE SHOULD BE TAKEN WHERE CONCRETE BASES, DRAINAGE STRUCTURES OR UTILITIES ARE CLOSE TOGETHER.

THE OFFSET FOR CONCRETE BASES (FACE OF CURB OR EDGE OF PAVEMENT TO CENTER OF CONCRETE BASE) SHALL BE A MINIMUM OF 2'-6" OR AS OTHERWISE NOTED ON THE PLANS.

POLES, ANCHOR BASES AND ARM

ALL NEW STREET LIGHT POLES, POLE BASES AND LUMINAIRE ARMS SHOULD BE ALUMINUM, PAINTED FLAT BLACK TO MATCH THE TRAFFIC SIGNAL EQUIPMENT.

ALL STREET LIGHT POLES SHALL HAVE A FRANGIBLE OR BREAKAWAY DEVICE (TRANSFORMER BASE, UNLESS NOTED ON THE PLANS).

UTILIZE APPROVED DUAL-RATED PARALLEL TAP CONNECTOR WITH INSULATING COVER TO TAPS AT POLE BASES.

LUMINAIRES

LUMINAIRES SHALL BE L.E.D. TYPE.

POLE-MOUNTED LUMINAIRES SHALL BE ONE OF THE FOLLOWING:
- BETA LEDWAY IP SERIES
- HOLOPHANE LEDgends SERIES
- LRL LED #SAT-96M SERIES

ALL POLE-MOUNTD LUMINAIRES SHALL BE SAME, A MIX OF FIXTURES WILL NOT BE ALLOWED.

NO LUMINAIRE SUBSTITUTIONS SHALL BE ALLOWED.

ALL LUMINAIRE HOUSINGS SHALL BE PAINTED FLAT BLACK.

CONDUIT SLEEVE

THE SLEEVE SHALL EXTEND TO WITHIN TWO FEET OF THE SIDE OF A CONCRETE BASE OR PULLBOX. WHERE NO CONCRETE BASE OR PULLBOX IS PRESENT, THE SLEEVE SHALL EXTEND FOUR FEET BEYOND THE OUTSIDE EDGE OF SHOULDER OR FACE OF CURB. BACKFILLING AROUND A SLEEVE SHALL BE IN ACCORDANCE WITH THE MANUFACTURER'S SPECIFICATIONS. THE SLEEVE SHALL BE SCHEDULE 80.

WIRE

ALL WIRING BETWEEN THE METER AND/OR POWER SOURCE AND THE FIRST POLE AND/OR PULLBOX AND BETWEEN POLES AND/OR PULLBOXES SHALL BE COPPER AND SIZE AS SPECIFIED ON THE PLANS. ALL WIRE SHALL HAVE TYPE XHHW INSULATION OR EQUIVALENT.

CIRCUIT CONDUCTORS SHALL BE CLEARLY IDENTIFIED BY CORROSION RESISTANT TAGS INDICATING CIRCUIT NUMBER AND PANEL SOURCES AT EVERY POLE BASE AND HANDHOLE.

GROUNDING

ALL CONDUIT MUST INCLUDE A GROUNDING CONDUCTOR. RIGID STEEL CONDUIT SHALL BE PROPERLY CONNECTED AT THE JOINTS SO AS TO BE WATERTIGHT AND MAINTAIN ELECTRICAL CONTINUITY AND HAVE GROUNDING BUSHINGS SO AS TO ACT AS A GROUNDING CONDUCTOR. ALUMINUM WIRE SHALL NOT BE USED FOR GROUND WIRE.

THE GROUNDING CONDUCTOR SHALL BE CONTINUOUS.

PULLBOXES, HANDHOLES AND JUNCTION BOXES

POLYMER CONCRETE AND REINFORCED FIBERGLASS U.L. LISTED PULLBOXES, HANDHOLES SHALL BE INSTALLED WITH HEAVY DUTY COVERS.

ALL CONNECTIONS IN HANDHOLES SHALL BE MADE WITH INSULATED WATERPROOF MECHANICAL SCREW-TYPE CONNECTOR SUITABLE FOR DIRECT BURIAL. NO BARE OR COMPRESSION TYPE CONNECTORS MAY BE USED.

GENERAL

THE LOAD ON EACH BRANCH OF A THREE WIRE CIRCUIT SHALL BE AS BALANCED AS POSSIBLE. LOAD TO NEUTRAL.

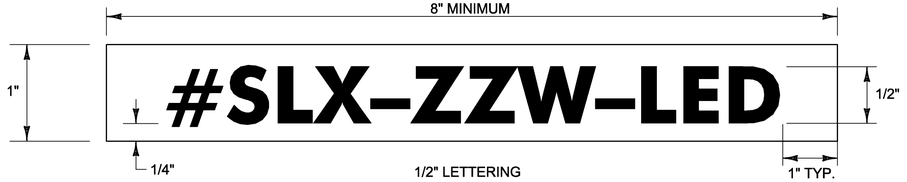
THE LAST CONCRETE POLE BASE AT THE END OF EACH CIRCUIT AND SOME PULLBOXES SHALL HAVE A CONDUIT SWEEP WITH CAP INSTALLED FOR FUTURE USE.

THE CONTRACTOR SHALL ACQUIRE ALL NECESSARY PERMITS AND MAKE ALL NECESSARY ARRANGEMENTS WITH THE UTILITY COMPANY TO PROVIDE A PERMANENT POWER SUPPLY TO THE STREET LIGHTING SYSTEM. IF APPLICABLE, THE ROUTING OF POWER TO THE SYSTEM SHALL BE SUCH THAT THE AGENCY OF TRANSPORTATION HAS FULL RESPONSIBILITY FROM THE TRANSFORMER THROUGH THE LIGHTING SYSTEM. NO INTERVENING OWNERSHIP OR RESPONSIBILITY SHALL BE ALLOWED.

ALL CONNECTING HARDWARE (NUTS, BOLTS, ETC.) SHALL BE STAINLESS STEEL.

MATERIALS AND EQUIPMENT SHALL BE LISTED BY UNDERWRITERS' LABORATORIES AND SHALL BE INSTALLED IN ACCORDANCE WITH SUCH LISTINGS.

ALL MATERIALS AND INSTALLATION SHALL BE IN ACCORDANCE WITH THE LATEST EDITION OF THE NATIONAL ELECTRICAL CODE, AND ALL CODES, REGULATIONS AND REQUIREMENTS OF ALL MUNICIPAL, STATE, FEDERAL AND OTHER PUBLIC OR PRIVATE AUTHORITIES WHICH HAVE JURISDICTION. IN EACH CASE, CODES ARE MINIMUM REQUIREMENTS.



LEGEND: BLACK OR WHITE (NON-REFLECTIVE) - STAMPED PRIOR TO PRINTING/PAINTING.
BACKGROUND: NATURAL ALUMINUM OR FLAT BLACK SURFACE, THE SAME AS POLE FINISH.

NOTES:

1. THE TAG SHALL BE MOUNTED ON ALL STREET LIGHT POLES IN SUCH A MANNER AS NOT TO BE EASILY REMOVED, SUCH AS WELDED, RIVETED, OR BOLTED WITH VANDAL PROOF BOLTS.
2. THE LETTERS SHALL BE PUNCHED, STAMPED, ENGRAVED, OR PHOTO-ETCHED. PUNCHING, STAMPING OR ENGRAVING SHALL PENETRATE AT LEAST 1/2 THE BASE MATERIAL THICKNESS.
3. THE BASE MATERIAL FOR THE TAG SHALL BE ALUMINUM WITH A MINIMUM THICKNESS OF 0.10 INCHES.
4. THE TAG SHALL BE ATTACHED TO THE POLE ABOVE THE HANDHOLE, 6 INCHES MAXIMUM, IF THE POLE HAS A TRANSFORMER BASE, ATTACH TAG TO COVER.
5. FIXTURE TAG CHARACTER "X" SHALL BE THE DESIGNATED SL NUMBER AS SHOWN ON THE LIGHTING PLANS.
6. FIXTURE TAG CHARACTER "ZZ" SHALL BE THE WATTAGE OF THE LUMINAIRE

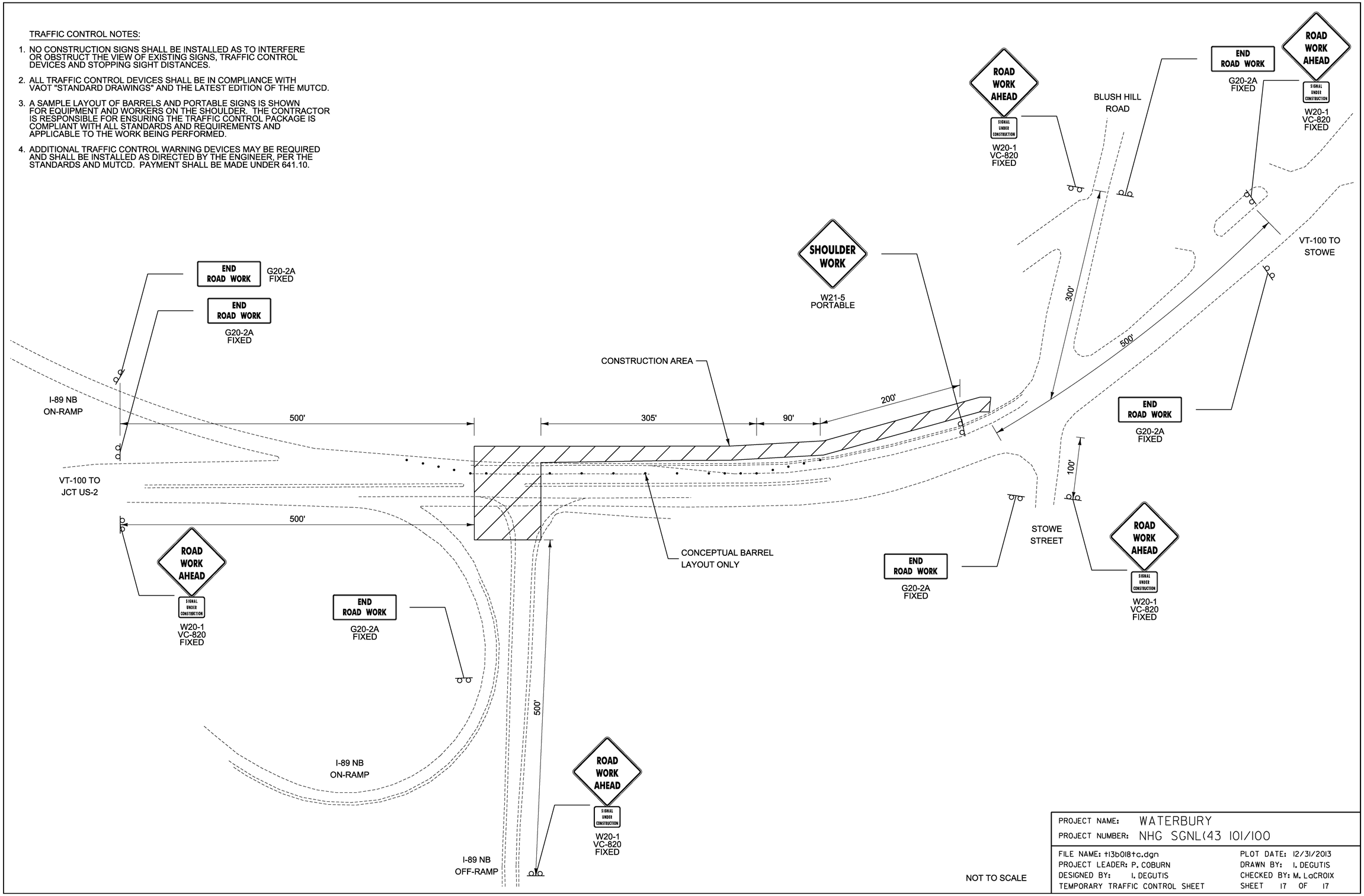
DETAIL FOR TAGS ATTACHED TO STREET LIGHT POLES

NOT TO SCALE

PROJECT NAME:	WATERBURY
PROJECT NUMBER:	NHG SGNL(43)
FILE NAME: t13b018traf.dgn	PLOT DATE: 12/31/2013
PROJECT LEADER: P. COBURN	DRAWN BY: I. DEGUTIS
DESIGNED BY: I. DEGUTIS	CHECKED BY: M. LaCROIX
STREET LIGHTING GENERAL NOTES SHEET	SHEET 16 OF 17

TRAFFIC CONTROL NOTES:

1. NO CONSTRUCTION SIGNS SHALL BE INSTALLED AS TO INTERFERE OR OBSTRUCT THE VIEW OF EXISTING SIGNS, TRAFFIC CONTROL DEVICES AND STOPPING SIGHT DISTANCES.
2. ALL TRAFFIC CONTROL DEVICES SHALL BE IN COMPLIANCE WITH VAOT "STANDARD DRAWINGS" AND THE LATEST EDITION OF THE MUTCD.
3. A SAMPLE LAYOUT OF BARRELS AND PORTABLE SIGNS IS SHOWN FOR EQUIPMENT AND WORKERS ON THE SHOULDER. THE CONTRACTOR IS RESPONSIBLE FOR ENSURING THE TRAFFIC CONTROL PACKAGE IS COMPLIANT WITH ALL STANDARDS AND REQUIREMENTS AND APPLICABLE TO THE WORK BEING PERFORMED.
4. ADDITIONAL TRAFFIC CONTROL WARNING DEVICES MAY BE REQUIRED AND SHALL BE INSTALLED AS DIRECTED BY THE ENGINEER, PER THE STANDARDS AND MUTCD. PAYMENT SHALL BE MADE UNDER 641.10.



PROJECT NAME:	WATERBURY
PROJECT NUMBER:	NHG SGNL(43 101/100
FILE NAME: t13b018tc.dgn	PLOT DATE: 12/31/2013
PROJECT LEADER: P. COBURN	DRAWN BY: I. DEGUTIS
DESIGNED BY: I. DEGUTIS	CHECKED BY: M. LaCROIX
TEMPORARY TRAFFIC CONTROL SHEET	SHEET 17 OF 17

FRITZ BROTHERS ENGINEERING, LTD.

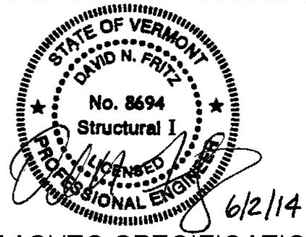
June 2, 2014

STRUCTURAL CALCULATIONS & DRAWINGS

FOR

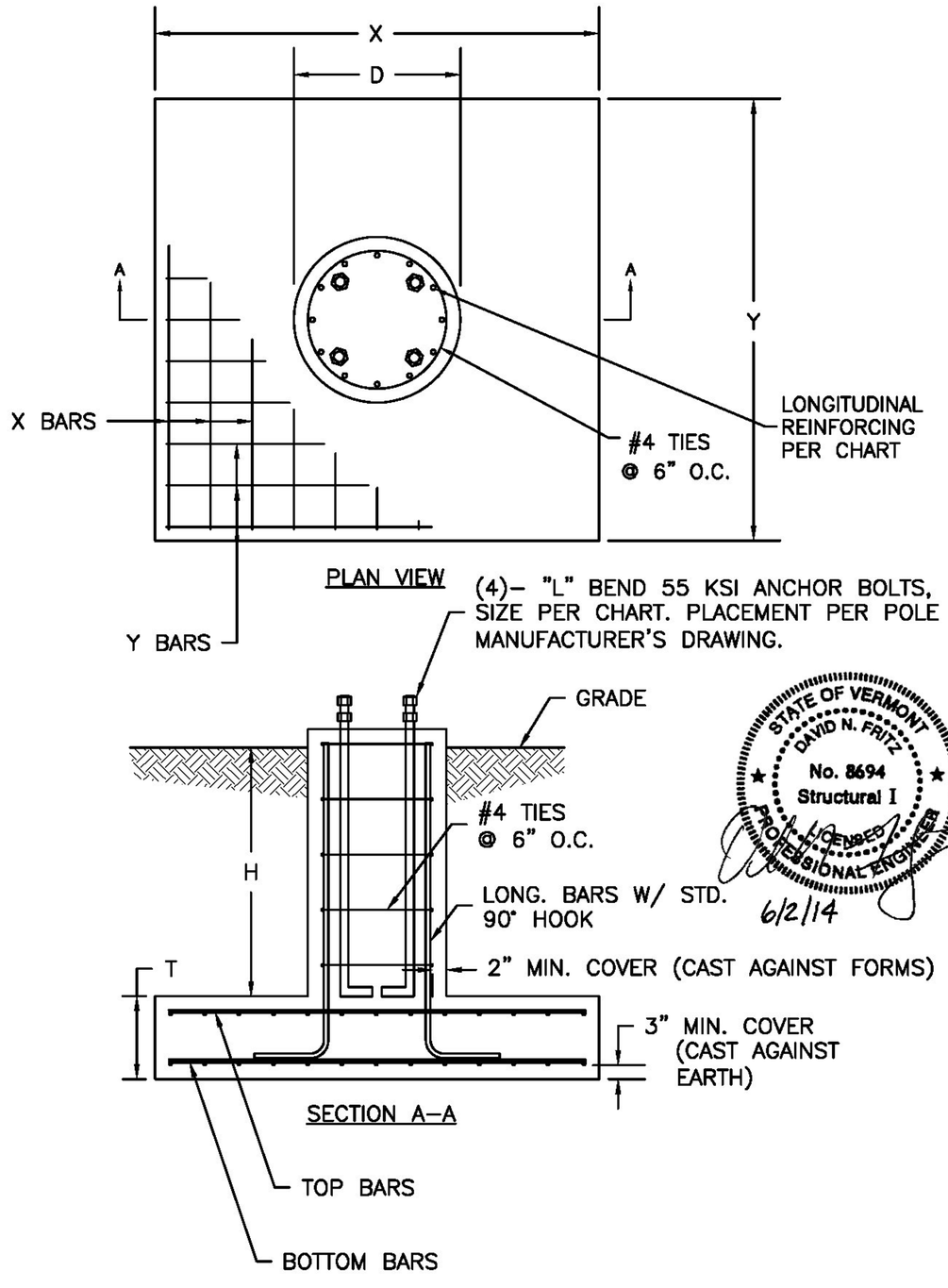
TRAFFIC SIGNAL POLE FOUNDATIONS

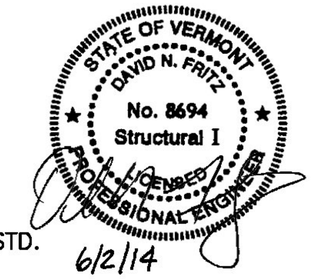
WATERBURY NHG SGNL(43), VERMONT
VT ROUT 100 & I-89 EXIT 10 NB OFF RAMP



2009 AASHTO SPECIFICATION
VTRANS MREI 10-01
VTRANS STANDARD SPECIFICATIONS FOR CONSTRUCTION

2800 POSSUM HOLLOW RD. SE, NEW PHILADELPHIA OHIO 44663-7322
PHONE: 330-844-0994 • FAX: 330-308-5461





TRAFFIC SIGNAL POLE FOUNDATION DESIGN
WATERBURY NHG SGNL(43), VERMONT
VT ROUTE 100 & 1–89 EXIT 10 NB OFF RAMP
DRAWING NO. 235821–SF

NOTES:
1. FOUNDATION IS BASED ON SOIL BEARING CAPACITY OF 1,300 PSF.

2. GROUND SLOPE PER CROSS SECTIONS.

3. IF ACTUAL SITE CONDITIONS VARY FROM ABOVE INFORMATION, FOUNDATION REDESIGN IS REQUIRED.

4. MIN. CONCRETE COMPRESSIVE STRENGTH OF 3,500 PSI @ 28 DAYS. REINFORCING: ASTM A615 GR. 60.

5. FOUNDATION SHALL BE CAST AGAINST UNDISTURBED SOIL AND BACKFILLED WITH WELL COMPACTED GRANULAR MATERIAL.

6. IF REQUIRED, INSTALL CONDUIT PER OWNER SPECIFICATIONS.

6/2/14

POLE ID	D	H	T	X	Y	ANCHOR BOLTS
MAP–1, 42', B–102	3'–0"	2'–6"	1'–6"	9'–6"	9'–6"	1 1/2" X 54" X 6"

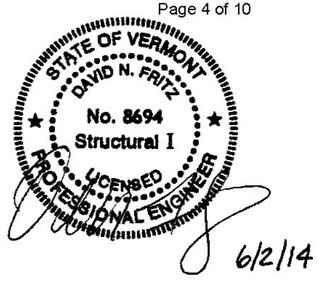
TOTAL NO. OF REBARS REQUIRED				
LONG.	X–TOP	X–BOT.	Y–TOP	Y–BOT.
12–#6	13–#5	13–#5	13–#5	13–#5

POLE ID	D	H	T	X	Y	ANCHOR BOLTS
MAP–2, 34'/31', B–103	3'–0"	3–6"	1'–6"	13–0"	8'–0"	1 1/2" X 54" X 6"

TOTAL NO. OF REBARS REQUIRED				
LONG.	X–TOP	X–BOT.	Y–TOP	Y–BOT.
12–#6	11–#5	11–#8	17–#5	17–#5

VALMONT DRAWING NO. VT235821P1

TRAFFIC SIGNAL POLE FOUNDATION DESIGN
WATERBURY NHG SGNL(43), VERMONT
VT ROUTE 100 & 1–89 EXIT 10 NB OFF RAMP
DRAWING NO. 235821–SF



TRAFFIC SIGNAL POLE FOUNDATION DESIGN
WATERBURY NHG SGNL(43), VERMONT
VT R0UTE 100 & I-89 EXIT 10 NB OFF RAMP

Spread Footing Analysis

DRAWING NO. 235821-SF

	GROUP II	GROUP III	GROUP II	GROUP III
	MAP-1, 42'	MAP-1, 42'	MAP-2, 34'/31'	MAP-2, 34'/31'
Structure ID	B-102	B-102	B-103	B-103
Fx - Shear (lbs)	6	576	5	8
Fz - Axial (lbs)	2,126	3,267	2,612	4,380
Fy - Shear (lbs)	1,622	812	2,376	1,592
Mx - Moment (ft-lbs)	33,229	15,476	62,830	63,629
Mz - Torsion (ft-lbs)	41,890	17,129	30,658	19,018
My - Moment (ft-lbs)	30,728	67,623	19,102	39,496
Depth to Ground Water (ft)	6.8	6.8	3.1	3.1
Soil Unit Wt (pcf)	120	120	120	120
Soil Friction Angle (deg)	32	32	32	32
At Rest Earth Pressure Coef.	0.38	0.38	0.38	0.38
Soil Friction Coef.	0.40	0.40	0.40	0.40
Conc. Unit Wt.(pcf)	150	150	150	150
Concrete Strength (psi)	3500	3500	3500	3500
Reinforcing Yield (psi)	60000	60000	60000	60000
Pedestal Diameter (ft)	3.00	3.00	3.00	3.00
Pedestal Height (ft)	2.50	2.50	3.50	3.50
Footing Thickness (ft)	1.50	1.50	1.50	1.50
X - Footing Width (ft)	9.50	9.50	13.00	13.00
Y - Footing Width (ft)	9.50	9.50	8.00	8.00
Check O.T. & Sliding:				
Pedestal Wt. (lb)	2651	2651	3535	3535
Footing Wt. (lb)	20306	20306	13666	13666
Soil Wt. (lb)	24954	24954	38292	38292
Pole Wt. (lb)	2126	3267	2612	4380
Total Wt. (lb)	50037	51178	58104	59872
X - Factor of Safety (O.T.)	5.98	12.98	3.11	3.35
Y - Factor of Safety (O.T.)	7.73	3.48	19.75	9.84
Factor of Safety (Sliding)	12.34	20.56	9.78	15.04
	OK	**OK**	**OK**	**OK**
Check Torsional Resistance:				
Bot. Of Footing Friction	47536	48619	61009	62866
Top of Footing Friction	31193	31193	51694	51694
Side of Pedestal Friction	1259	1259	2467	2467
Passive Pressure Coefficient	3.25	3.25	3.25	3.25
Side of Footing Passive	85915	85915	137248	137248
Total Torsional Resistance	165902	166986	252418	254275
Factor of Safety (Torsion)	3.96	9.75	8.23	13.37
	OK	**OK**	**OK**	**OK**

	MAP-1, 42'	MAP-1, 42'	MAP-2, 34'/31'	MAP-2, 34'/31'
Structure ID	**B-102**	**B-102**	**B-103**	**B-103**
Check Bearing Capacity:				
X - Moment about toe (ft-lbs)	39717	18724	74710	71589
Y - Moment about toe (ft-lbs)	30752	69927	19127	39536
Area (sf)	90.25	90.25	104	104
X - Section Modulus (cf)	142.9	142.9	138.7	138.7
Y - Section Modulus (cf)	142.9	142.9	225.3	225.3
X - Eccentricity (ft)	0.615	1.366	0.329	0.660
e<=1/6 B	**OK**	**OK**	**OK**	**OK**
Y - Eccentricity (ft)	0.794	0.366	1.286	1.196
e<=1/6 B	**OK**	**OK**	**OK**	**OK**
Senario 1 - No Tension:				
Qa (psf)	617	209	1013	917
Qb (psf)	1048	1187	1182	1267
Qc (psf)	492	925	105	235
Qd (psf)	61	-53	-65	-116
Senario 2 - Corner Tension:				
Zero Pressure Angle (radians)	0.6589	1.3092	0.0967	0.2062
H1 (ft) - SELECT VALUE	14.171	11.130	8.729	9.584
X- Leg (ft)	23.147	11.522	90.455	46.817
Y - Leg (ft)	17.922	43.031	8.770	9.791
H2 (ft)	8.355	1.953	7.474	6.923
H3 (ft)	6.659	8.673	0.766	1.753
L1 (ft)	29.275	44.547	90.880	47.830
L2 (ft)	17.260	7.818	77.819	34.549
L3 (ft)	13.757	34.712	7.979	8.751
Load Offset (ft)	8.511	6.728	5.432	5.644
Moment of Inertia (ft^4)	5764.98	3226.35	2328.78	2549.69
Qa (psf)	617	208	1013	917
Qb (psf)	**1047**	**1188**	**1183**	**1270**
Qc (psf)	492	926	104	232
Psoil (lbs)	50035	51180	58105	59872
Papplied (lbs)	50037	51178	58104	59872
% Difference	**0.00**	**0.00**	**0.00**	**0.00**
	OK	**OK**	**OK**	**OK**

Check Settlement:				
Subgrade Material	Gravel/Rock	Gravel/Rock	Gravel/Rock	Gravel/Rock
	OK	**OK**	**OK**	**OK**

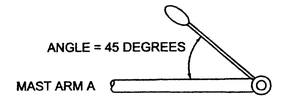
Concrete Structural Design:				
X - Q at face of pedestal (psf)	900	853	1118	1134
Y- Q at face of pedestal (psf)	857	1098	846	946
Mx at face of pedestal (pos.)	55697	61092	32386	34455
My at face of pedestal (pos.)	54980	65195	195786	213741
Mx at face of pedestal (neg.)	26340	26340	16125	16125
My at face of pedestal (neg.)	26340	26340	104813	104813

	MAP-1, 42'	MAP-1, 42'	MAP-2, 34'/31'	MAP-2, 34'/31'
Structure ID	**B-102**	**B-102**	**B-103**	**B-103**
X-Direction - Top Slab Reinforcing:				
Load Factor	1.3	1.3	1.3	1.3
Mu (k-in)	411	411	1635	1635
phi	0.9	0.9	0.9	0.9
Mn (k-in)	457	457	1817	1817
Bar Diameter (in)	**0.625**	**0.625**	**0.625**	**0.625**
Cover	2	2	2	2
d (in)	15.06	15.06	15.06	15.06
Rn (ksi)	0.0177	0.0177	0.0834	0.0834
m	20.17	20.17	20.17	20.17
p - reinforcing ratio required	0.0003	0.0003	0.0014	0.0014
p - s+t	0.0018	0.0018	0.0018	0.0018
p min (1.33 x p)	0.0004	0.0004	0.0019	0.0019
p bal	0.0249	0.0249	0.0249	0.0249
p max	0.0187	0.0187	0.0187	0.0187
p required	0.0018	0.0018	0.0019	0.0019
As - (in^2) - Top Bars	3.69	3.69	3.24	3.24
Number of Bars - Top	**13**	**13**	**11**	**11**

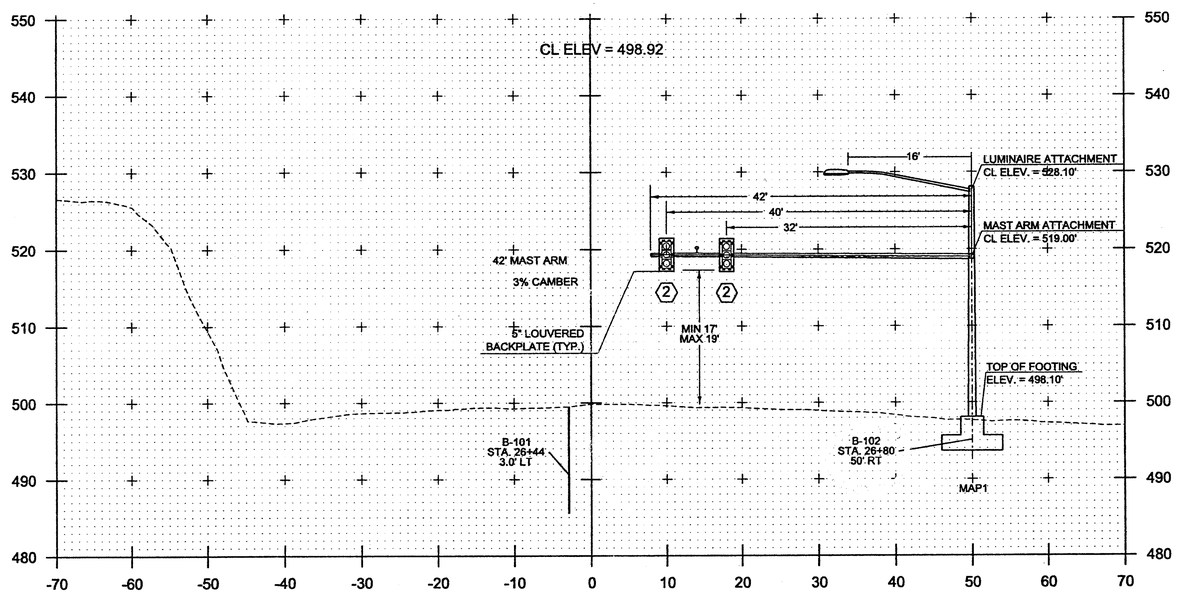
X-Direction - Bottom Slab Reinforcing:				
Mu (k-in)	858	1017	3054	3334
phi	0.9	0.9	0.9	0.9
Mn (k-in)	953	1130	3394	3705
Bar Diameter (in)	**0.625**	**0.625**	**1.000**	**1.000**
Cover	3	3	3	3
d (in)	14.06	14.06	13.50	13.50
Rn (ksi)	0.0423	0.0501	0.1940	0.2118
m	20.17	20.17	20.17	20.17
p - reinforcing ratio required	0.0007	0.0008	0.0033	0.0037
p - s+t	0.0018	0.0018	0.0018	0.0018
p min (1.33 x p)	0.0009	0.0011	0.0044	0.0049
p bal	0.0249	0.0249	0.0249	0.0249
p max	0.0187	0.0187	0.0187	0.0187
p required	0.0018	0.0018	0.0044	0.0049
As - (in^2) - Top Bars	3.69	3.69	7.69	8.42
Number of Bars - Top	**13**	**13**	**10**	**11**

	MAP-1, 42'	MAP-1, 42'	MAP-2, 34'/31'	MAP-2, 34'/31'
Structure ID	**B-102**	**B-102**	**B-103**	**B-103**
Y-Direction - Top Slab Reinforcing:				
Mu (k-in)	411	411	252	252
phi	0.9	0.9	0.9	0.9
Mn (k-in)	457	457	280	280
Bar Diameter (in)	**0.625**	**0.625**	**0.625**	**0.625**
Cover	2	2	2	2
d (in)	15.06	15.06	15.06	15.06
Rn (ksi)	0.0177	0.0177	0.0079	0.0079
m	20.17	20.17	20.17	20.17
p - reinforcing ratio required	0.0003	0.0003	0.0001	0.0001
p - s+t	0.0018	0.0018	0.0018	0.0018
p min (1.33 x p)	0.0004	0.0004	0.0002	0.0002
p bal	0.0249	0.0249	0.0249	0.0249
p max	0.0187	0.0187	0.0187	0.0187
p required	0.0018	0.0018	0.0018	0.0018
As - (in^2) - Top Bars	3.69	3.69	5.05	5.05
Number of Bars - Top	**13.0**	**13.0**	**17.0**	**17.0**
Y-Direction - Bottom Slab Reinforcing:				
Mu (k-in)	869	953	505	538
phi	0.9	0.9	0.9	0.9
Mn (k-in)	965	1059	561	597
Bar Diameter (in)	**0.625**	**0.625**	**0.625**	**0.625**
Cover	3	3	3	3
d (in)	14.06	14.06	14.06	14.06
Rn (ksi)	0.0428	0.0470	0.0182	0.0194
m	20.17	20.17	20.17	20.17
p - reinforcing ratio required	0.0007	0.0008	0.0003	0.0003
p - s+t	0.0018	0.0018	0.0018	0.0018
p min (1.33 x p)	0.0010	0.0010	0.0004	0.0004
p bal	0.0249	0.0249	0.0249	0.0249
p max	0.0187	0.0187	0.0187	0.0187
p required	0.0018	0.0018	0.0018	0.0018
As - (in^2) - Top Bars	3.69	3.69	5.05	5.05
Number of Bars - Top	**13.0**	**13.0**	**17.0**	**17.0**

	MAP-1, 42'	MAP-1, 42'	MAP-2, 34'/31'	MAP-2, 34'/31'
Structure ID	**B-102**	**B-102**	**B-103**	**B-103**
Vertical Direction - Pedestal Reinforcing:				
Load Factor	1.3	1.3	1.3	1.3
Strength Reduction Factor	0.7	0.7	0.7	0.7
Mu (k-in)	592	862	888	966
Concrete Strength (psi)	3500	3500	3500	3500
Reinforcing Steel Yield (psi)	60000	60000	60000	60000
Concrete Cover (in)	2	2	2	2
Shear Reinf. Dia. (in)	0.5	0.5	0.5	0.5
Tension Reinf. Dia. (in)	**0.75**	**0.75**	**0.75**	**0.75**
No. of Bars	**12**	**12**	**12**	**12**
Tie Bars	**#4 @6"**	**#4 @6"**	**#4 @6"**	**#4 @6"**
e (in)	278.35	263.95	339.90	220.45
As (in^2)	5.30	5.30	5.30	5.30
Ag (in^2)	1017.88	1017.88	1017.88	1017.88
m	20.17	20.17	20.17	20.17
D (in)	36.00	36.00	36.00	36.00
Ds (in)	30.25	30.25	30.25	30.25
p - reinforcement ratio	0.0052	0.0052	0.0052	0.0052
phi*Pn (lbs)	7692	8139	6231	9871
Pu (lbs)	2764	4247	3396	5694
	OK	**OK**	**OK**	**OK**



LUMINAIRE ORIENTATION



26+80

MAST ARM POLE #1
ARM A
LOOKING NORTH-EAST ON
VT 100 NORTH

NOTES :

1. ALL MAST ARM FOOTINGS SHALL INCLUDE A 4" REVEAL. ELEVATIONS SHOWN IN CROSS-SECTIONS ARE APPROXIMATE FINAL GRADE ELEVATIONS FOR CONTRACTOR BIDDING PURPOSES ONLY. ACTUAL FOOTING ELEVATIONS SHALL BE DETERMINED BY THE CONTRACTOR PRIOR TO SUBMITTING WORKING DRAWINGS.

2. MAST ARM FOOTING SIZES ARE NOT TO SCALE. FOOTING DESIGNS SHALL BE DETERMINED BY THE CONTRACTOR IN ACCORDANCE WITH SOIL CONDITIONS AND ACTUAL MAST ARM LOADINGS TRANSMITTED TO THE TOP OF THE FOOTINGS.

3. PLEASE REFER TO SHEET 3-4 FOR BORING INFORMATION. FOR ADDITIONAL INFORMATION PLEASE REFER TO THE GEOTECHNICAL REPORT IN THE CONTRACT DOCUMENTS.

4. SIGNAL HEADS SHALL BE MOUNTED ON THE VERTICAL CENTER OF THE MAST ARM.

NEW	LEGEND
	VIDEO DETECTION CAMERA
	PREEMPTION STROBE
	OPTICAL PREEMPTION DETECTOR

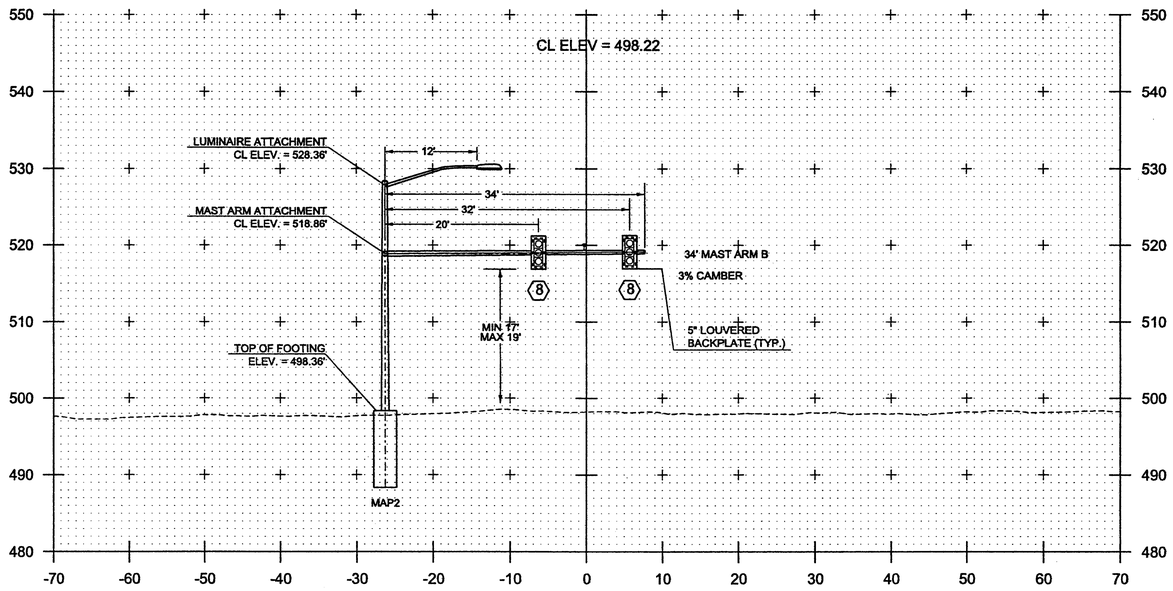
0 10 20
SCALE

PROJECT NAME: WATERBURY
PROJECT NUMBER: NHG SGNL(43)

FILE NAME: t13b0181raf.dgn
PROJECT LEADER: P. COBURN
DESIGNED BY: I. DEGUTIS
MAST ARM CROSS SECTION SHEET 1

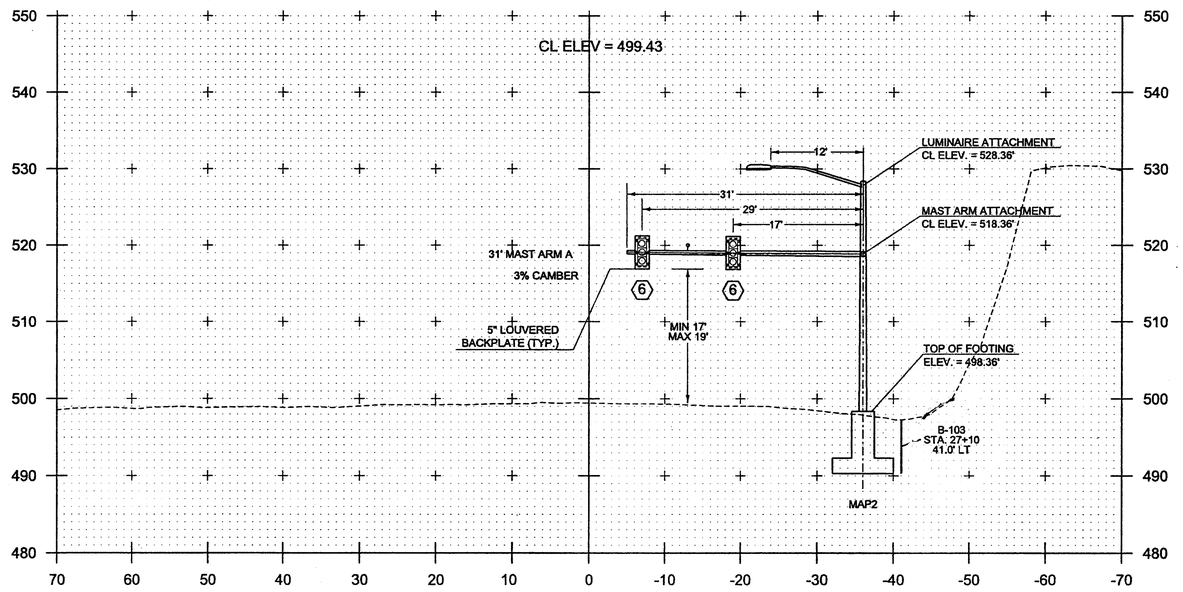
PLOT DATE: 12/31/2013
DRAWN BY: I. DEGUTIS
CHECKED BY: M. LaCROIX
SHEET 14 OF 17

MAST ARM POLE #2
ARM B
LOOKING NORTH-WEST ON
I-89 NB EXIT 10 OFF-RAMP

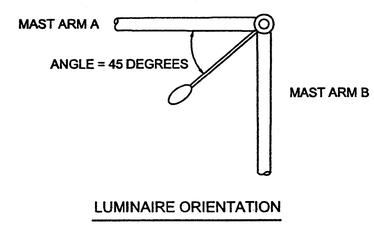


115+64

MAST ARM POLE #2
ARM A
LOOKING SOUTH-WEST ON
VT 100 SOUTH



27+10



LUMINAIRE ORIENTATION

NOTES :

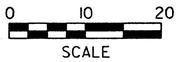
1. ALL MAST ARM FOOTINGS SHALL INCLUDE A 4" REVEAL. ELEVATIONS SHOWN IN CROSS-SECTIONS ARE APPROXIMATE FINAL GRADE ELEVATIONS FOR CONTRACTOR BIDDING PURPOSES ONLY. ACTUAL FOOTING ELEVATIONS SHALL BE DETERMINED BY THE CONTRACTOR PRIOR TO SUBMITTING WORKING DRAWINGS.

2. MAST ARM FOOTING SIZES ARE NOT TO SCALE. FOOTING DESIGNS SHALL BE DETERMINED BY THE CONTRACTOR IN ACCORDANCE WITH SOIL CONDITIONS AND ACTUAL MAST ARM LOADINGS TRANSMITTED TO THE TOP OF THE FOOTINGS.

3. PLEASE REFER TO SHEET 3-4 FOR BORING INFORMATION. FOR ADDITIONAL INFORMATION PLEASE REFER TO THE GEOTECHNICAL REPORT IN THE CONTRACT DOCUMENTS.

4. SIGNAL HEADS SHALL BE MOUNTED ON THE VERTICAL CENTER OF THE MAST ARM.

NEW	LEGEND
	VIDEO DETECTION CAMERA
	PREEMPTION STROBE
	OPTICAL PREEMPTION DETECTOR



SCALE

PROJECT NAME: WATERBURY
PROJECT NUMBER: NHG SGNL(43)

FILE NAME: t13b018traf.dgn
PROJECT LEADER: P. COBURN
PLOT DATE: 12/31/2013
DRAWN BY: I. DEGUTIS

DURALIGHT ®

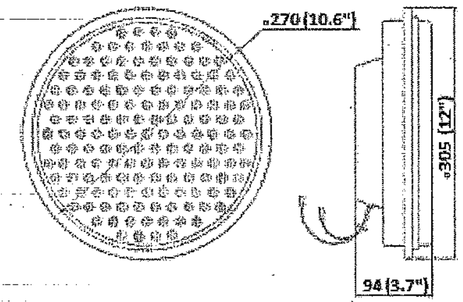
TECHNICAL DATA

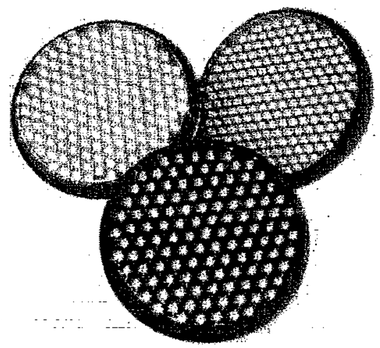
Certified by ISO9001 International Quality Control System

JXC-300CA Series LED Vehicular Lamps

Features & Specifications

- Compliance with ITE/Caltrans specifications
- Retrofit design & UV stabilized lens
- MIL-STD-883 mechanical vibration
- MIL-STD-810F moisture resistant
- Compliant to FCC Title 47
- Fully compatible with NEMA controllers/conflict monitors
- Wide viewing angle for span wire/mast arm mount





Model Number	JXC-300CAR	JXC-300CAY	JXC-300CAG
Size (mm)	300mm	300mm	300mm
Color (nm)	Red (626)	Yellow (592)	Green (505)
Voltage (Typical)	120V - 60hz	120V - 60hz	120V - 60hz
Voltage Range	80V - 135V	80V - 135V	80V - 135V
Power (w) Typical	10.5	17	12
Operation Temperature	-40°F to +165°F	-40°F to +165°F	-40°F to +165°F
Power Factor	> 0.9	> 0.9	> 0.9
T.H.D.	< 20%	< 20%	< 20%
ITE/Caltrans Specifications	Yes	Yes	Yes

All characteristics, including, chromaticity, moisture and vibration resistance, electronic noise, transient protection, etc., are conformed to standards specified in ITE LED Vehicle Signal Modules.

Graybar
works to your advantage

SIGNALSRYG, INC.
FRED CHAMBERLIN

PROJECT:
WATERBURY NHG SIGNAL 43

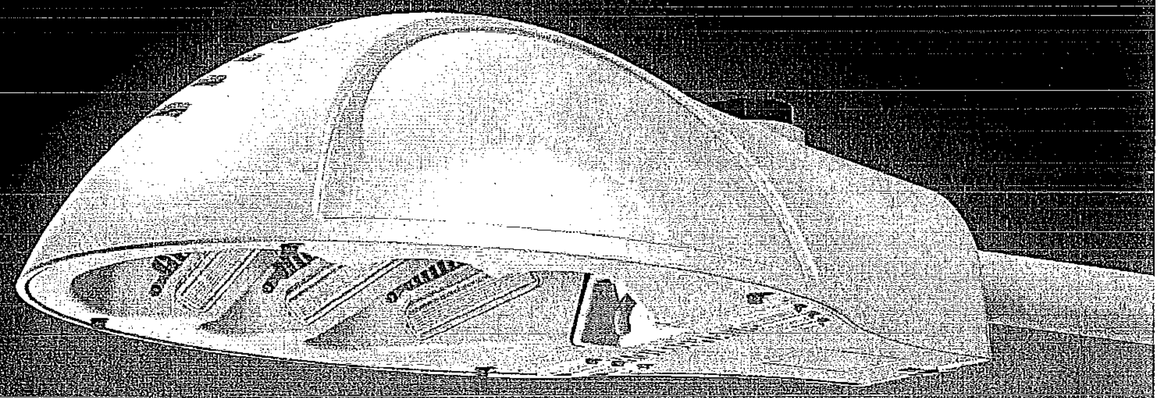
LIGHTING SUBMITTAL
03/26/2014

Mike Mone | Project Specialist Direct Line (802) 448-7607
58 Miller Lane | Williston, VT 05495 | Office (802) 660-9900 | Fax (802) 660-8700 |
mike.mone@graybar.com
www.graybar.com -

Steven Merritt | Outside Sales Representative Direct Line 802-448-7627
21 Allen Street | Rutland, VT 05701 | Office (802) 660-9900 | Fax (802) 775-3863 |
steven.merritt@graybar.com
www.graybar.com -

LEDGEND®

ROADWAY LED LUMINAIRE



Our History of Roadway Lighting is Ledgendary

- Permanent prismatic glass optics protect LED's, control light, and reduce glare
- Optimized maintained thermal management system for maximum performance and life
- Precise optical control for high application efficacy
- Multiple lumen packages offer design flexibility
- Environmentally friendly design with zero uplight prevents light pollution
- Optional dual driver system extends driver life up to 100,000 hours
- Dimming options reduce energy load

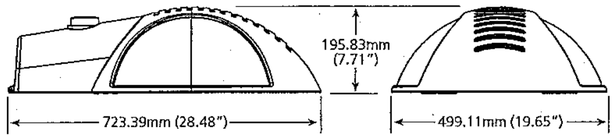
HOLOPHANE®
LEADER IN LIGHTING SOLUTIONS

LED

HL-2454 7/10

Ordering Information

Dimensional Details



Maximum Weight: 12.7 kg (28 lbs)
Maximum E.P.A.: 0.62 sq. ft.

Performance Specifications

General Construction
Rugged die cast aluminum housing, low copper aluminum, allow for corrosion resistance and long life. Horizontal arm mount with +/-6 degrees vertical adjustment. Four bolt mast arm provides easy, secure installation and adjustability for arms 1¼ to 2" (1¼- 2 ⅜ inch O.D.) Trigger latch disengages for easy access to four-bolt-mounting, terminal block, surge protection module, LED drivers, and electronic transfer switch. An optimized maintained thermal management system is achieved by combining a robust heat sink utilizing both convection and conduction methodology with a mechanical design that provides maximum airflow ensuring a minimum of 50,000 hours L70 at 25°C operating ambient. Internal perforated stainless steel cover protects the luminaire against dirt and foliage build up while maintaining the integrity of the airflow requirement. Solar guard technology isolates top cover of luminaire from thermal heat sink through four touch points providing protection from solar loading while not in operation.

Environmental
Luminaire design and tested to comply with ANSI C136:31 2001 for 100,000 cycles at 3G acceleration for normal road and bridge applications. The range of luminaire operation is -40°C to +50°C. Six sealed LED light engines meet dust and moisture rating of IP-66 per IEC 60068-2-3 1987 ensures long component life and protection from the environment. The luminaire is finished with polyester paint applied after a pretreatment process to ensure maximum durability. The finish shall pass the 1000 hour salt fog test per ASTM B117 and D1654 standard. The luminaire passed Humidity testing per IEC 60068-2-3 1987 and passed Temperature-Voltage Cycling and Condensing Humidity testing per Acuity Brands Validation Test Specification 902-00007-001

Regulatory
The luminaire is designed to meet CSA-C22.2 number 250, wet location. See chart below for model rating based on drive current and led combination.

Series	Drive Current	Number of LEDs	CSA Ambient Rating
LEDG	350mA	36,60,72,84,96,108,120	40°C
LEDG	525mA	36,48,60,72,84,96,108,120	40°C
LEDG	700mA	72,60,48,36	40°C
LEDG	700mA	84	35°C
LEDG	700mA	96	30°C
LEDG	700mA	108	25°C

The luminaire is ROHS compliant. Luminaire meets EMI compliance per FCC Title 47 CFR Part 15, Class A.

Electrical
The surge protection is tested to ANSI/IEEEC62.41-2002 specification. For the AS voltage option (120-277), the device meets category C high (20kV, 10kA). For AH voltage rating (347-480), the protection level is category C low. (6kV, 3kA) The surge protection module (SPD) protects all downstream electronics such as led drivers, transfer switch, and relays for the purpose of protecting from electrical disturbances such as nearby lightning strikes. Extended life driver option (EL 350 mA only) provides both main and auxiliary driver system extending system driver to 200,000 hours minimum. The control in EL option constantly monitors an output current of the main driver. In the event of a main driver failure (no output current), the control switches power to the auxiliary driver. The auxiliary driver is not energized during normal operation. The photocontrol receptacle is adjustable without tools and is ROAM compatible. The luminaire is designed to conform to ANSI C82.77:2002 for maximum total harmonic distortion (THD) -20%. Inrush current complies with NEMA410:2004 table B-2 and line fluctuations and ramp input voltage per UL 991:2004. The luminaire conforms to electromagnetic compatibility tests for electrostatic discharge (ESD) per IEC 61000-4-2:2001, Level 4.

Optical
Environmentally friendly, zero uplight luminaire reduces light pollution. Glass optics provides minimal dirt depreciation and will not discolor or become brittle over time. The permanence of glass results in less dirt depreciation and more maintained lumens on the intended space. The luminaire is available with narrow, medium, and wide asymmetric distributions designed to maximize pole spacing and reduce energy usage resulting in a lower total cost of ownership. The highly engineered light engine is designed to restrict direct view of individual LED's increasing visual comfort within the field of view. The luminaire is available with LED color temperatures of 4000K and 5000K. Reference www.Holophane.com for individual photometric tests on LEDgend LED luminaire that are tested per LM79 guidelines. Consult factory for LM80 data as that varies per LED chip manufacturer.

Warranty
Five year limited warranty on LED light engine. Five year limited warranty on LED drivers. Five year limited warranty on non electrical components.

PREFERRED SELECTIONS

Most Frequently Ordered Catalog Numbers

LEDG	120	35	5K	AS	H	L3	R
1	2	3	4	5	6	7	8
LUMINAIRE	LED'S	CURRENT	TEMPERATURE	VOLTAGE	COLOR	OPTICS	OPTIONS
LEDG	120	35	5K	AS	H	L3	R

CATALOG NUMBERS FOR ENTIRE PRODUCT OFFERING

(Pricing and lead times may be affected)

STEP 1- LUMINAIRE

LEDG	LEDgend LED luminaire

STEP 2- QUANTITY OF LED'S

120	120
108	108
096	96
084	84
072	72
060	60
048	48
036	36

STEP 3- DRIVE CURRENT

35	350mA driver
53	525mA driver
70[1]	700mA driver

1 Not available with 120 code

STEP 4- COLOR TEMPERATURE

4K	4,000K CCT +/- 250K
5K	5,000K CCT +/- 250K

STEP 5- VOLTAGE

AS	Auto-sensing (120-277V)
AH[1]	Auto-sensing (347-480V)

1 Not available with 36 LED's with 35 or 53 drive currents

STEP 6- HOUSING COLOR

A	As specified
G	Gray
H	Graphite
K	Black
N	Green
W	White
Z	Bronze

Colors are just a representation. Custom colors are available upon request

STEP 7- OPTICS

L1	Type I, narrow asymmetric
L2	Type II, medium asymmetric
L3	Type III, wide asymmetric
L4	Type IV, forward throw

STEP 8- OPTIONS

B	0-10 Volt dimming, bi-level dimming, constant lumen output
D	ROAM 0-10 volt dimming control
EL	Extended life driver system
PSC	Shorting cap
SP	Single pack for UPS

Photocontrols

PCS	120-277 Volt DTL
P34	347 volt DTL twist-off
P48	480 volt DTL twist-off
R	NEMA twist-off photocontrol receptacle

STEP 9- ACCESSORIES

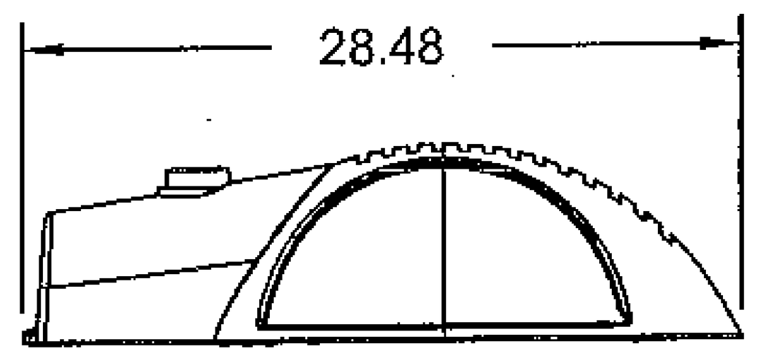
F1	Single fusing
F2	Double fusing
BR-1055-XX	P2 tenon adapter
SPDPLUGIN	Replacement surge protector auto-sensing voltage (120-277V)
SPDPLUGIN-48	Replacement surge protector auto-sensing voltage (347-480V)

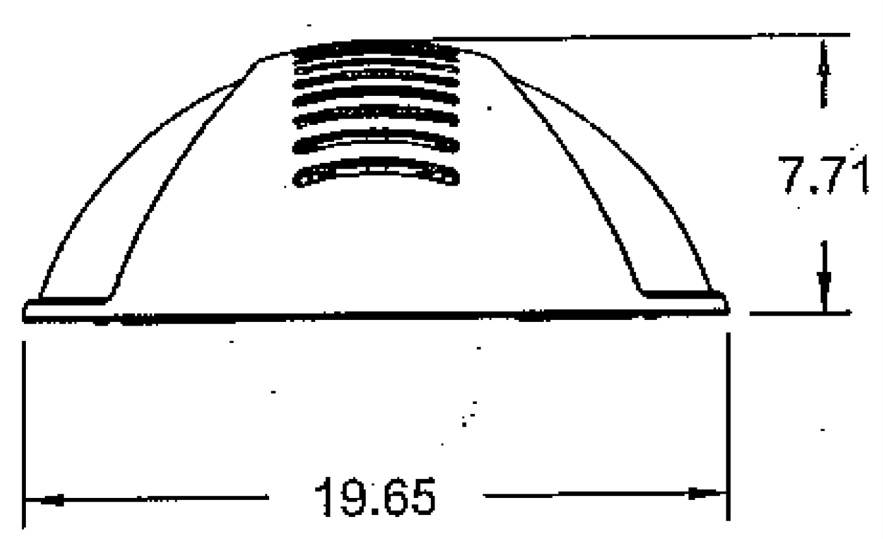
OPERATING CHARACTERISTICS

Number of LEDs	CCT	Drive Current	Minimum Delivered Lumens[1,2]	Wattage	LPW	L70 @ 25°C	L70 @ 40°C
120	4000K	350mA	9652	129	75	106,000	83,000
108	4000K	350mA	8778	116	76	110,000	85,000
96	4000K	350mA	7903	103	77	117,000	88,000
84	4000K	350mA	7029	91	77	125,000	92,000
72	4000K	350mA	6049	81	75	135,000	98,000
60	4000K	350mA	5037	65	77	146,000	106,000
48	4000K	350mA	4049	52	78	159,000	115,000
36	4000K	350mA	3060	42	73	171,000	124,000
120	4000K	525mA	12660	198	64	65,000	51,000
108	4000K	525mA	11492	178	65	68,000	53,000
96	4000K	525mA	10324	159	65	72,000	56,000
84	4000K	525mA	9156	148	62	78,000	61,000
72	4000K	525mA	7988	120	67	85,000	65,000
60	4000K	525mA	6736	99	68	94,000	72,000
48	4000K	525mA	5490	79	69	104,000	79,000
36	4000K	525mA	4241	62	68	115,000	87,000
108	4000K	700mA	14320	240	60	50,000	NA
96	4000K	700mA	13055	213	61	51,000	NA
84	4000K	700mA	11829	187	63	53,000	NA
72	4000K	700mA	9780	162	60	60,000	47,000
60	4000K	700mA	8625	133	65	65,000	52,000
48	4000K	700mA	6937	107	65	73,000	58,000
36	4000K	700mA	5248	80	66	77,000	66,000

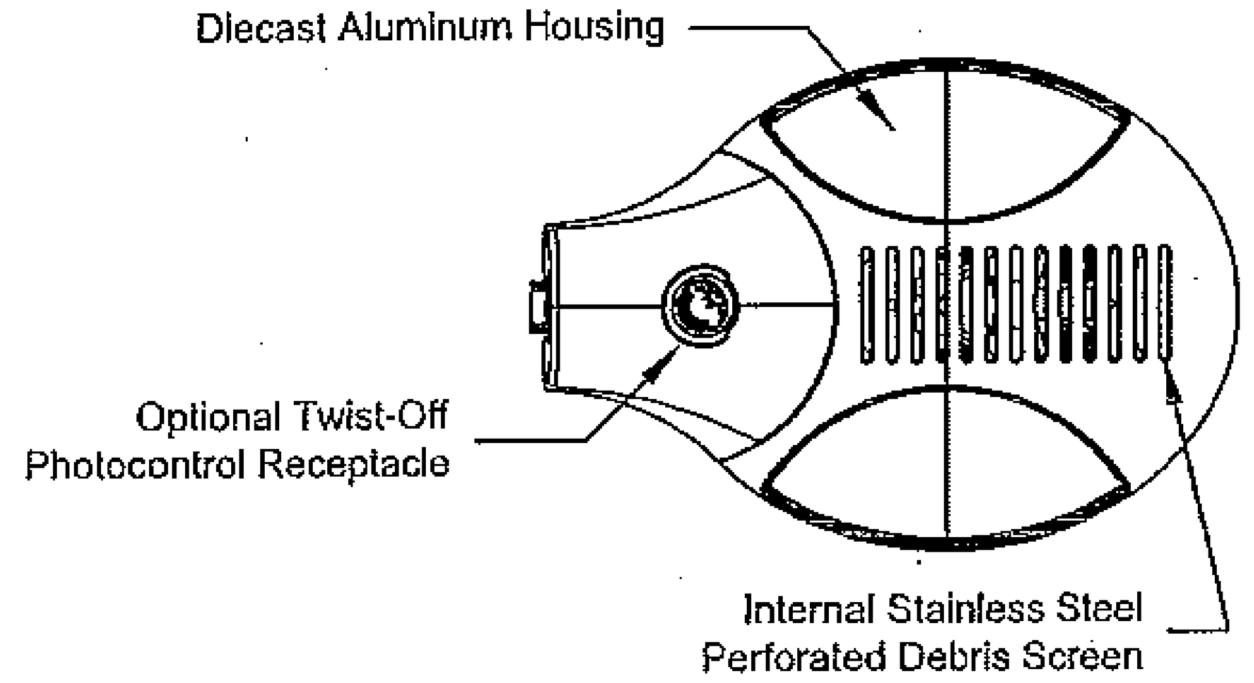
1 Minimum lumen values, reference photometric test for delivered lumens for each distribution
2 For 5000K use 1.045 multiplier X 4000 K lumen value

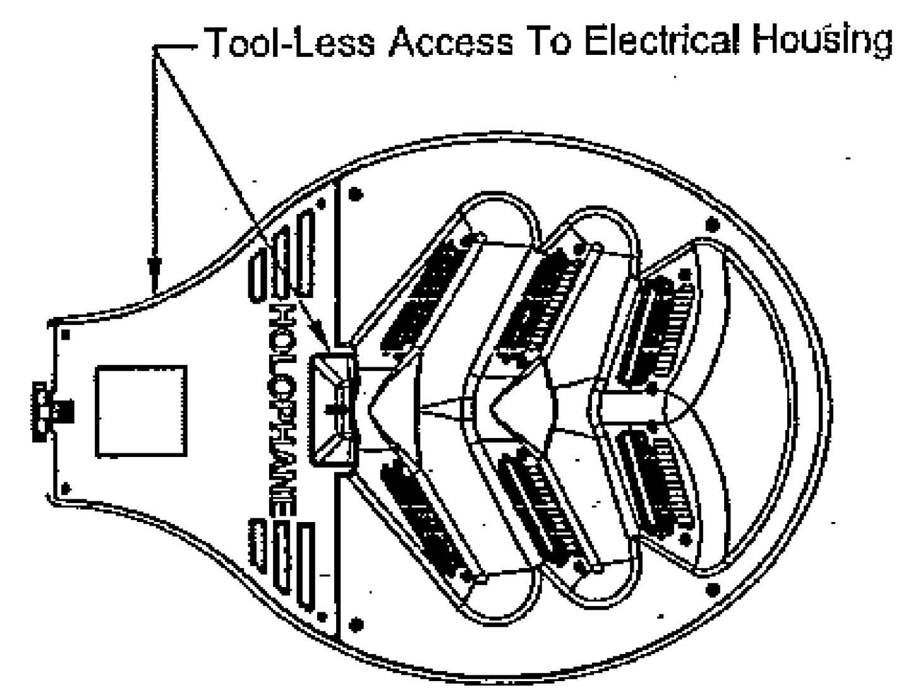
CAT# LEDG 060 70 4K AS K L3





Weight = 28lbs
EPA = .62





LEDGEND™
LED Roadway Lighting

Functional
Outdoor

HOLOPHANE®
LEADER IN LIGHTING SOLUTIONS
An AcuityBrandsCompany

ORDERING INFORMATION:

Customer Preferred: (Most Frequently Ordered Catalog Numbers)
LEDG 120 35 4K AS G L1 R F1
K L2
W

LEDG — Series
LEDgend
LED Roadway

060 — Number of LED'S
120 = 120 LED'S
108 = 108 LED'S
096 = 96 LED'S
084 = 84 LED'S
072 = 72 LED'S
060 = 60 LED'S
048 = 48 LED'S
[3]036 = 36 LED'S

70 — Drive Current
35 = 350mA Driver
53 = 525mA Driver
[4]70 = 700mA Driver

4k — Color Temperature
4K = 4,000 K CCT +/- 250K
5K = 5,000 K CCT +/- 250K

AS — Voltage
AS = Auto-Sensing Voltage (120 thru 277)
[2]AH = Auto-Sensing Voltage (347 thru 480)

K — Housing Color
A = As Specified
G = Gray
H = Graphite
K = Black
N = Green
W = White
Z = Bronze

L3 — Optics
L1 = Type I, Narrow Asymmetric
L2 = Type II, Medium Asymmetric
L3 = Type III, Wide Asymmetric
L4 = Type IV, Forward Throw

R — Options

OPTIONS
B = Constant Lumen Output, Bi-Level Dimming
C = Constant Lumen Output
DE = ROAM CONCIERGE Dimming Control
VE = ROAMVIEW Dimming Control
EL = Extended Life - Driver
PCS = DTL Solid-State Lighting Photocontrol 120-277V
P34 = DTL Twist-Off Photocontrol 347V
P48 = DTL Twist-Off Photocontrol 480V
PSC = Shorting Cap
R = NEMA Twist-Off Photocontrol Receptacle
SP = Single Pack For UPS

Accessories

ACCESSORIES
F1 = Single Fusing (120, 240, 277, 347V)
F2 = Double Fusing (208, 240, 480V)
BR-1055-XX = P2 Tenon Adapter
LEDGHSS = House Side Shield

NOTES:
[2]Not available with 36 LED's with 35 or 53 drive currents or with options B, C, DE, VE, EL or PCS
[3]Not available with B, C, DE or VE options with 53 drive current
[4]Not available with 120 LED's

ORDER #:
TYPE:
DRAWN: JRM
DATE: 10/31/12
DWG #: LUM_LEDG

Specifications

General Construction

Rugged die cast aluminum housing, low copper aluminum, allow for corrosion resistance and long life. Horizontal arm mount with +/-6 degrees vertical adjustment. Four bolt mast arm provides easy, secure installation and adjustability for arms 1-1/4 & 2 inch pipe (1.66" & 2.38" O.D.) Trigger latch disengages for easy access to four bolt mounting, terminal block, surge protection module, LED drivers, and electronic transfer switch. An optimized maintained thermal management system is achieved by combining a robust heat sink utilizing both convection and conduction methodology with a mechanical design that provides maximum airflow ensuring a minimum of 50,000 hours L70 at 25C operating ambient. Internal perforated stainless steel cover protects the luminaire against dirt and foliage build up while maintaining the integrity of the airflow requirement. Solar guard technology isolates top cover of luminaire from thermal heat sink through four touch points providing protection from solar loading while not in operation.

Environmental

Luminaire design and tested to comply with ANSI C136:31 2001 for 100,000 cycles at 3G acceleration for normal road and bridge applications. The range of luminaire operation is -40C to +50C.

Six sealed LED light engines meet dust and moisture rating of IP-66 per IEC 60068-2-3 1987 ensures long component life and protection from the environment.

The luminaire is finished with polyester paint applied after a pretreatment process to ensure maximum durability. The finish shall pass the 1000 hour salt fog test per ASTM B117 and D1654 standard.

The luminaire passed Humidity testing per IEC 60068-2-3 1987 and passed Temperature-Voltage Cycling and Condensing Humidity testing per Acuity Brands Validation Test Specification 902-00007-001

Regulatory

The luminaire is safety listed to CSA-C22.2 number 250, wet location. See chart below for model rating based on drive current and led combination.

Series	Drive Current	Number of LED'S	CSA Ambient Listing
LEDG	350 mA	36,60,72,84,96,108,120	40C
LEDG	525 mA	36,48,60,72,84,96,108,120	40C
LEDG	700 mA	72,60,48,36	40C
LEDG	700 mA	84	35C
LEDG	700 mA	96	30C
LEDG	700 mA	108	25C

The luminaire is ROHS compliant. Luminaire meets EMI compliance per FCC Title 47 CFR Part 15, Class A.

Electrical

The surge protection is tested to ANSI/IEEEC62.41-2002 specification. For the AS voltage option (120-277), the device meets category C high (20kV, 10kA). For AH voltage rating (347-480), the protection level is category C low. (6kV, 3kA) The surge protection module (SPD) protects all downstream electronics such as led drivers, transfer switch, and relays for the purpose of protecting from electrical disturbances such as nearby lightning strikes.

Extended life driver option (EL 350 mA only) provides both main and auxiliary driver system extending system driver to 200,000 hours minimum. The control in EL option constantly monitors an output current of the Main Driver. In the event of a Main driver failure (no output current), the control switches power to the Auxiliary driver. The Auxiliary driver is not energized during normal operation.

The photocontrol receptacle is adjustable without tools and is ROAM compatible.

The luminaire is designed to conform to ANSI C82.77:2002 for Maximum Total Harmonic Distortion (THD) -20%. Inrush current complies with NEMA410:2004 table B-2 and line Fluctuations and Ramp input voltage per UL 991:2004.

The luminaire conforms to Electromagnetic compatibility tests for Electrostatic Discharge (ESD) per IEC 61000-4-2:2001, Level 4.

Optical

Environmentally friendly, zero uplight luminaire reduces light pollution. Glass optics provides minimal dirt depreciation and will not discolor or become brittle over time. The permanence of glass results in less dirt depreciation and more maintained lumens on the intended space. The luminaire is available with narrow, medium, and wide asymmetric distributions designed to maximize pole spacing and reduce energy usage resulting in a lower total cost of ownership. The highly engineered light engine is designed to restrict direct view of individual LED's increasing visual comfort within the field of view. The luminaire is available with LED color temperatures of 4000K and 5000K. The minimum color rendering index (CRI) is 70.

Reference www.Holophane.com for individual photometric tests on LEDgend LED luminaire that are tested per LM79 guidelines. Consult factory for LM80 data as that varies per LED chip manufacturer.

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ORDER #:
TYPE:
DRAWN: LJS
DATE: 10/6/11
DWG #: LUM_LEDG

Operating Characteristics

Number of LED's	CCT	Drive Current	Min Delivered lumens *	Input operating Amps						Input Watts	LPW	L70 @ 25C	L70 @ 40C	Driver life @25C hrs
				120V	208V	240V	277V	347V	480V					
120	4000K	350Ma	9652	1.07	0.63	0.55	0.48	0.37	0.27	129	75	106,000	83,000	100,000
108	4000K	350Ma	8778	0.96	0.57	0.50	0.43	0.33	0.24	116	76	110,000	85,000	100,000
96	4000K	350Ma	7903	0.86	0.50	0.44	0.38	0.30	0.22	103	77	117,000	88,000	100,000
84	4000K	350Ma	7029	0.75	0.44	0.39	0.34	0.26	0.19	91	77	125,000	92,000	100,000
72	4000K	350Ma	6049	0.68	0.40	0.36	0.32	0.23	0.18	81	75	135,000	98,000	100,000
60	4000K	350Ma	5037	0.54	0.32	0.28	0.24	0.19	0.14	65	77	146,000	106,000	100,000
48	4000K	350Ma	4049	0.43	0.25	0.22	0.19	0.15	0.11	52	78	159,000	115,000	100,000
36	4000K	350Ma	3060	0.35	0.22	0.19	0.16	NA	NA	42	73	171,000	124,000	100,000
120	4000K	525Ma	12660	1.65	0.95	0.86	0.75	0.60	0.43	198	64	65,000	51,000	100,000
108	4000K	525Ma	11492	1.49	0.86	0.77	0.68	0.54	0.39	178	65	68,000	53,000	100,000
96	4000K	525Ma	10324	1.32	0.76	0.69	0.60	0.48	0.34	159	65	72,000	56,000	100,000
84	4000K	525Ma	9156	1.22	0.73	0.65	0.59	0.44	0.33	148	62	78,000	61,000	100,000
72	4000K	525Ma	7988	0.98	0.57	0.50	0.44	0.35	0.26	120	67	85,000	65,000	100,000
60	4000K	525Ma	6736	0.83	0.48	0.43	0.38	0.30	0.22	99	68	94,000	72,000	100,000
48	4000K	525Ma	5490	0.66	0.38	0.34	0.30	0.24	0.17	79	69	104,000	79,000	100,000
36	4000K	525Ma	4241	0.52	0.31	0.27	0.25	NA	NA	62	68	115,000	87,000	100,000
108	4000K	700Ma	14320	2.01	1.15	1.02	0.90	0.70	0.51	240	60	50,000	NA	50,000
96	4000K	700Ma	13055	1.79	1.02	0.91	0.80	0.62	0.45	213	61	51,000	NA	65,000
84	4000K	700Ma	11829	1.56	0.89	0.79	0.70	0.54	0.40	187	63	53,000	NA	80,000
72	4000K	700Ma	9780	1.34	0.77	0.68	0.60	0.47	0.34	162	60	60,000	47,000	95,000
60	4000K	700Ma	8625	1.12	0.64	0.57	0.50	0.39	0.28	133	65	65,000	52,000	100,000
48	4000K	700Ma	6937	0.91	0.52	0.46	0.41	0.31	0.23	107	65	73,000	58,000	100,000
36	4000K	700Ma	5248	0.67	0.38	0.34	0.30	0.23	0.17	80	66	77,000	66,000	100,000

1. * Minimum lumen values, reference photometric test for delivered lumens for each distribution
2. For 5000K use 1.045 multiplier X 4000 K lumen value

Warranty
Limited warranty located at
www.acuitybrands.com/CustomerResources/Terms _and_conditions.aspx

Actual performance may differ as a result of end-user environment and application.

Actual wattage may differ by +/-8% when operating between 120-480V +/-10%.

NOTE: Specifications subject to change without notice.

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LED Roadway Lighting

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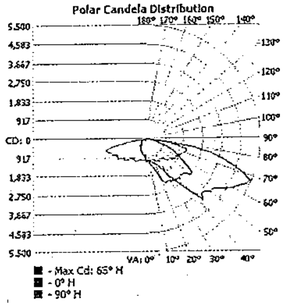
ORDER #:
TYPE:
DRAWN: JRM
DATE: 1/21/13
DWG #: LUM_LEDG

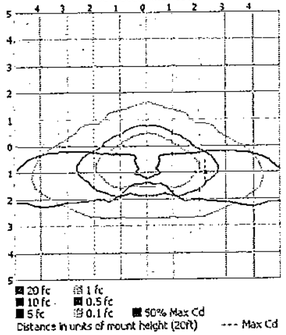
OUTDOOR PHOTOMETRIC REPORT
CATALOG: LEDG 060 70 4K AS 2H L3

TEST #:	500974
TEST LAB:	ACUITY BRANDS LIGHTING GRANVILLE LAB
ISSUE DATE:	4/20/2011
CATALOG #:	LEDG 060 70 4K AS 2H L3
LUMINAIRE:	LEDGEND
LAMP CAT #:	CREE XP-G
LAMP:	10 X 12 4K LED ARRAY CREE XP-G
LAMP OUTPUT:	TOTAL LUMINAIRE LUMENS: 8627.2
	TEST BASED ON ABSOLUTE PHOTOMETRY *
BALLASTCAT:	BL-1142
BALLAST:	2 X 120V 150W ELECTRONIC LED INTA 0700C 210 FO
INPUT WATTAGE:	140
LUMINOUS OPENING:	CIRCULAR (DIA: 3")
Max Cd:	5,428.0 AT HORIZONTAL: 65°, VERTICAL: 67.5°
Roadway Class:	SHORT, TYPE III

Polar Candela Distribution



Isofootcandle Plot



*TEST BASED ON ABSOLUTE PHOTOMETRY WHERE LAMP LUMENS=LUMENS TOTAL.
*CUTOFF CLASSIFICATION AND EFFICIENCY CANNOT BE PROPERLY CALCULATED FOR ABSOLUTE PHOTOMETRY.

VISUAL PHOTOMETRIC TOOL 1.2.46 COPYRIGHT 2014, ACUITY BRANDS LIGHTING
REPORTED DATA CALCULATED FROM MANUFACTURER'S DATA FILE, BASED ON IESNA RECOMMENDED METHODS.

OUTDOOR PHOTOMETRIC REPORT
CATALOG: LEDG 060 70 4K AS 2H L3

ZONAL LUMEN SUMMARY

Zone	Lumens	% Luminaire
0-30	1,030.1	11.9%
0-40	2,023.0	23.4%
0-60	5,303.4	61.5%
60-90	3,323.8	38.5%
70-100	1,466.5	17%
90-120	0	0%
0-90	8,627.2	100%
90-180	0	0%
0-180	8,627.2	100%

LUMENS PER ZONE

Zone	Lumens	% Total	Zone	Lumens	% Total
0-10	100.0	1.2%	90-100	0	0%
10-20	314.9	3.7%	100-110	0	0%
20-30	615.3	7.1%	110-120	0	0%
30-40	992.9	11.5%	120-130	0	0%
40-50	1,443.2	16.7%	130-140	0	0%
50-60	1,837.3	21.3%	140-150	0	0%
60-70	1,857.3	21.5%	150-160	0	0%
70-80	1,269.9	14.7%	160-170	0	0%
80-90	196.5	2.3%	170-180	0	0%

ROADWAY SUMMARY

Distribution:	TYPE III, SHORT
Max Cd, 90 Deg Vert:	0
Max Cd, 80 to <90 Deg:	2,828.0

	Lumens	% Lamp
Downward Street Side:	7,102.0	82.3%
Downward House Side:	1,524.5	17.7%
Downward Total:	8,626.5	100%
Upward Street Side:	0	0%
Upward House Side:	0	0%
Upward Total:	0	0%
Total Lumens:	8,626.5	100%

LCS TABLE

BUG RATING	B1 - U0 - G2	
FORWARD LIGHT	LUMENS	LUMENS %
Low(0-30):	689.8	8%
Medium(30-60):	3,567.1	41.3%
High(60-80):	2,685.8	31.1%
Very High(80-90):	159.3	1.8%
BACK LIGHT		
Low(0-30):	340.1	3.9%
Medium(30-60):	705.9	8.2%
High(60-80):	442.4	5.1%
Very High(80-90):	36.2	0.4%
UPLIGHT		
Low(90-100):	0	0%
High(100-180):	0	0%
TRAPPED LIGHT:	0.8	0%

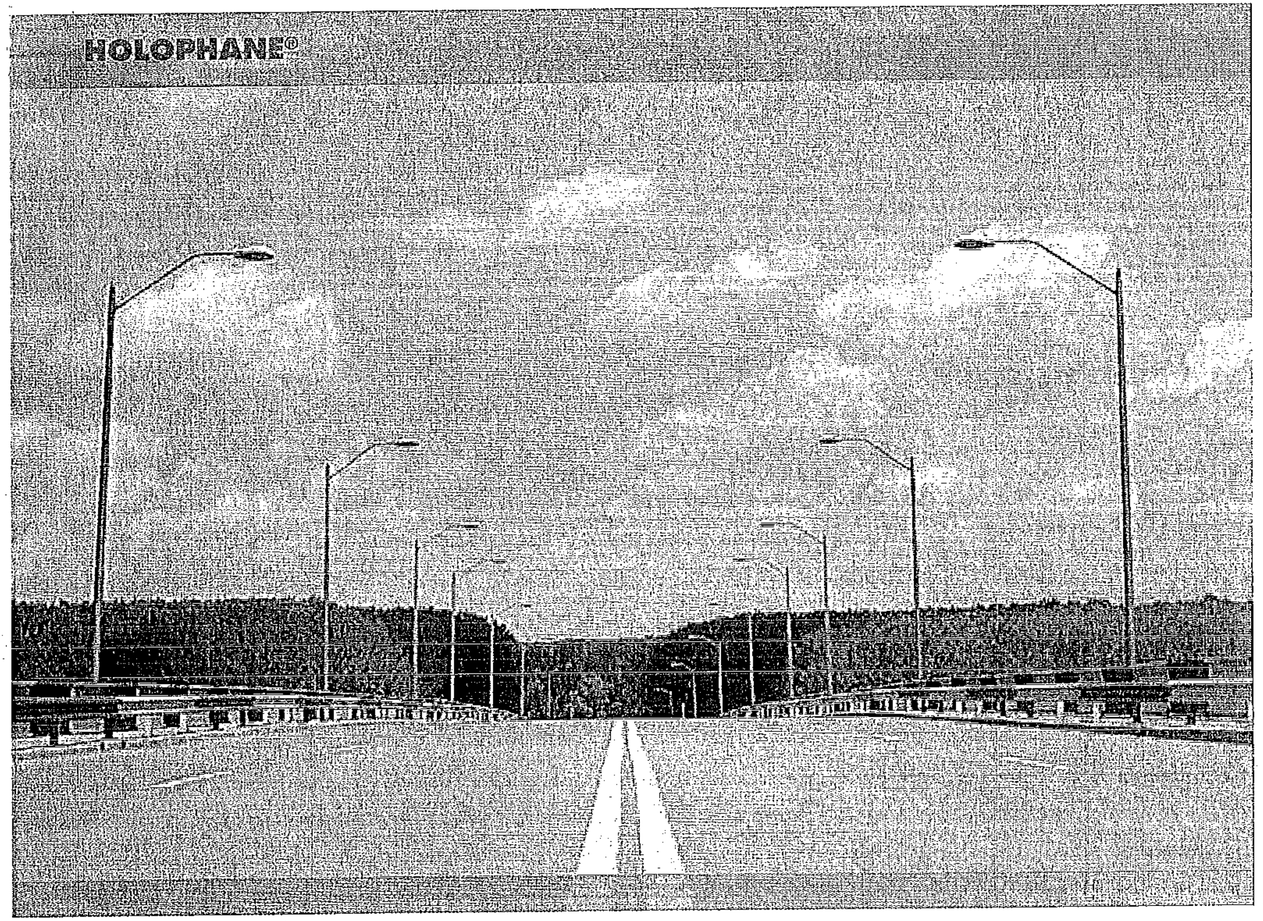
OUTDOOR PHOTOMETRIC REPORT
CATALOG: LEDG 060 70 4K AS 2H L3

AcuityBrands.

CANDELA TABLE - TYPE C

	0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180
0	1083	1083	1083	1083	1083	1083	1083	1083	1083	1083	1083	1083	1083	1083	1083	1083	1083	1083	1083
5	1128	1129	1129	1124	1118	1113	1105	1096	1089	1084	1079	1078	1076	[illegible]	1076	1075	1068	1061	1055
10	1299	1297	1297	1289	1275	1258	1243	1226	1213	1201	1187	1170	1149	1132	1121	1109	1089	1068	1052
15	1551	1547	1530	1499	1478	1460	1431	1406	1383	1344	1307	1273	1236	1212	1196	1169	1122	1086	1056
20	2134	2098	2072	2023	2012	1970	1910	1786	1676	1562	1495	1426	1367	1306	1240	1193	1161	1139	1092
25	2322	2284	2269	2311	2367	2431	2343	2240	2134	2019	1886	1726	1608	1527	1444	1350	1258	1231	1215
30	2356	2327	2311	2370	2407	2356	2306	2294	2321	2454	2588	2549	2250	2075	1756	1531	1407	1272	1195
35	2425	2425	2474	2537	2534	2460	2402	2417	2561	2922	3207	3466	3115	2563	2241	1984	1602	1341	1193
40	2463	2508	2633	2717	2702	2711	2737	3005	3490	3723	3808	4022	4000	3430	2675	2056	1796	1552	1226
45	2442	2546	2646	2651	2632	2707	3020	3665	4148	4263	4369	3909	4157	3737	3404	2639	[illegible]	1637	1466
50	2697	2780	2918	2878	2776	2807	3196	3814	4095	4704	4890	4799	4006	4009	3645	2998	2283	1829	1479
55	2526	2607	2759	2776	2851	3116	4198	4577	4806	4294	4668	4919	4894	4234	3910	3390	2513	1918	1677
60	1837	1907	1989	1985	2088	2449	3441	4620	4897	5181	4649	4768	5075	4806	4309	3920	3153	2091	1602
65	1535	1573	1654	1624	1698	2032	2741	3045	3661	4363	4671	4692	4924	5295	4916	4315	3661	2675	1817
70	881	898	957	1027	1120	1456	1889	2450	2541	2788	3400	4122	4266	5007	5386	4998	4059	3057	1949
75	474	484	515	567	616	642	745	918	1407	1861	2168	2621	3377	3826	4787	4692	4104	3115	2014
80	230	238	[illegible]	293	333	391	432	455	473	584	975	1427	1952	2220	2828	[illegible]	2177	1296	897
85	62	64	[illegible]	86	104	124	139	150	160	161	138	[illegible]	[illegible]	150	135	[illegible]	144	127	120
90	0	0	0	0	0	0	0	0	0	0	0	[illegible]	[illegible]	0	0	0	0	0	0
95	0	0	0	0	0	0	0	0	0	0	0	[illegible]	[illegible]	0	0	0	0	0	0
100	0	0	0	0	0	0	0	0	0	0	0	0	[illegible]	0	0	0	0	0	0
105	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
110	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
115	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
120	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
125	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
130	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
135	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
140	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
145	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
150	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
155	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

160	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
165	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
170	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
175	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
180	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

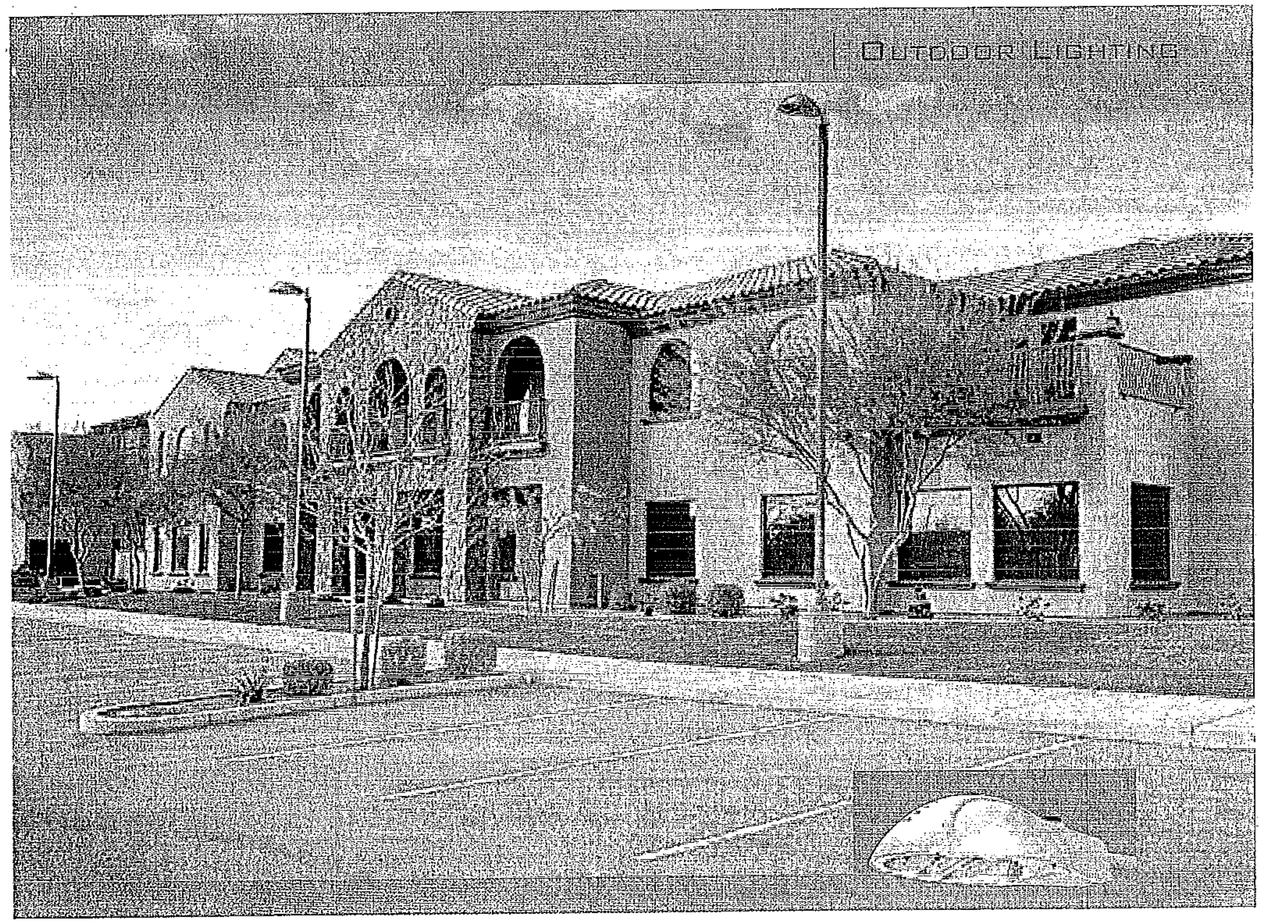


LEDGEND®

Roadway and Area LED

Holophane is the preeminent innovator and leading brand in roadway lighting systems designed to meet industry-specific needs.

LED



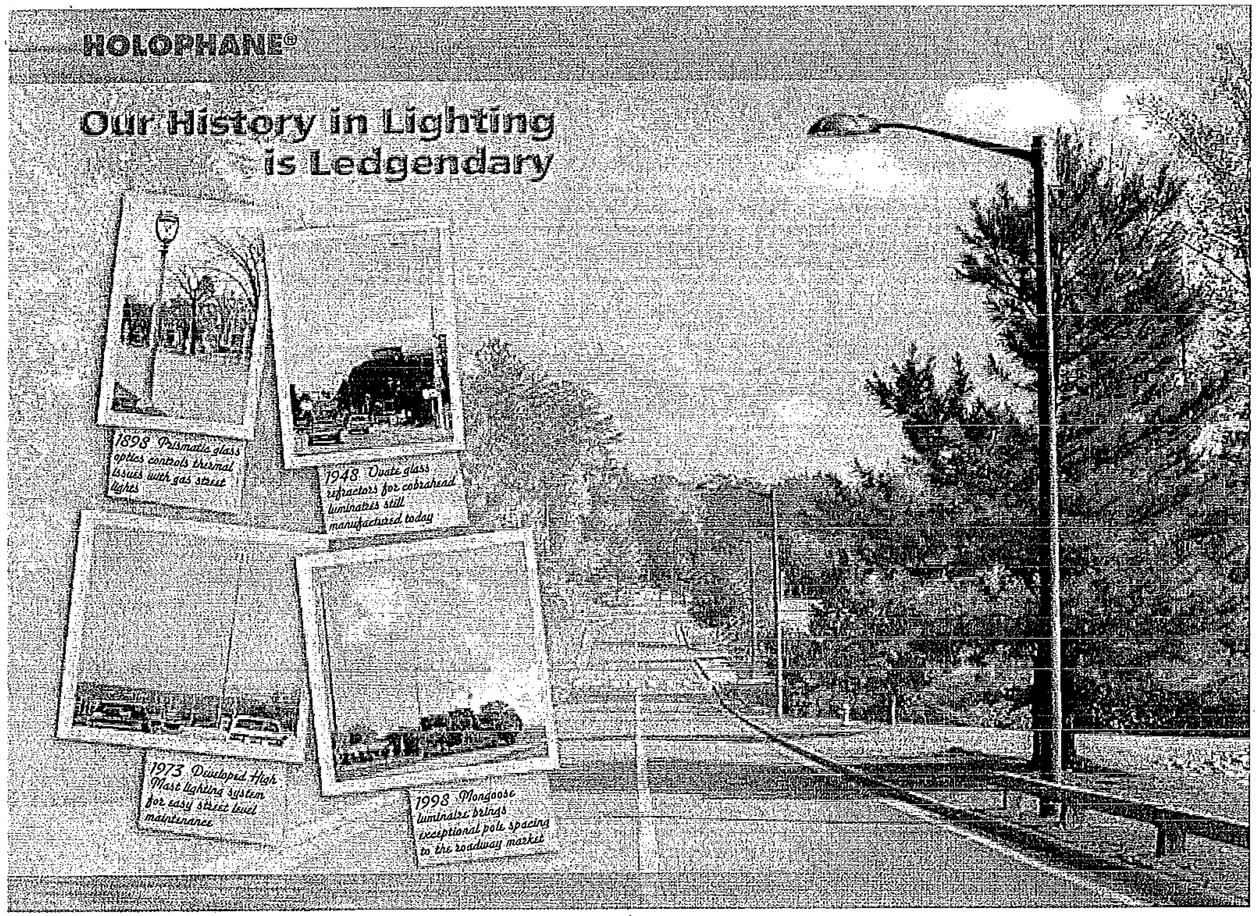
FEATURES AND BENEFITS

- Permanent prismatic glass optics protect LED's, control light, and reduce glare
- Optimized maintained thermal management system for maximum performance and life
- Precise optical control for high application efficacy
- Multiple lumen packages offer design flexibility replacing 50-310 watt luminaires
- Environmentally friendly design with zero uplight prevents light pollution
- Optional dual driver system extends driver life up to 200,000 hours
- Dimming options reduce energy load
- Area and roadway lighting distributions

TYPICAL APPLICATIONS

- Municipal Streets and Public Roadways
- Residential Areas
- Campuses
- Military Bases
- Industrial Parks
- Hotels/Resorts
- Bridges
- Municipal Parks
- Recreation Centers
- Parking Lots

Our History in Lighting is Ledgendary



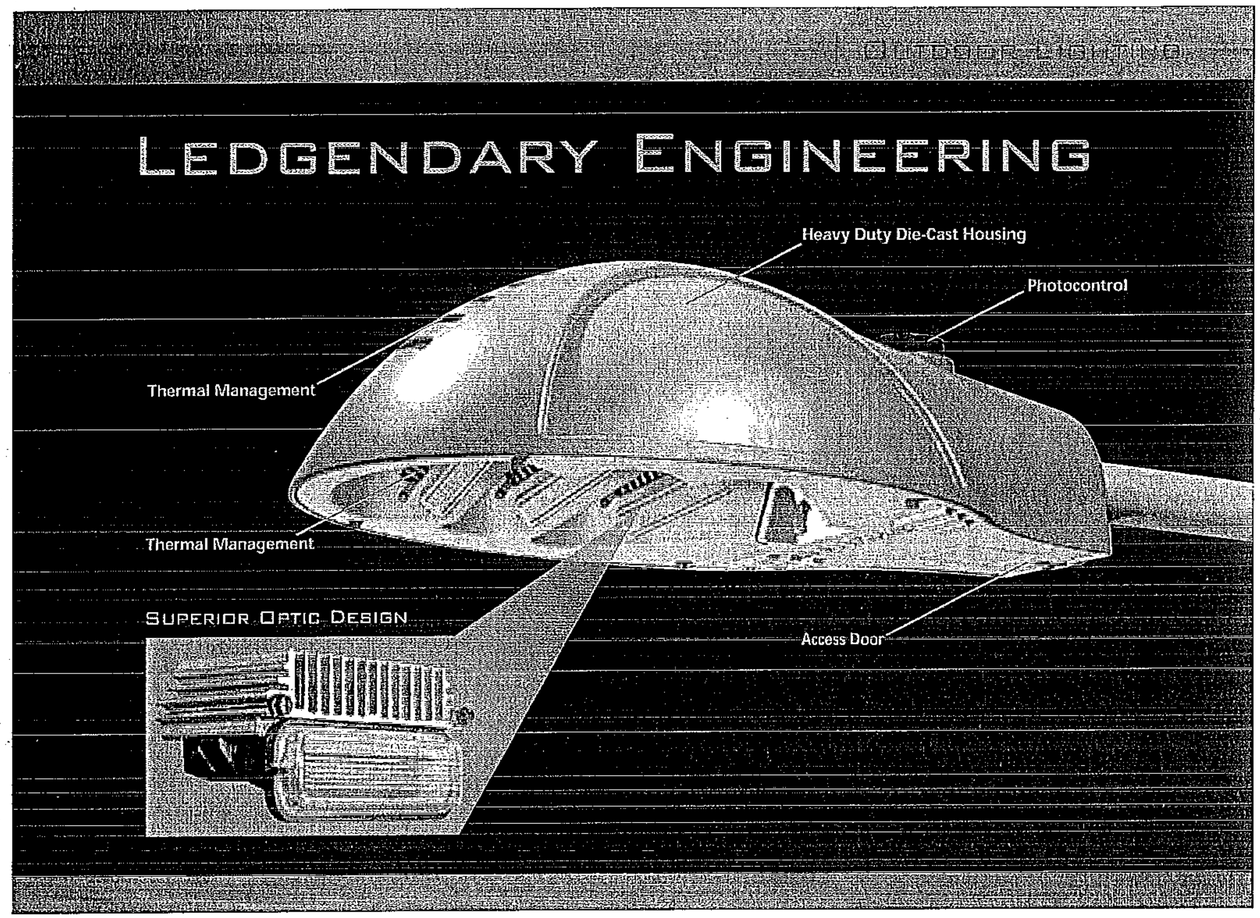
During the 1890s, Holophane pioneered glass globes for gas street lights that illuminated main streets across America. We were also instrumental in developing the technology to manage the thermal issues posed by the gas burners. During the 1940s, Holophane developed an ovate refractor that revolutionized street lighting by utilizing prismatic glass technology. We still produce these refractors in our glass plant in Newark, Ohio, with millions of units installed in cobrahead style roadway products worldwide.

New LEDgend Luminaires

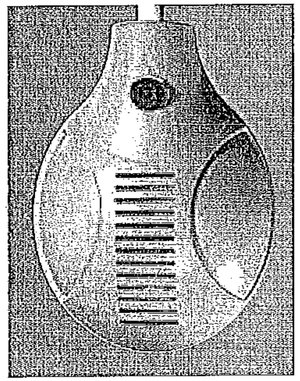
This heritage of leadership in lighting technology continues as Holophane leverages its technical expertise to efficiently control both the optical and thermal challenges associated with LED technology. Holophane LEDgend luminaires meet modern demands for sustainability and long-term performance by combining superior quality with outstanding engineering to effectively manage heat for longer luminaire life and higher lumen output.

Premium LEDgend luminaires are designed to enhance visual comfort and safety for pedestrians and drivers. Their sustainable modular design facilitates fixture upgrades as LED technology advances over time.

LEDGENDARY ENGINEERING

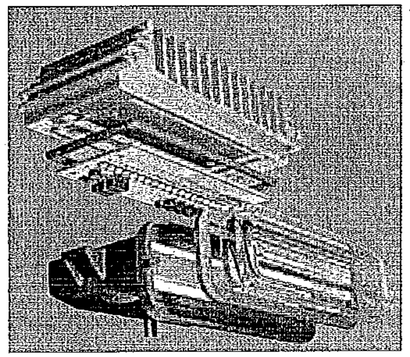


Heavy Duty Die-Cast Housing holds and protects electronic driver, optics and other luminaire components.

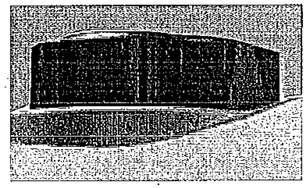


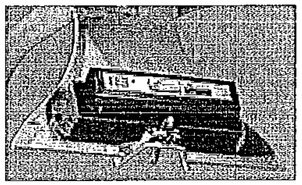
Thermal Management engineered to provide intricate heat sinking design allowing air convection and conduction to keep LEDs and Driver cool.

Superior Optical Design features precise optical control via high performance reflector and prismatic glass refractor lens.



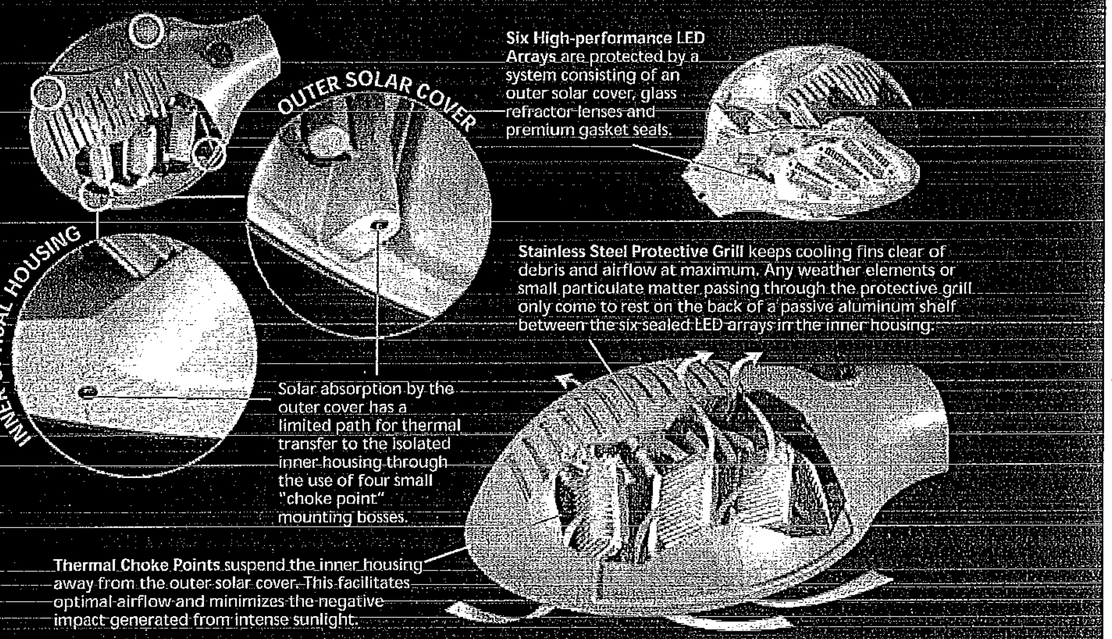
Photocontrol saves energy and reduces costs with reliability and accurate light sensing.





Access Door provides tool-less access to LED driver, terminal block, surge module and arm mounting bolts.

Thermal Management

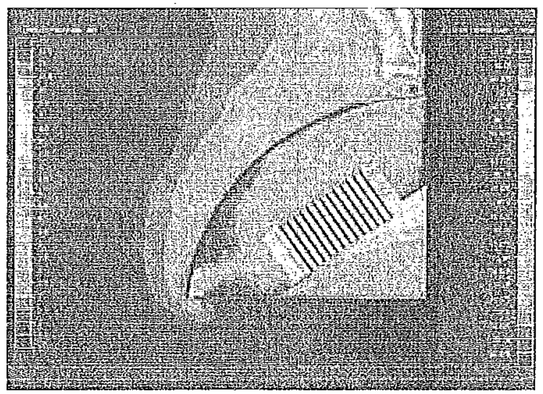


Better maintained thermal performance and lower Junction Temperature equals longer life and higher delivered lumen output for the LED

Electrical current that is not converted into light at the semi-conductor junction turns into heat and results in increasing temperatures that reduce lumen output and LED life. Junction temperature is affected by the ambient temperature surrounding the LEDs, the thermal path junction through the heat sink, air flow through the unit and the outside ambient temperature.

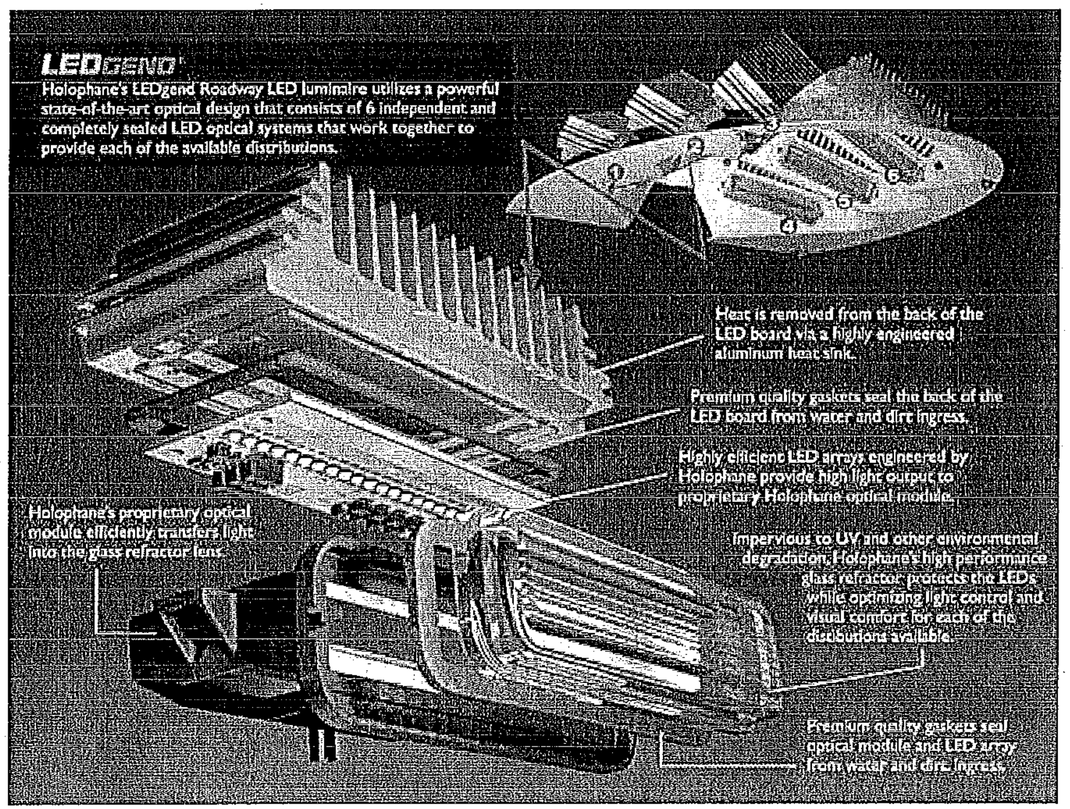
LEDgend luminaires incorporate intricate heat sinking technology to provide air convection and conduction that keeps the LEDs and the driver cool to ensure longer life, higher delivered lumens and color consistency. An internal perforated cover prevents debris accumulation and facilitates flow-through ventilation to keep components cool.

Holophane LEDgend luminaires are designed for a minimum 80,000 hours of maintenance–free operation in a 40C ambient attaining 70 percent of the initial lumen output (350mA only). Longer life is attained when the fixtures operate at lower ambient temperatures of 15°C to 25°C.



Thermal "venturi effect" optimizes heat transfer

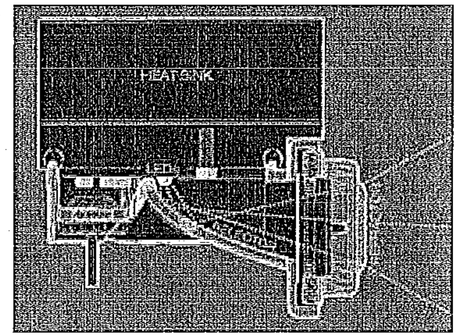
Precise Optical Control



The fixtures' prismatic glass refractor lens offers permanence and ensures long-term performance with very low dirt depreciation, resulting in more light within the intended space. A sealed optical system provides an IP66 ingress rating against water and dust and extends component life. Glass optics, a legendary core value to the Holophane brand, never yellow, haze, scratch, or discolor and will not become brittle over time.

LEDgend luminaire optics are designed to maximize pole spacing and reduce energy usage resulting in a lower total cost of ownership.

The LEDgend's highly engineered light engine is designed to restrict the direct view of individual LED's. The result is a luminaire that appears "wholly luminous" without the unsightly view of individual LED points of light, increasing visual comfort within the field of view.



Cross section of a LEDgend LED optical module illustrating how the reflector bends the light into the glass refractor.

Application Efficacy

A major benefit of the LEDgend luminaire is directing the distribution precisely on task. The benefit to the customer is that poles may be spaced further apart, improving visibility, minimizing light trespass, improving visual comfort, with less consumed wattage as compared to traditional sources and competitive LED products.

A major component to evaluating LED sourced luminaires is applied lumens. This is a metric that defines how well a luminaire distributes the lighting in the intended space while meeting the uniformity and veiling luminance (glare) requirements per industry standards for roadway lighting.

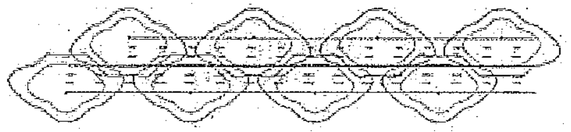
The example on the right illustrates applied lumens comparing an existing HPS cobrahead and competing LED roadway luminaire to the LEDgend luminaire.

Application: Three lanes each direction with thirty five foot poles mounted in staggered configuration with luminaire placed at edge of pavement. This simulation is a replacement of existing 150 HPS luminaires originally designed to meet 1 footcandle maintained with a 3.0:1 Avg/Min uniformity ratio.

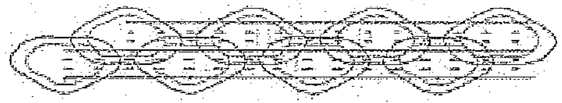
Visualization of Applied Lumens @ 168' Pole Spacing

Inner Ring = .5 Footcandles; Outer ring = .25 Footcandles

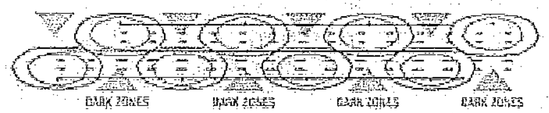
Traditional HPS Cobrahead 115 15S DG



Holophane LEDgend LED



Competitive LED Product



System Comparison:

LEDgend meets existing maintained light levels with 31% energy savings over existing HPS Cobraheads.

Luminaire Performance	150 HPS Qvate Cobrahead	LEDgend	LED Competitor
	115-15S-DG	LEDG120L3	Type 3
Pole Spacing	168	168	168
Average Footcandles	1.00	1.00	0.75 [1]
Avg/Min	2.33:1	2.86:1	2.14:1
Max/Min	5.09:1	4.60:1	5.14:1
Power (Watts)	186	129	157
Energy Savings	Baseline	31%	16%

1 To meet 1.0 average footcandle, 3.0:1 Avg/Min uniformity, poles for LED Competitor would need to be spaced 125 foot staggered grid.

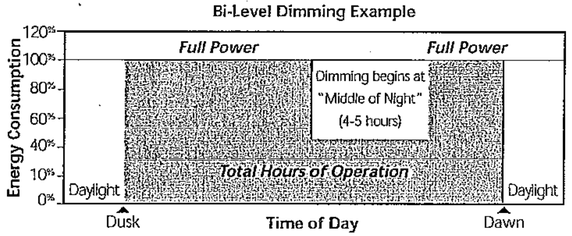
As compared to a typical LED competitor, the LEDgend provides 25% more light on the roadway while consuming 22% less energy

DIMMING CAPABILITIES

Bi-Level Dimming

Many municipalities are looking for the ability to reduce their energy loads even further by dimming luminaires during off-peak hours. The LEDgend luminaire is available with an integral control system that automatically reduces power. Light output is set at 100% until the midpoint of the night, then reduces to 50% light output for up to five hours. Since LED's deliver more efficacy (lpw) when driven at lower power, this translates to an energy savings of up to 55% during the dimmed state. The integrated intelligence of the control device daily monitors on/off cycles and adjusts for current sunset/ sunrise time so that the luminaire is always synchronized with the environment. And all of this without the need for an expensive external control system... Perfect for seamlessly enabling this great energy reduction on existing installations.

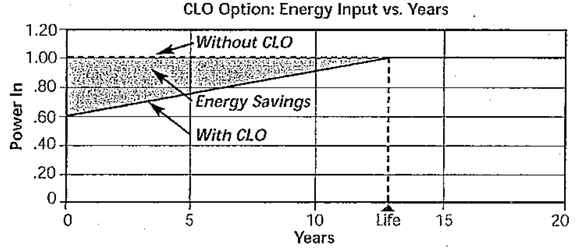
Bi-Level Dimming Example



Constant Lumen Output

Another innovative option available with the LEDgend is constant lumen output (CLO). This option provides constant lumen output for the entire life of the luminaire. The embedded intelligence compensates for the natural lumen depreciation of the LED. Since most street lighting is designed to maintain a specific level of lighting, this avoids the traditional waste of light and energy that would normally occur for any lighting installation. The luminaire is initially driven at roughly 60% of power, and then power is gradually increased as the system ages. Over the lifetime of the installation, this can provide a 15% overall energy savings. This allows LEDgend to add a whole new level of incremental energy savings while ensuring that light levels are maintained for the entire life of the installation. And most importantly, it accelerates the early years of energy savings so critical to ensuring a good economic payback.

CLO Option: Energy Input vs. Years

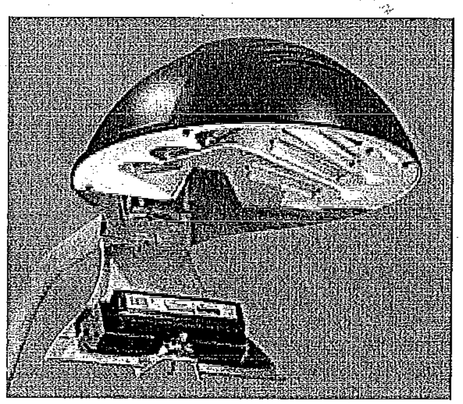


SURGE PROTECTION

Most electronic ballasts or drivers cannot survive long-term outdoor transient levels without added surge protection. State of the art Holophane-designed surge protection extends LEDgend luminaire life by protecting electronic devices from electrical disturbances, including nearby lightning strikes. This protection extends to all downstream electronics including LED drivers, photo controls, and relays. Instead of replacing an expensive light engine or driver, all that may be needed is a replacement surge device. As a result, LEDgend luminaires offer a higher level of protection and a more economical replacement solution if and when mother nature strikes.

DUAL DRIVER

A major benefit of LED technology is long life. The benefit to our customers is reduced maintenance costs. The optional dual driver system available with LEDgend luminaires increases driver life to approximately 200,000 hours (350mA only). The dual driver system incorporates an electronic transfer switch that senses current on the main driver and will switch to the auxiliary driver when a failure occurs. The auxiliary driver does not energize until the main driver fails and includes a built in time delay that eliminates nuisance switching due to power fluctuations. Luminaires incorporating the dual driver system eliminate a trip to the field to replace a failed driver, which reduces travel and labor expenses. Fewer inventoried replacement parts and less equipment rental and labor coordination translate into significant maintenance savings that free capital for today's more pressing city service demands.



Intelligent lighting systems utilizing Acuity Brands ROAM® technology provide system monitoring, control and dimming interface capability. Holophane LEDgend luminaires incorporate this type of intelligence and offer various alternatives to meet specific dimming needs. For more information on ROAM controls visit www.roamcontrols.com

HOLOPHANE®
LEADER IN LIGHTING SOLUTIONS

An AcuityBrands Company

Acuity Brands Lighting, Inc.
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Holophane Canada, Inc. 9040 Leslie Street,
Suite 208 Richmond Hill, ON L4B 3M4
Holophane Europe Limited, Bond Ave.
Milton Keynes MK1 1JG, England
Holophane, S.A. de C.V., Apartado Postal No.
986 Naucalpan de Juarez, 53000 Edo. de Mexico

Contact your local Holophane factory sales representative for application assistance, and computer-aided design and cost studies. For information on other Holophane products and systems, call the Inside Sales Service Department at 866.759.1677. In Canada call 905.707.5830 or fax 905.707.5606.

Limited Warranty and Limitation of Liability

Refer to the Holophane limited material warranty and limitation of liability on this product, which are published in the Terms and Conditions section of the current Indoor Buyer's Guide (HL2140), and is available from your local Holophane sales representative.

Visit our web site at www.holophane.com

Luminaires may utilize fluorescent or high intensity discharge sources that contain small amounts of mercury. New disposal label for the lamps includes the mercury identifier shown on the left to indicate that the lamp contains mercury and should be disposed of in accordance with local requirements.

Information sources regarding lamp recycling and disposal are included on the packaging of most mercury containing lamps and also can be located at www.lamprecycle.org.

Product specifications may change without notice. Please contact your local Holophane factory sales representative for the latest product information.

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A Light & Traffic Structure Proposal
for
VERMONT D.O.T.
WATERBURY
PROJECT NO. NHG SGNL(43)

Valmont Order No.: 235821

Prepared By:
Barry N. Sladek, P.E.
Senior Professional Engineer
May 12, 2014

Revision B

STATE OF VERMONT
NORMAND G. COTE JR.
No. 5564
Structural
LICENSED
PROFESSIONAL ENGINEER
MAY 15 2014

Valmont Industries, Inc.
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P.O. Box 358
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Table Of Contents

IN ACCORDANCE WITH AASHTO-2009 RQMTS. (FINAL DEFLECTED POSITION)
BY BNS 5/12/2014 VERSION Fuse 1.10.0.540 32-bit

SUBJECT: VERMONT, 34' & 31' MAST ARMS W/12' LUM ARM

FOLDER: VTTRAF FILE: 3431L12

ELEVATION OF FOUNDATION ABOVE SURROUNDING TERRAIN = 0.0 (FT)
STEPS INCLUDED ? NO

RECURRENCE INTERVAL = 50 SPECIAL FATIGUE WIND SPEEDS
FATIGUE CATEGORY = 2

TRUCK GUST: YES GALLOPING : NO TRUCK GUST = 45 MPH
WIND VELOCITY = 90 MPH CRITERIA: AASHTO-2009
AASHTO ICE INCLUDED ? YES

DESIGN SUMMARY
POLE

HEIGHT (FT)	POLE SHAFT WEIGHT (LBS)	GROUND LINE DIAMETER (IN)	TOP DIAMETER (IN)
27.00	775	13.00	9.22

SECTION CHARACTERISTICS	SECTION 1
SHAPE	ROUND
BASE DIAMETER (IN)	13.00
TOP DIAMETER (IN)	9.22
THICKNESS (IN)	0.23910
LENGTH (FT)	27.00
WEIGHT (LBS)	775
TAPER (IN/FT)	0.1400
YIELD STRENGTH (KSI)	55
MATERIAL	S105 - 55
BASE WELD FATIGUE CATEGORY	= E(FULL-PEN)

BASE PLATE (SQUARE)

MATERIAL	=	S70 - 36 ksi
WIDTH	=	20.00 IN
THICKNESS	=	1.500 IN
YIELD STRENGTH	=	36 KSI

ANCHOR BOLTS

MATERIAL	=	S100 - 55 ksi
BOLT DIAMETER	=	1.50 IN
BOLT CIRCLE	=	19.00 IN
QUANTITY	=	4
YIELD STRENGTH	=	55 KSI

ANALYSIS OF VALMONT INDUSTRIES LIGHTING STRUCTURE
IN ACCORDANCE WITH AASHTO-2009 RQMTS. (FINAL DEFLECTED POSITION)
BY BNS 5/12/2014 VERSION Fuse 1.10.0.540 32-bit

SUBJECT: VERMONT, 34' & 31' MAST ARMS W/12' LUM ARM

FOLDER: VTTRAF FILE: 3431L12

DESIGN SUMMARY (CONTINUED)
ARMS

SIGNAL AND SIGN ARM 1			SIGNAL AND SIGN ARM 2		
SPAN LENGTH	=	34.00 FT	SPAN LENGTH	=	31.00 FT
TAPER	=	0.14 IN/FT	TAPER	=	0.14 IN/FT
BASE SECTION			BASE SECTION		
BASE O.D.	=	11.50 IN	BASE O.D.	=	11.00 IN
THICKNESS	=	0.1793 IN	THICKNESS	=	0.1793 IN
LENGTH	=	34.00 FT	LENGTH	=	31.00 FT
YIELD STR.	=	55 KSI	YIELD STR.	=	55 KSI

BASE WELD FATIGUE CATEGORY = Full-Pen / E

********** SIMPLEX DIMENSIONS **********

CONNECTION BOLT DATA		ARM 1	ARM 2
NUMBER	=	4	4
BOLT DIAMETER (IN)	=	1.250	1.250
ASTM SPECIFICATION	=	A325	A325
HORIZONTAL SPACING (IN)	=	14.50	14.50
VERTICAL SPACING (IN)	=	14.50	14.50
ATTACHMENT PLATE DATA			
HORIZONTAL WIDTH (IN)	=	17.75	17.75
VERTICAL WIDTH (IN)	=	17.75	17.75
THICKNESS (IN)	=	1.500	1.500
YIELD STRENGTH (KSI)	=	36	36
GUSSET THICKNESS (IN)			
- VERTICAL	=	0.250	0.250
- HORIZONTAL	=	0.250	0.250

ATTACHMENT TYPE

ARM 1: SIMPLEX - RING-STIFFENED BOX, TAPPED, BASE WELD TYPE = Full-Pen
ARM 2: SIMPLEX - RING-STIFFENED BOX, TAPPED, BASE WELD TYPE = Full-Pen

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SUBJECT: VERMONT, 34' & 31' MAST ARMS W/12' LUM ARM

FOLDER: VTTRAF FILE: 3431L12

LUMINAIRE ARM 1
==========

STYLE DS70-12
SPAN LENGTH = 12.00 FT
UPPER (OR ONLY) MEMBER
SHAPE = Round
ROUNDED BASE O.D. = 2.38 IN
OUTER END O.D. = 2.38 IN
THICKNESS = 0.1540 IN
UNBENT LENGTH = 12.62 FT

LOWER MEMBER
SHAPE = Round
ROUNDED BASE O.D. = 2.38 IN
OUTER END O.D. = 2.38 IN
THICKNESS = 0.1540 IN
UNBENT LENGTH = 12.62 FT

ANALYSIS OF VALMONT INDUSTRIES LIGHTING STRUCTURE
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FOLDER: VTTRAF FILE: 3431L12

ELEVATION OF FOUNDATION ABOVE SURROUNDING TERRAIN = 0.0 (FT)
STEPS INCLUDED ? NO

RECURRENCE INTERVAL = 50
FATIGUE CATEGORY = 2

SPECIAL FATIGUE WIND SPEEDS

TRUCK GUST: YES GALLOPING : NO
TRUCK GUST = 45 MPH
WIND VELOCITY = 90 MPH CRITERIA: AASHTO-2009
AASHTO ICE INCLUDED ? YES

DESCRIPTION OF EPA LOADING *

POSITION OF LOAD	MOUNTING HEIGHT** (FT)	CENTROID HEIGHT** (FT)	DISTANCE TO CENT. FROM POLE (FT)	WEIGHT (LBS)	EFFECTIVE PROJECTED AREA SQ. (FT)
MAST ARM 1	20.00	27.00	27.00	50	2.00
MAST ARM 2	20.00	27.00	24.00	40	2.00

DESCRIPTION OF SIGNAL LOADING *

POSITION OF SIGNAL	MOUNTING HEIGHT** (FT)	CENTROID HEIGHT** (FT)	DISTANCE TO CENT. FROM POLE (FT)	SIGNAL WEIGHT (LBS)	SIGNAL PROJECTED AREA VERTICAL PLANE (FT^2)	SIGNAL PROJECTED AREA HORIZONTAL PLANE (FT^2)
ARM 1	20.00	20.00	34.00	96	13.72	3.60
ARM 1	20.00	20.00	34.00	70	8.67	1.80
ARM 1	20.00	20.00	20.00	70	8.67	1.80
ARM 2	20.00	20.00	31.00	96	13.72	3.60
ARM 2	20.00	20.00	31.00	70	8.67	1.80
ARM 2	20.00	20.00	17.00	70	8.67	1.80

DESCRIPTION OF LUMINAIRE *

	MOUNTING** HEIGHT	CENTROID** HEIGHT	DISTANCE TO CENT. FROM POLE	WEIGHT	PROJECTED AREA

POSITION	SHAPE	(FT)	(FT)	(FT)	(LBS)	(FT^2)
LUMINAIRE ARM 1	ROUND	26.50	30.00	13.00	55	3.30

* THE VALUES SHOWN IN THIS TABLE MUST NOT BE EXCEEDED WITHOUT CONSULTING VALMONT. ANY SIZES OR OTHER DIMENSIONS NOT PROVIDED BY THE SPECIFYING AGENCY HAVE BEEN ESTIMATED BY VALMONT.

** THESE HEIGHTS ARE ABOVE BOTTOM OF BASE PLATE OR TRANSFORMER BASE.

ANALYSIS OF VALMONT INDUSTRIES LIGHTING STRUCTURE
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SUBJECT: VERMONT, 34' & 31' MAST ARMS W/12' LUM ARM

FOLDER: VTTRAF FILE: 3431L12

R E S U L T S S U M M A R Y

MAXIMUM COMBINED STRESS RATIO
IN EACH MAJOR COMPONENT
====(GROUPS I,II & III)====

POLE (AT 20.00 (FT))	= 0.75
SIGNAL AND SIGN ARM 1	= 0.56
SIGNAL AND SIGN ARM 2	= 0.53
LUMINAIRE ARM 1	= 0.45
BASE PLATE	= 0.73
ANCHOR BOLTS	= 0.95
S/S ARM 1 ATTACH. BOLTS	= 0.42
S/S ARM 1 ATTACH. PLATE	= 0.63
S/S ARM 2 ATTACH. BOLTS	= 0.36
S/S ARM 2 ATTACH. PLATE	= 0.56

MAXIMUM FATIGUE STRESS
RATIO IN EACH MAJOR COMPONENT
==========(GROUP IV)==========

POLE (AT 0.00 FT)	= 0.98
SIGNAL AND SIGN ARM 1	
ARM TUBE	= 1.00
BUILT-UP BOX GUSSET	= 0.57
SIMPLEX BOLTS	= 0.41
SIGNAL AND SIGN ARM 2	
ARM TUBE	= 0.95
BUILT-UP BOX GUSSET	= 0.50
SIMPLEX BOLTS	= 0.36
ANCHOR BOLT	= 0.63

MAXIMUM REACTIONS APPLIED TO FOUNDATION
==========

BENDING MOMENT	=	77794 FT-LBS
TORSION	=	30659 FT-LBS
SHEAR FORCE	=	2370 LBS
AXIAL FORCE	=	4387 LBS

MAXIMUM BENDING + AXIAL DEAD WT. STRESS
==========

POLE	=	16.16 KSI
SIGN/SIGNAL ARM 1	=	11.84 KSI
SIGN/SIGNAL ARM 2	=	10.85 KSI
LUMINAIRE ARM 1	=	6.20 KSI

RESULTANT DEFLECTION OF POLE TOP
CAUSED BY DEAD WEIGHT
==========
1.08 DEGREES

ANALYSIS OF VALMONT INDUSTRIES LIGHTING STRUCTURE
IN ACCORDANCE WITH AASHTO-2009 RQMTS. (FINAL DEFLECTED POSITION)
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SUBJECT: VERMONT, 34' & 31' MAST ARMS W/12' LUM ARM

FOLDER: VTTRAF FILE: 3431L12

SIGNAL AND SIGN ARM 1

SHAPE	= Round	
SPAN LENGTH	= 34.00	FT
BASE O.D.	= 11.50	IN
TAPER	= 0.14	IN/FT
ATTACH. HT. *	= 20.00	FT
ORIENTATION **	= 0	DEGREES
SLOPE AT BASE	= 0	DEGREES
CENTROID LOCATION		
HORIZONTAL	= 15.52	FT
ABOVE ATTACH.	= 0.00	FT
UNBENT LENGTH	= 34.00	FT
MATERIAL-BASE	= S105 - 55 ksi	
WEIGHT	= 608	LBS

BASE WELD FATIGUE CATEGORY = Full-Pen / E

ARM 1 SECTIONS

BASE SECTION

THICKNESS	= 0.1793	IN
LENGTH	= 34.00	FT
YIELD STRENGTH	= 55	KSI

SIGNAL AND SIGN ARM 2

SHAPE	= Round	
SPAN LENGTH	= 31.00	FT
BASE O.D.	= 11.00	IN
TAPER	= 0.14	IN/FT
ATTACH. HT. *	= 20.00	FT
ORIENTATION **	= 90	DEGREES
SLOPE AT BASE	= 0	DEGREES
CENTROID LOCATION		
HORIZONTAL	= 14.23	FT
ABOVE ATTACH.	= 0.00	FT
UNBENT LENGTH	= 31.00	FT
MATERIAL-BASE	= S105 - 55 ksi	
WEIGHT	= 537	LBS

BASE WELD FATIGUE CATEGORY = Full-Pen / E

ARM 2 SECTIONS

BASE SECTION

THICKNESS	= 0.1793	IN
LENGTH	= 31.00	FT
YIELD STRENGTH	= 55	KSI

* THIS IS HEIGHT OF ATTACHMENT TO POLE ABOVE BOTTOM OF BASE PLATE OR TRANSFORMER BASE. SEE *** BELOW.

** ARM ORIENTATIONS ARE ANGLES FROM +X AXIS IN X-Y PLANE. X AND Y AXIES ARE PERPENDICULAR/PARALLEL TO SIDES OF POLE BASE PLATE. SEE *** BELOW.

*** IF ARM IS ATTACHED WITH A CLAMP, HEIGHT AND ORIENTATION MUST NOT BE CHANGED FROM VALUES SHOWN ABOVE WITHOUT CONSULTING VALMONT.

ANALYSIS OF VALMONT INDUSTRIES LIGHTING STRUCTURE
IN ACCORDANCE WITH AASHTO-2009 RQMTS. (FINAL DEFLECTED POSITION)
BY BNS 5/12/2014 VERSION Fuse 1.10.0.540 32-bit

SUBJECT: VERMONT, 34' & 31' MAST ARMS W/12' LUM ARM

FOLDER: VTTRAF FILE: 3431L12

LUMINAIRE ARM 1 (DS70-12)

SPAN LENGTH	=	12.00 FT
ORIENTATION **	=	0 DEGREES
TOP MEMBER		
SHAPE = ROUND		
BASE O.D.	=	2.38 IN
OUTER END O.D.	=	2.38 IN
THICKNESS	=	0.1540 IN
ATTACH. HT. *	=	26.50 FT
RISE	=	3.50 FT
SLOPE AT BASE	=	26.0 DEGREES
CENTROID LOCATION		
HORIZONTAL	=	5.88 FT
VERTICAL	=	2.24 FT
SPAN TO JOINT	=	8.44 FT
YIELD STRENGTH	=	36 KSI
UNBENT LENGTH	=	12.62 FT
UNBENT LENGTH TO JOINT	=	8.44 FT
BOTTOM MEMBER		
SHAPE = ROUND		
DIAMETER	=	2.38 IN
THICKNESS	=	0.1540 IN
ATTACH. HT. *	=	24.25 FT
CENTROID LOCATION		
HORIZONTAL	=	4.00 FT
VERTICAL	=	3.73 FT
YIELD STRENGTH	=	36 KSI
UNBENT LENGTH	=	9.98 FT
MATERIAL	=	S109 - 36 ksi
WEIGHT	=	84 LBS

* THESE HEIGHTS ARE ABOVE BOTTOM OF BASE PLATE OR TRANSFORMER BASE.
\+ ELLIPTICAL CROSS SECTION; FIRST DIAMETER IS HORIZONTAL.
** ARM ORIENTATIONS ARE ANGLES FROM +X AXIS IN X-Y PLANE. X AND Y AXIES ARE PERPENDICULAR/PARALLEL TO SIDES OF POLE BASE PLATE. SEE *** BELOW.
*** IF ARM IS ATTACHED WITH A CLAMP, HEIGHT AND ORIENTATION MUST NOT BE CHANGED FROM VALUES SHOWN ABOVE WITHOUT CONSULTING VALMONT.

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SUBJECT: VERMONT, 34' & 31' MAST ARMS W/12' LUM ARM

FOLDER: VTTRAF FILE: 3431L12

FORCES AND MOMENTS WITH WIND ACTING PERPENDICULAR TO EACH ARM

ARM TYPE	ARM NO.	ANALYSIS LOCATION	GROUP LOAD NO.	FORCES (LBS) AXIAL	FY	FZ	MOMENTS (FT-LBS) TORSION	MY	MZ
SIGNAL	1	BASE	1	20	15	891	6	17778	296
SIGNAL	1	BASE	2	68	1164	845	330	16577	30249
SIGNAL	1	BASE	3	93	824	1588	199	35295	19366
SIGNAL	2	BASE	1	14	17	810	6	14886	315
SIGNAL	2	BASE	2	53	1140	763	328	13770	26975
SIGNAL	2	BASE	3	70	790	1476	199	30247	17100
LUMIN.	1	TOP BASE	1	571	2	9	0	41	12
LUMIN.	1	TOP BASE	2	563	101	9	0	43	670
LUMIN.	1	TOP BASE	3	935	79	19	0	77	561
LUMIN.	1	BOT BASE	1	623	1	4	1	30	9
LUMIN.	1	BOT BASE	2	606	62	4	53	32	517
LUMIN.	1	BOT BASE	3	1008	32	11	50	60	405

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SUBJECT: VERMONT, 34' & 31' MAST ARMS W/12' LUM ARM

FOLDER: VTTRAF FILE: 3431L12

STRESSES WITH WIND ACTING PERPENDICULAR TO EACH ARM

ANAL. ARM TYPE	LOCATION ARM NO.	SITE	GROUP LOAD NO.	COMB. STR. RATIO	APPLIED STRESS (KSI) AXIAL	APPLIED STRESS (KSI) BEND.	APPLIED STRESS (KSI) SHEAR	ALLOW. STRESS (KSI) AXIAL	ALLOW. STRESS (KSI) BEND.	ALLOW. STRESS (KSI) SHEAR
SIG	1	BASE	1	0.33	0.00	11.84	0.28	33.00	36.30	18.15
SIG	1	BASE	2	0.48	0.01	22.97	0.56	33.00	48.28	24.14
SIG	1	BASE	3	0.56	0.01	26.80	0.63	33.00	48.28	24.14
SIG	2	BASE	1	0.30	0.00	10.85	0.27	33.00	36.30	18.15
SIG	2	BASE	2	0.46	0.01	22.07	0.57	33.00	48.28	24.14
SIG	2	BASE	3	0.53	0.01	25.32	0.62	33.00	48.28	24.14
LUM	1	TOP	1	0.06	0.53	0.86	0.02	21.60	23.76	11.88
LUM	1	TOP	2	0.45	0.52	13.44	0.19	21.60	31.60	15.80
LUM	1	TOP	3	0.40	0.87	11.34	0.15	21.60	31.60	15.80
LUM	1	BOT	1	0.05	0.58	0.63	0.02	21.60	23.76	11.88
LUM	1	BOT	2	0.36	0.56	10.36	0.65	21.60	31.60	15.80
LUM	1	BOT	3	0.30	0.94	8.20	0.56	21.60	31.60	15.80

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SUBJECT: VERMONT, 34' & 31' MAST ARMS W/12' LUM ARM

FOLDER: VTTRAF FILE: 3431L12

GROUP IV FATIGUE ANALYSIS OF ARMS:

ANAL. ARM TYPE	ARM NO.	LOCATION SITE	LOAD CASE	BENDING MOMENT (FT-LBS)	SHEAR FORCE (LBS)
SIG	1	BASE	NATURAL WIND GUST	6725	282
SIG	1	BASE	TRUCK-INDUCED GUST	3382	160
SIG	2	BASE	NATURAL WIND GUST	5886	268
SIG	2	BASE	TRUCK-INDUCED GUST	3033	156

ANALYSIS OF VALMONT INDUSTRIES LIGHTING STRUCTURE
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BY BNS 5/12/2014 VERSION Fuse 1.10.0.540 32-bit

SUBJECT: VERMONT, 34' & 31' MAST ARMS W/12' LUM ARM

FOLDER: VTTRAF FILE: 3431L12

GROUP IV FATIGUE ANALYSIS OF ARMS:

ANAL. ARM TYPE	ARM NO.	LOCATION SITE	LOAD CASE	STRESS RATIO	STRESS CAT.	BENDING STRESS KSI	SHEAR STRESS KSI
SIG	1	BASE	NATURAL WIND GUST	1.00	E	4.48	0.11
SIG	1	BASE	TRUCK-INDUCED GUST	0.50	E	2.25	0.05
SIG	2	BASE	NATURAL WIND GUST	0.95	E	4.29	0.11
SIG	2	BASE	TRUCK-INDUCED GUST	0.49	E	2.21	0.05

ANALYSIS OF VALMONT INDUSTRIES LIGHTING STRUCTURE
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SUBJECT: VERMONT, 34' & 31' MAST ARMS W/12' LUM ARM

FOLDER: VTTRAF FILE: 3431L12

THIS PAGE PROVIDES THE PERTINENT INFORMATION CONCERNING THE ANALYSIS OF THE ARM-TO-POLE ATTACHMENT COMPONENTS OF THE SIGNAL AND SIGN ARMS.

********** INPUT DATA **********

		ARM 1	ARM 2
CONNECTION BOLT DATA			
NUMBER	=	4	4
BOLT DIAMETER (IN)	=	1.250	1.250
ASTM SPECIFICATION	=	A325	A325
HORIZONTAL SPACING (IN)	=	14.50	14.50
VERTICAL SPACING (IN)	=	14.50	14.50
ATTACHMENT PLATE DATA			
HORIZONTAL WIDTH (IN)	=	17.75	17.75
VERTICAL WIDTH (IN)	=	17.75	17.75
THICKNESS (IN)	=	1.500	1.500
YIELD STRENGTH (KSI)	=	36	36
GUSSET THICKNESS (IN)			
- VERTICAL	=	0.250	0.250
- HORIZONTAL	=	0.250	0.250

ATTACHMENT TYPE

ARM 1: SIMPLEX - RING-STIFFENED BOX, TAPPED, BASE WELD TYPE = Full-Pen
ARM 2: SIMPLEX - RING-STIFFENED BOX, TAPPED, BASE WELD TYPE = Full-Pen

********** RESULTS **********

ANALYSIS OF SIGNAL/SIGN ARM SIMPLEX BOLTS

ARM	MAX. BOLT CSR	GROUP LOAD NO.	TENSION LBS	APPLIED STRESS KSI	ALLOWABLE STRESS KSI
1	0.42	3	22642	18.45	44.22
2	0.36	3	19609	15.98	44.22

ANALYSIS OF SIGNAL/SIGN ARM SIMPLEX PLATES

ARM	MAX. PLATE CSR	GROUP LOAD NO.	APPLIED STRESS KSI	ALLOWABLE STRESS KSI	ANGLE OF FAILURE LINE DEGREES	LENGTH OF BEND LINE IN
1	0.63	3	19.96	31.60	45	13.56
2	0.56	3	17.60	31.60	45	14.06

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SUBJECT: VERMONT, 34' & 31' MAST ARMS W/12' LUM ARM

FOLDER: VTTRAF FILE: 3431L12

GROUP IV FATIGUE ANALYSIS OF SIGNAL AND SIGN / POLE CONNECTION: ARM

COMPONENT	LOAD	STRESS RATIO	STRESS CAT.	STRESS (KSI)
BUILT-UP BOX GUSSET	NATURAL WIND GUST	0.57	E'	1.47
	TRUCK-INDUCED GUST	0.21	E'	0.55
POLE CROSS SECTION				
	TRUCK-INDUCED GUST	0.48	E	2.18
SIMPLEX BOLT	NATURAL WIND GUST	0.41	D	2.88
	TRUCK-INDUCED GUST	0.21	D	1.44
BUILT-UP BOX GUSSET	NATURAL WIND GUST	0.50	E'	1.29
	TRUCK-INDUCED GUST	0.19	E'	0.50
POLE CROSS SECTION				
	TRUCK-INDUCED GUST	0.43	E	1.96
SIMPLEX BOLT	NATURAL WIND GUST	0.36	D	2.52
	TRUCK-INDUCED GUST	0.19	D	1.30

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FOLDER: VTTRAF FILE: 3431L12

POLE PROPERTIES

HEIGHT (FT)	DIAMETER (IN)	WALL THK. (IN)	ROUNDNESS RATIO %	D/T	MOMENTS OF INERTIA (IN^4)	SECTION MODULUS (IN^3)	AREA (IN^2)
27.00	9.220	0.2391	100.00	38.56	67.93	15.13	6.74
26.50	9.290	0.2391	100.00	38.85	69.53	15.36	6.80
24.25	9.605	0.2391	100.00	40.17	77.04	16.45	7.03
22.00	9.920	0.2391	100.00	41.49	85.08	17.58	7.27
20.00	10.200	0.2391	100.00	42.66	92.68	18.61	7.48
18.50	10.410	0.2391	100.00	43.54	98.66	19.40	7.64
17.00	10.620	0.2391	100.00	44.42	104.90	20.21	7.80
14.50	10.970	0.2391	100.00	45.88	115.87	21.60	8.06
12.00	11.320	0.2391	100.00	47.34	127.58	23.03	8.32
9.50	11.670	0.2391	100.00	48.81	140.06	24.50	8.58
7.00	12.020	0.2391	100.00	50.27	153.32	26.03	8.85
4.50	12.370	0.2391	100.00	51.74	167.39	27.60	9.11
2.00	12.720	0.2391	100.00	53.20	182.30	29.21	9.37
0.00	13.000	0.2391	100.00	54.37	194.85	30.54	9.58

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FOLDER: VTTRAF FILE: 3431L12

ANALYSIS OF POLE: FORCES AND MOMENTS

SECTION HEIGHT* (FT)	GROUP LOAD NO.	FORCES (LBS) FX	FY	FZ	MOMENTS (FT-LBS) MX	MY	MZ	WIND DIRECT** (DEGREES)
26.50	1	546	2	-157	-3	-41	11	0
26.50	2	538	109	-154	-189	-42	643	90
26.50	3	893	88	-265	-158	-77	539	90
20.00	1	40	32	2013	-15266	19345	0	0
20.00	2	122	2265	1930	-16248	18147	30657	90
20.00	3	175	1508	3526	-32496	37946	19018	90
0.00	1	2	2	2612	-15588	19753	0	0
0.00	2	5	2376	2612	-62830	19102	30658	90
0.00	3	8	1592	4380	-63629	39496	19018	90

* THESE HEIGHTS ARE ABOVE THE POLE BASE PLATE.
** THESE ARE DIRECTIONS TOWARD WHICH THE WIND IS FLOWING.
THEY ARE ANGLES FROM THE +X AXIS IN THE X-Y PLANE

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SUBJECT: VERMONT, 34' & 31' MAST ARMS W/12' LUM ARM

FOLDER: VTTRAF FILE: 3431L12

ANALYSIS OF POLE: STRESSES

SECTION HEIGHT* (FT)	GROUP LOAD NO.	COMB. STR. RATIO	APPLIED STRESS (KSI) AXIAL	APPLIED STRESS (KSI) BEND.	APPLIED STRESS (KSI) SHEAR	ALLOW. STRESS (KSI) AXIAL	ALLOW. STRESS (KSI) BEND	ALLOW. STRESS (KSI) SHEAR
26.50	1	0.00	0.02	0.03	0.17	33.00	36.30	18.15
26.50	2	0.00	0.02	0.15	0.41	33.00	48.28	24.14
26.50	3	0.00	0.04	0.14	0.47	33.00	48.28	24.14
20.00	1	0.45	0.27	15.89	0.01	33.00	36.30	18.15
20.00	2	0.52	0.26	15.71	10.49	33.00	48.28	24.14
20.00	3	0.75	0.47	32.20	6.54	33.00	48.28	24.14
0.00	1	0.28	0.27	9.89	0.00	33.00	36.30	18.15
0.00	2	0.62	0.27	25.79	6.52	33.00	48.28	24.14
0.00	3	0.65	0.46	29.42	4.07	33.00	48.28	24.14

* THESE HEIGHTS ARE ABOVE THE POLE BASE PLATE.

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FOLDER: VTTRAF FILE: 3431L12

GROUP IV ANALYSIS OF POLE:

SECTION HEIGHT* (FT)	LOAD CASE	AXIAL (LBS)	BENDING (FT-LBS)
0.0	NATURAL WIND GUST	N/A	11265
0.0	TRUCK GUST	N/A	3458

GROUP IV ANALYSIS OF POLE:

SECTION HEIGHT* (FT)	LOAD CASE	STRESS RATIO	STRESS CATEGORY	STRESS BENDING (KSI)
0.0	NATURAL WIND GUST	0.98	E	4.43
0.0	TRUCK GUST	0.31	E	1.38

* THESE HEIGHTS ARE ABOVE THE POLE BASE PLATE.

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SUBJECT: VERMONT, 34' & 31' MAST ARMS W/12' LUM ARM

FOLDER: VTTRAF FILE: 3431L12

ARM DEFLECTIONS:

ARM TYPE	ARM NO.	GROUP LOAD NO.	LOAD CASE NAME	DEFLECTION (IN)
SIGN	1	4	NATURAL WIND GUST	4.985
SIGN	1	4	TRUCK-INDUCED GUST	1.924
SIGN	2	4	NATURAL WIND GUST	4.042
SIGN	2	4	TRUCK-INDUCED GUST	1.598

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FOLDER: VTTRAF FILE: 3431L12

BASE PLATE (SQUARE)

WIDTH	=	20.00	IN
THICKNESS	=	1.500	IN
YIELD STRENGTH	=	36	KSI
STATIC COMBINED STRESS RATIO	=	0.73	
BASE WELD TYPE	=	FULL-PEN	

ANALYSIS OF BASE PLATE

COMBINED STRESS RATIO	=	0.73	
GROUP LOAD NUMBER	=	3	
CRITICAL WIND DIRECT.*	=	50.00	DEGREES
ALIGNMENT OF THE BEND LINE	=	315.00	DEGREES
BOLT FORCE	=	50166	LBS
BOLT-TO-BEND LINE MOMENT ARM	=	3.00	IN
WIDTH OF BENDING SECTION	=	15.28	IN
APPLIED BENDING STRESS	=	26.26	KSI
ALLOWABLE BENDING STRESS	=	35.91	KSI

ANCHOR BOLTS

QUANTITY	=	4	
BOLT DIAMETER	=	1.50	IN
BOLT CIRCLE	=	19.00	IN
INITIAL BOLT ANGLE	=	45.00	DEGREES
BOLT LENGTH	=	54	IN
YIELD STRENGTH	=	55.00	KSI
STATIC COMBINED STRESS RATIO	=	0.95	
FATIGUE STRESS RATIO	=	0.63	

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SUBJECT: VERMONT, 34' & 31' MAST ARMS W/12' LUM ARM

FOLDER: VTTRAF FILE: 3431L12

ANALYSIS OF ANCHOR BOLTS

GROUP LOAD NO.	CRITICAL WIND DIRECT* (DEG)	MAX. COMB. STRESS RATIO	AXIAL FORCE (LBS)	SHEAR FORCE (LBS)	APPLIED STRESS (KSI) AXIAL	APPLIED STRESS (KSI) SHEAR	ALLOWABLE STRESS (KSI) AXIAL	ALLOWABLE STRESS (KSI) SHEAR	BOLT CONST "K"
1	0	0.18	16436	0	11.66	0.00	27.50	16.50	0.60
2	55	0.70	42732	3425	30.31	2.43	36.58	21.95	0.60
3	55	0.95	50092	2159	35.53	1.53	36.58	21.95	0.60

FATIGUE ANALYSIS OF ANCHOR BOLTS

LOAD CASE	STR. RATIO	AXIAL (LBS)
NATURAL WIND GUST	0.63	6203.8
TRUCK-INDUCED GUST	0.16	-1544.1

* THESE ARE DIRECTIONS TOWARD WHICH THE WIND IS FLOWING.

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SUBJECT: VERMONT, 34' & 31' MAST ARMS W/12' LUM ARM

FOLDER: VTTRAF FILE: 3431L12

*** POLE DEFLECTION INFORMATION ***

ELEVATION FT	X-DEFL.(IN)	Y-DEFL.(IN)	DEFLECTION ANGLE, DEGREE X-	Y-
GP. LD. 1 ; WIND ANGLE 0				
27.00	2.79	2.18	0.86	0.66
26.50	2.70	2.11	0.86	0.66
24.25	2.29	1.80	0.85	0.66
22.00	1.89	1.49	0.84	0.66
20.00	1.54	1.22	0.84	0.66
18.50	1.29	1.02	0.75	0.59
17.00	1.07	0.85	0.67	0.53
14.50	0.75	0.60	0.54	0.43
12.00	0.50	0.40	0.43	0.34
9.50	0.30	0.24	0.32	0.25
7.00	0.16	0.13	0.23	0.18
4.50	0.06	0.05	0.14	0.11
2.00	0.01	0.01	0.06	0.05
0.00	0.00	0.00	0.00	0.00
GP. LD. 2 ; WIND ANGLE 90				
27.00	2.61	5.89	0.83	1.58
26.50	2.52	5.72	0.83	1.58
24.25	2.15	4.97	0.82	1.57
22.00	1.78	4.22	0.81	1.57
20.00	1.45	3.56	0.81	1.56
18.50	1.22	3.08	0.72	1.48
17.00	1.01	2.63	0.65	1.39
14.50	0.72	1.94	0.52	1.22
12.00	0.48	1.34	0.41	1.04
9.50	0.29	0.85	0.31	0.84
7.00	0.15	0.47	0.22	0.63
4.50	0.06	0.19	0.14	0.41
2.00	0.01	0.04	0.06	0.18
0.00	0.00	0.00	0.00	0.00
GP. LD. 3 ; WIND ANGLE 90				
27.00	5.48	7.01	1.70	1.98
26.50	5.30	6.80	1.70	1.98
24.25	4.51	5.86	1.69	1.98
22.00	3.73	4.92	1.67	1.97
20.00	3.05	4.09	1.66	1.96
18.50	2.56	3.49	1.49	1.81
17.00	2.12	2.94	1.33	1.66
14.50	1.50	2.13	1.08	1.41
12.00	1.00	1.45	0.85	1.16
9.50	0.61	0.90	0.65	0.91
7.00	0.32	0.49	0.45	0.67

4.50	0.13	0.20	0.28	0.43

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BY BNS 5/12/2014 VERSION Fuse 1.10.0.540 32-bit

SUBJECT: VERMONT, 34' & 31' MAST ARMS W/12' LUM ARM

FOLDER: VTTRAF FILE: 3431L12

*** POLE DEFLECTION INFORMATION ***

ELEVATION FT	X-DEFL.(IN)	Y-DEFL.(IN)	DEFLECTION ANGLE, DEGREE X-	Y-
2.00	0.02	0.04	0.12	0.19
0.00	0.00	0.00	0.00	0.00

IN ACCORDANCE WITH AASHTO-2009 RQMTS. (FINAL DEFLECTED POSITION)

BY BNS 5/12/2014 VERSION Fuse 1.10.0.540 32-bit

SUBJECT: VERMONT, 42' MAST ARM & 16' LUM ARM

FOLDER: VTTRAF FILE: 4216

ELEVATION OF FOUNDATION ABOVE SURROUNDING TERRAIN = 0.0 (FT)
STEPS INCLUDED ? NO

RECURRENCE INTERVAL = 50
FATIGUE CATEGORY = 2

SPECIAL FATIGUE WIND SPEEDS

TRUCK GUST: YES GALLOPING : NO
TRUCK GUST = 45 MPH
WIND VELOCITY = 90 MPH CRITERIA: AASHTO-2009
AASHTO ICE INCLUDED ? YES

DESIGN SUMMARY
POLE

HEIGHT (FT)	POLE SHAFT WEIGHT (LBS)	GROUND LINE DIAMETER (IN)	TOP DIAMETER (IN)
27.00	775	13.00	9.22

SECTION CHARACTERISTICS	SECTION 1
SHAPE	ROUND
BASE DIAMETER (IN)	13.00
TOP DIAMETER (IN)	9.22
THICKNESS (IN)	0.23910
LENGTH (FT)	27.00
WEIGHT (LBS)	775
TAPER (IN/FT)	0.1400
YIELD STRENGTH (KSI)	55
MATERIAL	S105 - 55
BASE WELD FATIGUE CATEGORY	= E(FULL-PEN)

BASE PLATE (SQUARE)

MATERIAL	=	S70 - 36 ksi
WIDTH	=	20.00 IN
THICKNESS	=	1.500 IN
YIELD STRENGTH	=	36 KSI

ANCHOR BOLTS

MATERIAL	=	S100 - 55 ksi
BOLT DIAMETER	=	1.50 IN
BOLT CIRCLE	=	19.00 IN
QUANTITY	=	4
YIELD STRENGTH	=	55 KSI

DESIGN SUMMARY (CONTINUED)
ARMS

SIGNAL AND SIGN ARM 1

SPAN LENGTH	=	42.00 FT
TAPER	=	0.14 IN/FT
BASE SECTION		
BASE O.D.	=	12.50 IN
THICKNESS	=	0.2092 IN
LENGTH	=	42.00 FT
YIELD STR.	=	55 KSI

BASE WELD FATIGUE CATEGORY = Full-Pen / E

********** SIMPLEX DIMENSIONS **********
ARM 1

CONNECTION BOLT DATA

NUMBER	=	4
BOLT DIAMETER (IN)	=	1.250
ASTM SPECIFICATION	=	A325
HORIZONTAL SPACING (IN)	=	14.50
VERTICAL SPACING (IN)	=	14.50

ATTACHMENT PLATE DATA

HORIZONTAL WIDTH (IN)	=	17.75
VERTICAL WIDTH (IN)	=	17.75
THICKNESS (IN)	=	1.500
YIELD STRENGTH (KSI)	=	36
GUSSET THICKNESS (IN)		
- VERTICAL	=	0.250
- HORIZONTAL	=	0.313

ATTACHMENT TYPE

ARM 1: SIMPLEX - RING-STIFFENED BOX, THRU, BASE WELD TYPE = Full-Pen

ANALYSIS OF VALMONT INDUSTRIES LIGHTING STRUCTURE
IN ACCORDANCE WITH AASHTO-2009 RQMTS. (FINAL DEFLECTED POSITION)
BY BNS 5/12/2014 VERSION Fuse 1.10.0.540 32-bit

SUBJECT: VERMONT, 42' MAST ARM & 16' LUM ARM

FOLDER: VTTRAF FILE: 4216

LUMINAIRE ARM 1
==========

STYLE
SPAN LENGTH = 16.00 FT
UPPER (OR ONLY) MEMBER
SHAPE = Round
ROUNDED BASE O.D. = 2.38 IN
OUTER END O.D. = 2.38 IN
THICKNESS = 0.1540 IN
UNBENT LENGTH = 16.48 FT

LOWER MEMBER
SHAPE = Round
ROUNDED BASE O.D. = 2.38 IN
OUTER END O.D. = 2.38 IN
THICKNESS = 0.1540 IN
UNBENT LENGTH = 16.48 FT

ANALYSIS OF VALMONT INDUSTRIES LIGHTING STRUCTURE
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BY BNS 5/12/2014 VERSION Fuse 1.10.0.540 32-bit

SUBJECT: VERMONT, 42' MAST ARM & 16' LUM ARM

FOLDER: VTTRAF FILE: 4216

ELEVATION OF FOUNDATION ABOVE SURROUNDING TERRAIN = 0.0 (FT)
STEPS INCLUDED ? NO

RECURRENCE INTERVAL = 50
FATIGUE CATEGORY = 2

SPECIAL FATIGUE WIND SPEEDS

TRUCK GUST: YES GALLOPING : NO
TRUCK GUST = 45 MPH
WIND VELOCITY = 90 MPH CRITERIA: AASHTO-2009
AASHTO ICE INCLUDED ? YES

DESCRIPTION OF EPA LOADING *

POSITION OF LOAD	MOUNTING HEIGHT** (FT)	CENTROID HEIGHT** (FT)	DISTANCE TO CENT. FROM POLE (FT)	WEIGHT (LBS)	EFFECTIVE PROJECTED AREA SQ. (FT)
MAST ARM 1	20.00	27.00	37.00	50	2.00

DESCRIPTION OF SIGNAL LOADING *

POSITION OF SIGNAL	MOUNTING HEIGHT** (FT)	CENTROID HEIGHT** (FT)	DISTANCE TO CENT. FROM POLE (FT)	SIGNAL WEIGHT (LBS)	SIGNAL PROJECTED AREA VERTICAL PLANE (FT^2)	HORIZONTAL PLANE (FT^2)
ARM 1	20.00	20.00	42.00	96	13.72	3.60
ARM 1	20.00	20.00	42.00	70	8.67	1.80
ARM 1	20.00	20.00	32.00	70	8.67	1.80

DESCRIPTION OF LUMINAIRE *

POSITION	SHAPE	MOUNTING** HEIGHT (FT)	CENTROID** HEIGHT (FT)	DISTANCE TO CENT. FROM POLE (FT)	WEIGHT (LBS)	PROJECTED AREA (FT^2)
LUMINAIRE ARM 1	ROUND	26.50	30.00	17.00	55	3.30

* THE VALUES SHOWN IN THIS TABLE MUST NOT BE EXCEEDED WITHOUT CONSULTING VALMONT. ANY SIZES OR OTHER DIMENSIONS NOT PROVIDED BY THE SPECIFYING AGENCY HAVE BEEN ESTIMATED BY VALMONT.

** THESE HEIGHTS ARE ABOVE BOTTOM OF BASE PLATE OR TRANSFORMER BASE.

ANALYSIS OF VALMONT INDUSTRIES LIGHTING STRUCTURE
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SUBJECT: VERMONT, 42' MAST ARM & 16' LUM ARM

FOLDER: VTTRAF FILE: 4216

R E S U L T S S U M M A R Y

MAXIMUM COMBINED STRESS RATIO
IN EACH MAJOR COMPONENT
====(GROUPS I,II & III)====

POLE (AT 20.00 (FT))	= 0.90
SIGNAL AND SIGN ARM 1	= 0.59
LUMINAIRE ARM 1	= 0.63
BASE PLATE	= 0.56
ANCHOR BOLTS	= 0.62
S/S ARM 1 ATTACH. BOLTS	= 0.59
S/S ARM 1 ATTACH. PLATE	= 0.86

MAXIMUM FATIGUE STRESS
RATIO IN EACH MAJOR COMPONENT
==========(GROUP IV)==========

POLE (AT 0.00 FT)	= 0.77
SIGNAL AND SIGN ARM 1	
ARM TUBE	= 1.00
BUILT-UP BOX GUSSET	= 0.76
SIMPLEX BOLTS	= 0.57
ANCHOR BOLT	= 0.43

MAXIMUM REACTIONS APPLIED TO FOUNDATION
==========

BENDING MOMENT	=	70959 FT-LBS
TORSION	=	41891 FT-LBS
SHEAR FORCE	=	1619 LBS
AXIAL FORCE	=	3273 LBS

MAXIMUM BENDING + AXIAL DEAD WT. STRESS
==========

POLE	=	19.77 KSI
SIGN/SIGNAL ARM 1	=	13.62 KSI
LUMINAIRE ARM 1	=	9.21 KSI

RESULTANT DEFLECTION OF POLE TOP
CAUSED BY DEAD WEIGHT
==========
1.34 DEGREES

ANALYSIS OF VALMONT INDUSTRIES LIGHTING STRUCTURE
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SUBJECT: VERMONT, 42' MAST ARM & 16' LUM ARM

FOLDER: VTTRAF FILE: 4216

SIGNAL AND SIGN ARM 1

SHAPE	=	Round
SPAN LENGTH	=	42.00 FT
BASE O.D.	=	12.50 IN
TAPER	=	0.14 IN/FT
ATTACH. HT. *	=	20.00 FT
ORIENTATION **	=	0 DEGREES
SLOPE AT BASE	=	0 DEGREES
CENTROID LOCATION		
HORIZONTAL	=	18.85 FT
ABOVE ATTACH.	=	0.00 FT
UNBENT LENGTH	=	42.00 FT
MATERIAL-BASE	=	S105 - 55 ksi
WEIGHT	=	912 LBS

BASE WELD FATIGUE CATEGORY = Full-Pen / E

ARM 1 SECTIONS

BASE SECTION

THICKNESS	=	0.2092 IN
LENGTH	=	42.00 FT
YIELD STRENGTH	=	55 KSI

* THIS IS HEIGHT OF ATTACHMENT TO POLE ABOVE BOTTOM OF BASE PLATE OR TRANSFORMER BASE. SEE *** BELOW.

** ARM ORIENTATIONS ARE ANGLES FROM +X AXIS IN X-Y PLANE. X AND Y AXIES ARE PERPENDICULAR/PARALLEL TO SIDES OF POLE BASE PLATE. SEE *** BELOW.

*** IF ARM IS ATTACHED WITH A CLAMP, HEIGHT AND ORIENTATION MUST NOT BE CHANGED FROM VALUES SHOWN ABOVE WITHOUT CONSULTING VALMONT.

ANALYSIS OF VALMONT INDUSTRIES LIGHTING STRUCTURE
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SUBJECT: VERMONT, 42' MAST ARM & 16' LUM ARM

FOLDER: VTTRAF FILE: 4216

LUMINAIRE ARM 1 ( )

SPAN LENGTH	=	16.00 FT
ORIENTATION **	=	0 DEGREES
TOP MEMBER		
SHAPE = ROUND		
BASE O.D.	=	2.38 IN
OUTER END O.D.	=	2.38 IN
THICKNESS	=	0.1540 IN
ATTACH. HT. *	=	26.50 FT
RISE	=	3.50 FT
SLOPE AT BASE	=	23.0 DEGREES
CENTROID LOCATION		
HORIZONTAL	=	7.90 FT
VERTICAL	=	2.25 FT
SPAN TO JOINT	=	10.86 FT
YIELD STRENGTH	=	36 KSI
UNBENT LENGTH	=	16.48 FT
UNBENT LENGTH TO JOINT	=	10.86 FT
BOTTOM MEMBER		
SHAPE = ROUND		
DIAMETER	=	2.38 IN
THICKNESS	=	0.1540 IN
ATTACH. HT. *	=	24.25 FT
CENTROID LOCATION		
HORIZONTAL	=	5.00 FT
VERTICAL	=	3.02 FT
YIELD STRENGTH	=	36 KSI
UNBENT LENGTH	=	12.07 FT
MATERIAL	=	S109 - 36 ksi
WEIGHT	=	105 LBS

* THESE HEIGHTS ARE ABOVE BOTTOM OF BASE PLATE OR TRANSFORMER BASE.
\+ ELLIPTICAL CROSS SECTION; FIRST DIAMETER IS HORIZONTAL.
** ARM ORIENTATIONS ARE ANGLES FROM +X AXIS IN X-Y PLANE. X AND Y AXIES ARE PERPENDICULAR/PARALLEL TO SIDES OF POLE BASE PLATE. SEE *** BELOW.
*** IF ARM IS ATTACHED WITH A CLAMP, HEIGHT AND ORIENTATION MUST NOT BE CHANGED FROM VALUES SHOWN ABOVE WITHOUT CONSULTING VALMONT.

ANALYSIS OF VALMONT INDUSTRIES LIGHTING STRUCTURE
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SUBJECT: VERMONT, 42' MAST ARM & 16' LUM ARM

FOLDER: VTTRAF FILE: 4216

FORCES AND MOMENTS WITH WIND ACTING PERPENDICULAR TO EACH ARM

ARM TYPE	ARM NO.	ANALYSIS LOCATION	GROUP LOAD NO.	FORCES (LBS) AXIAL	FY	FZ	MOMENTS (FT-LBS) TORSION	MY	MZ
SIGNAL	1	BASE	1	41	0	1193	0	28116	0
SIGNAL	1	BASE	2	109	1210	1172	320	27377	39749
SIGNAL	1	BASE	3	160	863	1986	179	52703	24887
LUMIN.	1	TOP BASE	1	810	0	10	0	59	0
LUMIN.	1	TOP BASE	2	815	121	9	4	59	936
LUMIN.	1	TOP BASE	3	1336	93	21	5	108	722
LUMIN.	1	BOT BASE	1	855	0	5	0	49	0
LUMIN.	1	BOT BASE	2	848	66	5	62	50	755
LUMIN.	1	BOT BASE	3	1394	23	14	52	96	526

ANALYSIS OF VALMONT INDUSTRIES LIGHTING STRUCTURE
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SUBJECT: VERMONT, 42' MAST ARM & 16' LUM ARM

FOLDER: VTTRAF FILE: 4216

STRESSES WITH WIND ACTING PERPENDICULAR TO EACH ARM

ANAL. ARM TYPE	LOCATION ARM NO.	SITE	GROUP LOAD NO.	COMB. STR. RATIO	APPLIED STRESS (KSI) AXIAL	APPLIED STRESS (KSI) BEND.	APPLIED STRESS (KSI) SHEAR	ALLOW. STRESS (KSI) AXIAL	ALLOW. STRESS (KSI) BEND.	ALLOW. STRESS (KSI) SHEAR
SIG	1	BASE	1	0.38	0.01	13.61	0.30	33.00	36.30	18.15
SIG	1	BASE	2	0.48	0.01	23.36	0.49	33.00	48.28	24.14
SIG	1	BASE	3	0.59	0.02	28.21	0.58	33.00	48.28	24.14
LUM	1	TOP	1	0.08	0.75	1.18	0.02	21.60	23.76	11.88
LUM	1	TOP	2	0.63	0.76	18.77	0.27	21.60	31.60	15.80
LUM	1	TOP	3	0.52	1.24	14.61	0.22	21.60	31.60	15.80
LUM	1	BOT	1	0.08	0.79	0.97	0.01	21.60	23.76	11.88
LUM	1	BOT	2	0.52	0.79	15.15	0.75	21.60	31.60	15.80
LUM	1	BOT	3	0.40	1.30	10.70	0.57	21.60	31.60	15.80

ANALYSIS OF VALMONT INDUSTRIES LIGHTING STRUCTURE
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SUBJECT: VERMONT, 42' MAST ARM & 16' LUM ARM

FOLDER: VTTRAF FILE: 4216

GROUP IV FATIGUE ANALYSIS OF ARMS:

ANAL. ARM TYPE	ARM NO.	LOCATION SITE	LOAD CASE	BENDING MOMENT (FT-LBS)	SHEAR FORCE (LBS)
SIG	1	BASE	NATURAL WIND GUST	9272	316
SIG	1	BASE	TRUCK-INDUCED GUST	4751	181

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SUBJECT: VERMONT, 42' MAST ARM & 16' LUM ARM

FOLDER: VTTRAF FILE: 4216

GROUP IV FATIGUE ANALYSIS OF ARMS:

ANAL. ARM TYPE	LOCATION ARM NO.	SITE	LOAD CASE	STRESS RATIO	STRESS CAT.	BENDING STRESS KSI	SHEAR STRESS KSI
SIG	1	BASE	NATURAL WIND GUST	1.00	E	4.49	0.09
SIG	1	BASE	TRUCK-INDUCED GUST	0.51	E	2.30	0.04

ANALYSIS OF VALMONT INDUSTRIES LIGHTING STRUCTURE
IN ACCORDANCE WITH AASHTO-2009 RQMTS. (FINAL DEFLECTED POSITION)
BY BNS 5/12/2014 VERSION Fuse 1.10.0.540 32-bit

SUBJECT: VERMONT, 42' MAST ARM & 16' LUM ARM

FOLDER: VTTRAF FILE: 4216

THIS PAGE PROVIDES THE PERTINENT INFORMATION CONCERNING THE ANALYSIS OF THE ARM-TO-POLE ATTACHMENT COMPONENTS OF THE SIGNAL AND SIGN ARMS.

********** INPUT DATA **********

ARM 1

CONNECTION BOLT DATA

NUMBER	=	4
BOLT DIAMETER (IN)	=	1.250
ASTM SPECIFICATION	=	A325
HORIZONTAL SPACING (IN)	=	14.50
VERTICAL SPACING (IN)	=	14.50

ATTACHMENT PLATE DATA

HORIZONTAL WIDTH (IN)	=	17.75
VERTICAL WIDTH (IN)	=	17.75
THICKNESS (IN)	=	1.500
YIELD STRENGTH (KSI)	=	36
GUSSET THICKNESS (IN)		
- VERTICAL	=	0.250
- HORIZONTAL	=	0.313

ATTACHMENT TYPE

ARM 1: SIMPLEX - RING-STIFFENED BOX, THRU, BASE WELD TYPE = Full-Pen

********** RESULTS **********

ANALYSIS OF SIGNAL/SIGN ARM SIMPLEX BOLTS

ARM	MAX. BOLT CSR	GROUP LOAD NO.	TENSION LBS	APPLIED STRESS KSI	ALLOWABLE STRESS KSI
1	0.59	3	32146	26.20	44.22

ANALYSIS OF SIGNAL/SIGN ARM SIMPLEX PLATES

ARM	MAX. PLATE CSR	GROUP LOAD NO.	APPLIED STRESS KSI	ALLOWABLE STRESS KSI	ANGLE OF FAILURE LINE DEGREES	LENGTH OF BEND LINE IN
1	0.86	3	27.17	31.60	45	12.56

ANALYSIS OF VALMONT INDUSTRIES LIGHTING STRUCTURE
IN ACCORDANCE WITH AASHTO-2009 RQMTS. (FINAL DEFLECTED POSITION)
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SUBJECT: VERMONT, 42' MAST ARM & 16' LUM ARM

FOLDER: VTTRAF FILE: 4216

GROUP IV FATIGUE ANALYSIS OF SIGNAL AND SIGN / POLE CONNECTION: ARM

COMPONENT	LOAD	STRESS RATIO	STRESS CAT.	STRESS (KSI)
BUILT-UP BOX GUSSET	NATURAL WIND GUST	0.76	E'	1.98
	TRUCK-INDUCED GUST	0.26	E'	0.67
POLE CROSS SECTION				
	TRUCK-INDUCED GUST	0.68	E	3.06
SIMPLEX BOLT	NATURAL WIND GUST	0.57	D	3.97
	TRUCK-INDUCED GUST	0.29	D	2.03

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SUBJECT: VERMONT, 42' MAST ARM & 16' LUM ARM

FOLDER: VTTRAF FILE: 4216

POLE PROPERTIES

HEIGHT (FT)	DIAMETER (IN)	WALL THK. (IN)	ROUNDNESS RATIO %	D/T	MOMENTS OF INERTIA (IN^4)	SECTION MODULUS (IN^3)	AREA (IN^2)
27.00	9.220	0.2391	100.00	38.56	67.93	15.13	6.74
26.50	9.290	0.2391	100.00	38.85	69.53	15.36	6.80
24.25	9.605	0.2391	100.00	40.17	77.04	16.45	7.03
22.00	9.920	0.2391	100.00	41.49	85.08	17.58	7.27
20.00	10.200	0.2391	100.00	42.66	92.68	18.61	7.48
18.50	10.410	0.2391	100.00	43.54	98.66	19.40	7.64
17.00	10.620	0.2391	100.00	44.42	104.90	20.21	7.80
14.50	10.970	0.2391	100.00	45.88	115.87	21.60	8.06
12.00	11.320	0.2391	100.00	47.34	127.58	23.03	8.32
9.50	11.670	0.2391	100.00	48.81	140.06	24.50	8.58
7.00	12.020	0.2391	100.00	50.27	153.32	26.03	8.85
4.50	12.370	0.2391	100.00	51.74	167.39	27.60	9.11
2.00	12.720	0.2391	100.00	53.20	182.30	29.21	9.37
0.00	13.000	0.2391	100.00	54.37	194.85	30.54	9.58

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SUBJECT: VERMONT, 42' MAST ARM & 16' LUM ARM

FOLDER: VTTRAF FILE: 4216

ANALYSIS OF POLE: FORCES AND MOMENTS

SECTION HEIGHT* (FT)	GROUP LOAD NO.	FORCES (LBS) FX	FY	FZ	MOMENTS (FT-LBS) MX	MY	MZ	WIND DIRECT** (DEGREES)
26.50	1	790	0	-171	0	-59	0	0
26.50	2	794	131	-171	-205	-59	913	90
26.50	3	1301	104	-291	-160	-108	704	90
20.00	1	48	0	1527	0	30335	0	0
20.00	2	122	1463	1503	-2102	29650	41889	90
20.00	3	179	1054	2462	-1501	56409	26457	90
0.00	1	3	0	2125	0	30831	0	0
0.00	2	6	1622	2126	-33229	30728	41890	90
0.00	3	576	812	3267	-15476	67623	17129	55

* THESE HEIGHTS ARE ABOVE THE POLE BASE PLATE.
** THESE ARE DIRECTIONS TOWARD WHICH THE WIND IS FLOWING.
THEY ARE ANGLES FROM THE +X AXIS IN THE X-Y PLANE

ANALYSIS OF VALMONT INDUSTRIES LIGHTING STRUCTURE
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SUBJECT: VERMONT, 42' MAST ARM & 16' LUM ARM

FOLDER: VTTRAF FILE: 4216

ANALYSIS OF POLE: STRESSES

SECTION HEIGHT* (FT)	GROUP LOAD NO.	COMB. STR. RATIO	APPLIED STRESS (KSI) AXIAL	APPLIED STRESS (KSI) BEND.	APPLIED STRESS (KSI) SHEAR	ALLOW. STRESS (KSI) AXIAL	ALLOW. STRESS (KSI) BEND	ALLOW. STRESS (KSI) SHEAR
26.50	1	0.00	0.03	0.05	0.23	33.00	36.30	18.15
26.50	2	0.00	0.03	0.17	0.59	33.00	48.28	24.14
26.50	3	0.01	0.04	0.15	0.66	33.00	48.28	24.14
20.00	1	0.55	0.20	19.56	0.01	33.00	36.30	18.15
20.00	2	0.73	0.20	19.17	13.90	33.00	48.28	24.14
20.00	3	0.90	0.33	36.38	8.82	33.00	48.28	24.14
0.00	1	0.34	0.22	12.11	0.00	33.00	36.30	18.15
0.00	2	0.50	0.22	17.78	8.57	33.00	48.28	24.14
0.00	3	0.60	0.34	27.25	3.57	33.00	48.28	24.14

* THESE HEIGHTS ARE ABOVE THE POLE BASE PLATE.

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SUBJECT: VERMONT, 42' MAST ARM & 16' LUM ARM

FOLDER: VTTRAF FILE: 4216

GROUP IV ANALYSIS OF POLE:

SECTION HEIGHT* (FT)	LOAD CASE	AXIAL (LBS)	BENDING (FT-LBS)
0.0	NATURAL WIND GUST	N/A	8791
0.0	TRUCK GUST	N/A	4835

GROUP IV ANALYSIS OF POLE:

SECTION HEIGHT* (FT)	LOAD CASE	STRESS RATIO	STRESS CATEGORY	STRESS BENDING (KSI)
0.0	NATURAL WIND GUST	0.77	E	3.45
0.0	NATURAL WIND GUST	0.77	E	3.45
0.0	TRUCK GUST	0.43	E	1.92

* THESE HEIGHTS ARE ABOVE THE POLE BASE PLATE.

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SUBJECT: VERMONT, 42' MAST ARM & 16' LUM ARM

FOLDER: VTTRAF FILE: 4216

ARM DEFLECTIONS:

ARM TYPE	ARM NO.	GROUP LOAD NO.	LOAD CASE NAME	DEFLECTION (IN)
SIGN	1	4	NATURAL WIND GUST	7.592
SIGN	1	4	TRUCK-INDUCED GUST	3.128

ANALYSIS OF VALMONT INDUSTRIES LIGHTING STRUCTURE
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BY BNS 5/12/2014 VERSION Fuse 1.10.0.540 32-bit

SUBJECT: VERMONT, 42' MAST ARM & 16' LUM ARM

FOLDER: VTTRAF FILE: 4216

BASE PLATE (SQUARE)

WIDTH	=	20.00	IN
THICKNESS	=	1.500	IN
YIELD STRENGTH	=	36	KSI
STATIC COMBINED STRESS RATIO	=	0.56	
BASE WELD TYPE	=	FULL-PEN	

ANALYSIS OF BASE PLATE

COMBINED STRESS RATIO	=	0.56	
GROUP LOAD NUMBER	=	3	
CRITICAL WIND DIRECT.*	=	70.00	DEGREES
ALIGNMENT OF THE BEND LINE	=	315.00	DEGREES
BOLT FORCE	=	38337	LBS
BOLT-TO-BEND LINE MOMENT ARM	=	3.00	IN
WIDTH OF BENDING SECTION	=	15.28	IN
APPLIED BENDING STRESS	=	20.07	KSI
ALLOWABLE BENDING STRESS	=	35.91	KSI

ANCHOR BOLTS

QUANTITY	=	4	
BOLT DIAMETER	=	1.50	IN
BOLT CIRCLE	=	19.00	IN
INITIAL BOLT ANGLE	=	45.00	DEGREES
BOLT LENGTH	=	54	IN
YIELD STRENGTH	=	55.00	KSI
STATIC COMBINED STRESS RATIO	=	0.62	
FATIGUE STRESS RATIO	=	0.43	

ANALYSIS OF VALMONT INDUSTRIES LIGHTING STRUCTURE
IN ACCORDANCE WITH AASHTO-2009 RQMTS.
BY BNS 5/12/2014 VERSION Fuse 1.10.0.540 32-bit

SUBJECT: VERMONT, 42' MAST ARM & 16' LUM ARM

FOLDER: VTTRAF FILE: 4216

ANALYSIS OF ANCHOR BOLTS

GROUP LOAD NO.	CRITICAL WIND DIRECT* (DEG)	MAX. COMB. STRESS RATIO	AXIAL FORCE (LBS)	SHEAR FORCE (LBS)	APPLIED STRESS (KSI) AXIAL	APPLIED STRESS (KSI) SHEAR	ALLOWABLE STRESS (KSI) AXIAL	ALLOWABLE STRESS (KSI) SHEAR	BOLT CONST "K"
1	0	0.14	14300	0	10.14	0.00	27.50	16.50	0.60
2	90	0.51	29093	13518	20.63	9.59	36.58	21.95	0.60
3	90	0.62	37989	8583	26.94	6.09	36.58	21.95	0.60

FATIGUE ANALYSIS OF ANCHOR BOLTS

LOAD CASE	STR. RATIO	AXIAL (LBS)
NATURAL WIND GUST	0.43	-4207.0
TRUCK-INDUCED GUST	0.22	-2159.4

* THESE ARE DIRECTIONS TOWARD WHICH THE WIND IS FLOWING.

ANALYSIS OF VALMONT INDUSTRIES LIGHTING STRUCTURE
IN ACCORDANCE WITH AASHTO-2009 RQMTS. (FINAL DEFLECTED POSITION)
BY BNS 5/12/2014 VERSION Fuse 1.10.0.540 32-bit

SUBJECT: VERMONT, 42' MAST ARM & 16' LUM ARM

FOLDER: VTTRAF FILE: 4216

*** POLE DEFLECTION INFORMATION ***

ELEVATION FT	X-DEFL.(IN)	Y-DEFL.(IN)	DEFLECTION ANGLE, DEGREE X-	Y-
GP. LD. 1 ; WIND ANGLE 0				
27.00	4.35	0.00	1.34	0.00
26.50	4.21	0.00	1.34	0.00
24.25	3.58	0.00	1.33	0.00
22.00	2.96	0.00	1.32	0.00
20.00	2.41	0.00	1.31	0.00
18.50	2.02	0.00	1.17	0.00
17.00	1.67	0.00	1.04	0.00
14.50	1.18	0.00	0.85	0.00
12.00	0.78	0.00	0.67	0.00
9.50	0.48	0.00	0.50	0.00
7.00	0.25	0.00	0.35	0.00
4.50	0.10	0.00	0.22	0.00
2.00	0.02	0.00	0.09	0.00
0.00	0.00	0.00	0.00	0.00
GP. LD. 2 ; WIND ANGLE 90				
27.00	4.28	2.75	1.33	0.68
26.50	4.14	2.68	1.33	0.68
24.25	3.52	2.34	1.32	0.68
22.00	2.91	2.00	1.31	0.67
20.00	2.37	1.71	1.30	0.66
18.50	1.99	1.50	1.16	0.65
17.00	1.65	1.29	1.04	0.62
14.50	1.16	0.96	0.84	0.57
12.00	0.77	0.68	0.66	0.50
9.50	0.47	0.43	0.50	0.41
7.00	0.25	0.24	0.35	0.32
4.50	0.10	0.10	0.22	0.21
2.00	0.02	0.02	0.09	0.10
0.00	0.00	0.00	0.00	0.00
GP. LD. 3 ; WIND ANGLE 55				
27.00	8.83	1.29	2.66	0.31
26.50	8.55	1.25	2.66	0.31
24.25	7.30	1.09	2.65	0.31
22.00	6.05	0.93	2.63	0.30
20.00	4.96	0.79	2.61	0.30
18.50	4.18	0.69	2.36	0.29
17.00	3.48	0.60	2.12	0.28
14.50	2.47	0.45	1.74	0.26
12.00	1.66	0.31	1.39	0.23
9.50	1.01	0.20	1.06	0.19
7.00	0.54	0.11	0.76	0.15

4.50	0.22	0.05	0.47	0.10

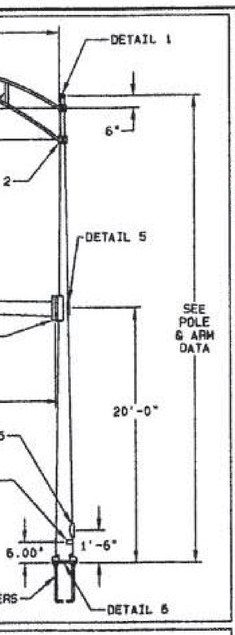
ANALYSIS OF VALMONT INDUSTRIES LIGHTING STRUCTURE
IN ACCORDANCE WITH AASHTO-2009 RQMTS. (FINAL DEFLECTED POSITION)
BY BNS 5/12/2014 VERSION Fuse 1.10.0.540 32-bit

SUBJECT: VERMONT, 42' MAST ARM & 16' LUM ARM

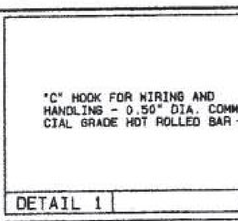
FOLDER: VTTRAF FILE: 4216

*** POLE DEFLECTION INFORMATION ***

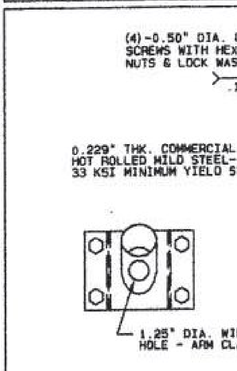
ELEVATION FT	X-DEFL.(IN)	Y-DEFL.(IN)	DEFLECTION ANGLE, DEGREE X-	Y-
2.00	0.04	0.01	0.20	0.04
0.00	0.00	0.00	0.00	0.00



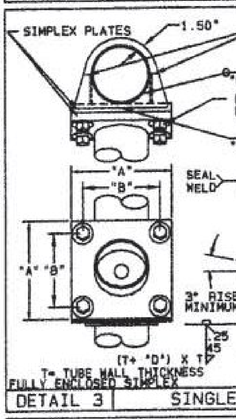
PONENT	ASTM DESIGNATION	MIN. YIELD (KSI)
S- STRUCTURE	A123	
S- HARDWARE	A153	



DETAIL 1 | POLE TOP



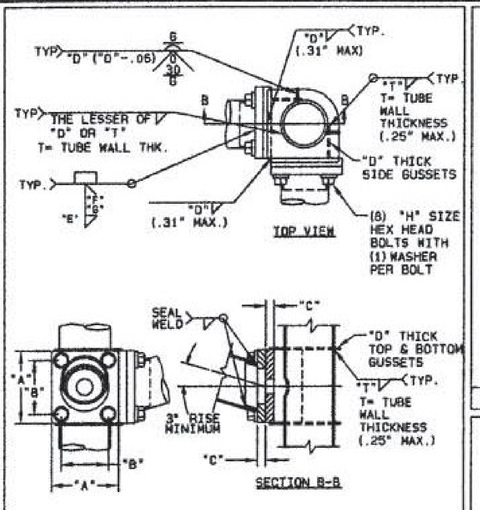
DETAIL 2 | LUMINAIRE ARM ATTACHMENT



DETAIL 3 | SINGLE ARM ATTACHMENT

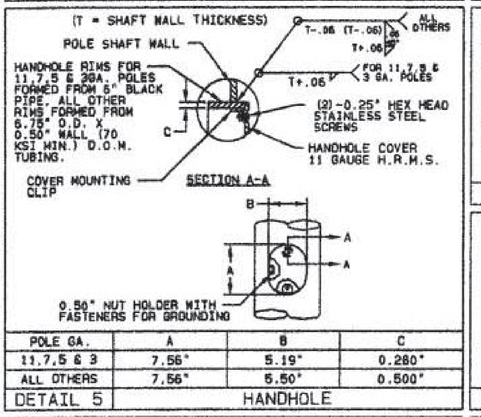
SIGNAL ARM ATTACHMENT DATA

POLE BASE DIA. SGL OR DBL	"A"	"B"	"C"	"D"	SCREW SIZE
13.00" SGL	17.75"	14.50"	1.500"	0.313"	1.25" X 5.00"
13.00" DBL	17.75"	14.50"	1.500"	0.250"	1.25" X 3.50"



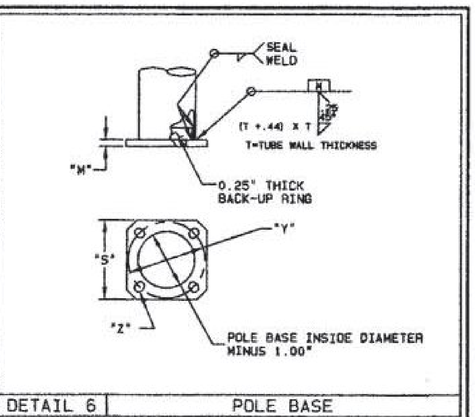
ARM TO PLATE WELD "E"	BEVEL SIZING "F"X"G"
(ARM THICK. + .25") X ARM THICK.	.19" X 30°

DETAIL 4 | DOUBLE SIGNAL ARM ATTACHMENT

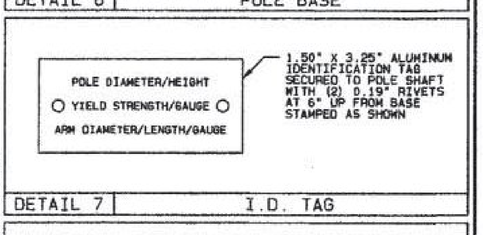


POLE GA.	A	B	C
11 7,5 & 3	7.56"	5.19"	0.280"
ALL OTHERS	7.56"	5.50"	0.500"

DETAIL 5 | HANDHOLE



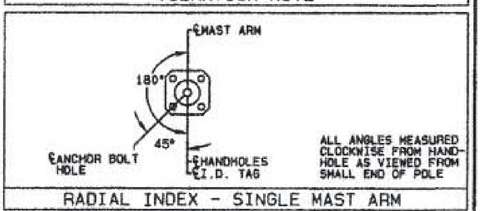
DETAIL 6 | POLE BASE



DETAIL 7 | I.D. TAG

ALTHOUGH RARE, VIBRATIONS SEVERE ENOUGH TO CAUSE DAMAGE CAN OCCASIONALLY OCCUR IN STRUCTURES OF ALL TYPES. BECAUSE THEY ARE INFLUENCED BY MANY INTERACTING VARIABLES, VIBRATIONS ARE GENERALLY UNPREDICTABLE. THE USER'S MAINTENANCE PROGRAM SHOULD INCLUDE OBSERVATION FOR EXCESSIVE VIBRATION AND EXAMINATION FOR ANY STRUCTURAL DAMAGE OR BOLT LOOSENING. THE VALMONT WARRANTY SPECIFICALLY EXCLUDES FATIGUE FAILURE OR SIMILAR PHENOMENA RESULTING FROM INDUCED VIBRATION, HARMONIC OSCILLATION OR RESONANCE ASSOCIATED WITH MOVEMENT OF AIR CURRENTS AROUND THE PRODUCT.

VIBRATION NOTE



RADIAL INDEX - SINGLE MAST ARM

THESE TRAFFIC SIGNAL SUPPORT STRUCTURES ARE DESIGNED IN ACCORDANCE WITH LOADING AND ALLOWABLE STRESS REQUIREMENTS OF 2009 AASHTO "STANDARDS SPECIFICATION FOR STRUCTURAL SUPPORTS FOR HIGHWAY SIGNS, LUMINAIRES AND TRAFFIC SIGNALS", FIFTH EDITION. WIND LOADS ARE BASED ON A BASIC WIND SPEED OF 90 MPH WITH A RECURRENCE INTERVAL OF 50 YEARS, AND A FATIGUE CATEGORY OF 2. FATIGUE LOADS ARE BASED ON THE REQUIREMENTS OF SECTION 11.7 AND THE FOLLOWING DESIGN LOADS:

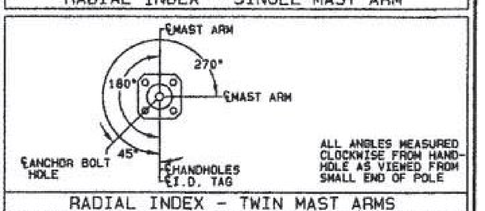
VORTEX SHEDDING: NOT APPLICABLE FOR STRUCTURES WITH A TAPER OF AT LEAST 0.14 IN/FT. PER AASHTO.

NATURAL WIND GUSTS: THE YEARLY MEAN WIND SPEED FOR NATURAL WIND GUSTS WILL BE ASSUMED TO BE 11.2 MPH.

GALLOPING: STRUCTURES ARE NOT DESIGNED TO RESIST PERIODIC GALLOPING FORCES.

TRUCK-INDUCED GUST: STRUCTURES ARE DESIGNED TO INCLUDE TRUCK-INDUCED GUSTS. (THE SPECIFIED AVERAGE TRUCK SPEED IS 45 MPH)

AASHTO 2009 SPECIFICATIONS



RADIAL INDEX - TWIN MAST ARMS

ASTM, A123.

VESTER BOWER.

VALMONT

G. COTE JR.

5564

uctural

ENSED ENGINEER

SOLD TO: HIGHWAY TECH	JOB VT D.D.T. - WATERBURY PROJ. NO. - NHG SGNL(43)	VALMONT INDUSTRIES, INC. RESERVES THE RIGHT TO INSTALL VARIOUS, ENGINEER APPROVED, MATERIAL HANGING ACCOMMODATIONS TO FACILITATE THE MANUFACTURING PROCESS.	valmont Valley, NE 68064 (402) 359-2201	ORDER NUMBER: 235821-P1	
SHIP TO: SIGNALS RYD, INC.				PAGE NUMBER: 1 OF 2	
P.O. #: 8706				DRAWING NUMBER VT235821P1	REV B
AGENT: HIGHWAY TECH	TITLE TRAFFIC SIGNAL STRUCTURES				

15 2014

POLE AND SIGNAL ARM DATA

POLE TUBE			POLE BASE				ANCHOR BOLT				SIGNAL ARM TUBE				LUMINAIRE ARM SPAN "L" (FT)
TOP DIA. (IN)	LENGTH (FT)	GAUGE OR THK. (IN)	SQUARE "S" (IN)	BOLT CIRCLE "Y" (IN)	THK. "M" (IN)	HOLE / SLOT "Z" (IN)	DIA. "K" (IN)	LENGTH "J" (IN)	HOOK "H" (IN)	THREAD LENGTH "U" (IN)	FIXED END DIA. (IN)	FREE END DIA. (IN)	GAUGE OR THICK (IN)	SPAN (FT)	
9.22	27.00	3	20.00	19.00	1.50	1.75	1.50	BY OTHERS			11.50	6.74	7	34.00	12.00
											11.00	6.66	7	31.00	
9.22	27.00	3	20.00	19.00	1.50	1.75	1.50	BY OTHERS			12.50	6.62	5	42.00	16.00

STATE OF VERMONT
NORMAND G. COTE, JR.
No. 5564
Structural
LICENSED PROFESSIONAL ENGINEER

MAY 15 2014

JOB VT D.O.T. - WATERBURY PROJ. NO. - NHG SGNL (43) TITLE TRAFFIC SIGNAL STRUCTURES	VALMONT INDUSTRIES, INC. RESERVES THE RIGHT TO INSTALL VARIOUS, ENGINEER APPROVED, MATERIAL HANDING ACCOMMODATIONS TO FACILITATE THE MANUFACTURING PROCESS.	valmont Valley, NE 68064 (402) 359-2201	ORDER NUMBER: 235821-P1 PAGE NUMBER: 2 OF 2 DRAWING NUMBER VT235821P1 REV B