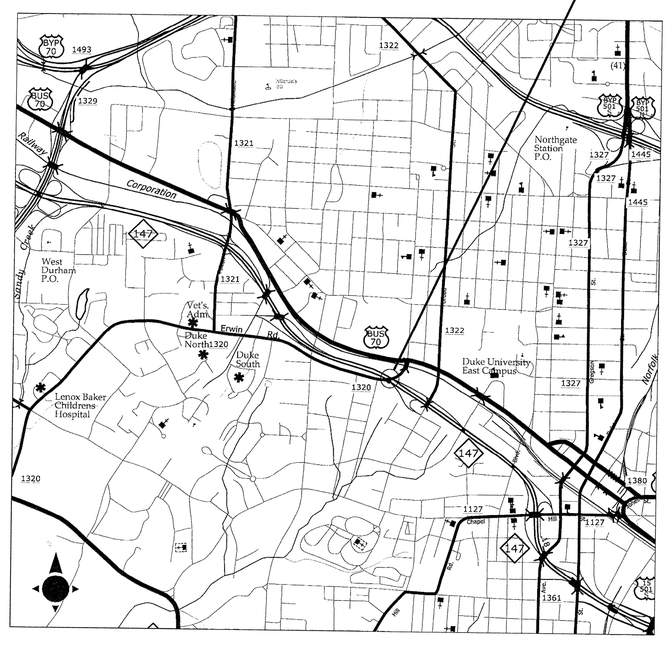
ERWIN ROAD & HIGHWAY 147 UNDERPASS LIGHTING

DUKE UNIVERSITY
DURHAM, NC

PROJECT LOCATION



VICINITY MAPS

PROJECT CONTACTS

Duke University
Paul A. Westray, P.E.
Electrical Engineer, Planning and Engineering
Duke Utility & Engineering Services, FMD
Duke University
114 S. Buchanan Blvd.
Durham, NC 27701
Office Phone: 919-660-1499
Cell Phone: 919-806-6684

City of Durham Transportation Department
Pete Nicholas, P.E.
City of Durham
101 City Hall Plaza, 4th Floor
Durham, NC 27701
Phone: 919-560-4366, ext. 36436

Duke Energy
Shane Smith
Engineering Technologist II
Duke Energy Carolinas
4412 Hillsborough Rd.
Durham, NC 27705
Office: (919) 687-3385

NCDOT District Office
Mark Craig
NCDOT Division 5, District 2 Engineer
815 Stadium Drive
Durham, NC 27704
Phone: 919-220-4750

NCDOT Durham County Maintenance
Highway Maintenance
Ashley Pilkington
County Maintenance Engineer
Durham County Maintenance Yard
3910 Guess Road
Durham, NC 27704

NCDOT Right of Way Office
Phone: 919-220-4700

Call Before You Dig (Utility Locator):
Phone: 1-800-632-4949

Durham One Call (Call Center for General Issues related to Street Maintenance or Lighting Installation):
Phone: 919-560-1200

DRAWING LIST

G-001	COVER SHEET
G-002	GENERAL NOTES AND SPECIFICATIONS
E-003	ELECTRIC PLAN
E-004	LIGHTING AND ELECTRICAL LAYOUT
E-005	GENERAL DETAILS
E-006	ELECTRIC DETAILS
E-007 TO E-009	TRAFFIC MANAGEMENT DETAILS

URS
URS Corporation - North Carolina
1600 Perimeter Park Dr., Suite 400
Morrisville, NC 27560
NC LIC # C-2243
Phone 919-481-1190
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Duke University

REVISIONS

DATE	CHK	DESCRIPTION

SEAL

NORTH CAROLINA PROFESSIONAL SEAL 28249 ENGINEER JAMES HARRINGTON
29-April-2014

NORTH CAROLINA PROFESSIONAL SEAL 18470 ENGINEER GLENN EDENS, JR.
4/29/14

PROJECT

NUMBER

DATE

DRAWING

DRAWN BY LHM

CHECKED BY EGE

SCALE

COVER SHEET

CITY OF DURHAM
PUBLIC WORKS DEPARTMENT
APPROVED

ENGINEERING DATE
STORM WATER DATE
TRANSPORTATION DATE 5-1-14
DATE
DATE

G-001

GENERAL NOTES

1. Materials furnished and installed under this project shall be in accordance with the "Roadway Standard Drawings NCDOT", dated January 2012, "Standard Specifications for Roads and Structures", dated January 2012, and all applicable sections of the latest revisions of the generic Project Special Provisions. All work shall be performed in accordance with the latest edition of the National Electric Code (NEC).
2. Lighting Control Equipment shall be installed in accordance with NCDOT Specification Section 1408.
3. Coordinated installation of new service entrance feeds from Duke Energy with Shane Smith, Engineering Technologist II, shane.smith@duke-energy.com, 919-687-3385.
4. Ground rods shall have a resistance to ground of less than 25 ohms. A report of electrical resistance measured between the ground rod and ground shall be provided to the Engineer.
5. Ground rods shall be connected to the ground wire utilizing an exothermic weld.
6. All wire shall be Type THWN. All metal conduit shall be type RMC. All flexible metal conduit shall be type LFMC.
7. Certified conductor test reports shall be approved by the engineer prior to installation.
8. Conductors in all equipment enclosures shall be neatly arranged and laced with approved cable ties.
9. Underground conduit, wire and junction boxes shall be furnished and installed in accordance with NCDOT Specification Sections 1409, 1410 and 1411. See NCDOT Standard Drawings 1409.01, 1410.01 and 1411.01.
10. Conductor splices shall not be permitted in junction boxes. Conductors shall be continuous from the lighting center to the first luminaire on the circuit. Conductor splices shall be permitted only in the luminaire housings.
11. Conduits shall be installed with large radius offsets (5-ft minimum radius) to bypass drainage inlets, manholes and other obstructions.
12. Metal conduit and flexible metal conduit shall be electrically bonded to the grounding rod and grounding system at the Lighting Control Equipment to provide a fully bonded lighting system.
13. Underpass Luminaires and Underpass Circuitry shall be installed in accordance with NCDOT Specification Section 1412 and shall include exposed metal conduit and conductor cable from the nearest in-ground electrical junction box. The work shall include, but not limited to furnishing and installing the underpass luminaires, all exposed metal conduit and flexible metal conduit, conduit bodies, conduit straps and wedge anchors, and all wire and conductor splices installed as part of the exposed Underpass Circuitry. The work shall include all testing and adjustment to provide a fully functional underpass lighting system.
14. All waste material, including but not limited to conduit, wire, conduit straps, and luminaires, shall be removed from the project site.
15. Certain utilities within the vicinity of this contract area are shown on the plans. The utilities shown are not guaranteed to be complete or accurately located. The contractor is responsible for locating all existing utilities and lighting system before proceeding with the work.
16. Expansion couplings shall be provided at all expansion joints on structures or as designated by the Engineer.
17. Areas around the Lighting Control Equipment and buried conduit shall be graded as approved by the Engineer.
18. All disturbed areas, landscaping (trees, shrubs, flowers, etc.), and fencing shall be returned to their original state at the completion of all work. Disturbed areas shall be seeded in accordance with NCDOT Specification Section 802.
19. If this plan set is less than 24" x 36" this is a reduction. Do not scale drawing.
20. Final electrical inspection to be completed by City-County Inspections Department. Contact Pete Nickolas, City of Durham Transportation Department.
21. Shop drawings and catalog cut sheets, including but not limited to lighting control center equipment and luminaire catalog order forms, shall be submitted to the City Transportation Department for approval prior to installation.
22. Threadless connectors may be used to connect the underpass luminaires to exposed conduits.
23. Luminaries shall be field located and marked, and approved by the Engineer prior to installation.
24. The Contractor shall clear trees and brush as necessary for the installation of the lighting system, including, but not limited to installation of the lighting control center.

TRAFFIC CONTROL NOTES

Installation of lighting system components directly over or adjacent to traffic will require lane closures per NCDOT Standard Temporary Traffic Control plans (TTC) include with the construction plans. When the TTC does not cover a particular work function, notify the Engineer to allow for the development or modification of a sealed set of Temporary Traffic Control Plans.

Access to pedestrian facilities shall be maintained in accordance with NCDOT Standard Specification Section 1101-15.

TRAFFIC CONTROL COMMUNICATIONS:

The contractor shall coordinate all lane closures with the City of Durham Transportation Department and NCDOT District Office. Contact Pete Nickolas, City of Durham Transportation Department, and Mark Craig, NCDOT Div. 5, Dist. 2 Engineer. See Cover sheet for contact information.

SPECIFICATIONS

The following NCDOT Standard Specifications shall apply for material and installation procedures required for this project:

Section 802, Disposal of Waste and Debris

Division 10, Materials

Division 11, Work Zone Traffic Control

Section 1101, Work Zone Traffic Control General Requirements
Section 1105, Temporary Traffic Control Devices
Section 1110, Work Zone Signs
Section 1135, Cones
Section 1150, Flaggers
Section 1165, Truck Mounted Attenuators

Division 14, Lighting

Section 1401, Roadway Lighting
Section 1407, Electrical Service Pole and Lateral
Section 1408, Lighting Control System
Section 1409, Electrical Duct
Section 1410, Feeder Circuits
Section 1411, Electrical Junction Boxes
Section 1412, Underpass Lighting

QUANTITIES

Pay Item	Pay Unit	Quantity
Temporary Traffic Control	Lump Sum	Lump Sum
Work Zones Signs (Portable)	Square Foot	311 SFT
Cones	Each	68 EA
Flaggers	Hour	32 H
Truck Mounted Attenuator	Each	1 EA
Electrical Service Lateral, 3#8 USE	Linear Foot	30 LFT
Light Control Equip, RW, 208/120 Volt	Each	1 EA
Electrical Duct, BD, 1" RMC	Linear Foot	65 LFT
#12 Feeder Circuit, 9	Linear Foot	70 LFT
Electrical Junction Box, PC18	Each	2 EA
Junction Box, Metal, NEMA-3R, 6"x6"x4"	Each	2 EA
Underpass Luminaires, LED, 40-watt*	Each	26 EA
Underpass Circuitry at Erwin Rd. (See General Note 13)	Lump Sum	Lump Sum

*Provide two (2) spare luminaires to the City Transportation Department

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Duke University

REVISIONS

DATE	CHK	DESCRIPTION

SEAL

NORTH CAROLINA PROFESSIONAL SEAL 18249 ENGINEER JAMES HARRINGTON
29-April-2014

NORTH CAROLINA PROFESSIONAL SEAL 18470 ENGINEER RICHARD GLENN EDENS
4/29/14

PROJECT
NUMBER
DATE

DRAWING
DRAWN BY LHM
CHECKED BY EGE
SCALE

GENERAL NOTES SPECIFICATIONS & QUANTITIES

G-002

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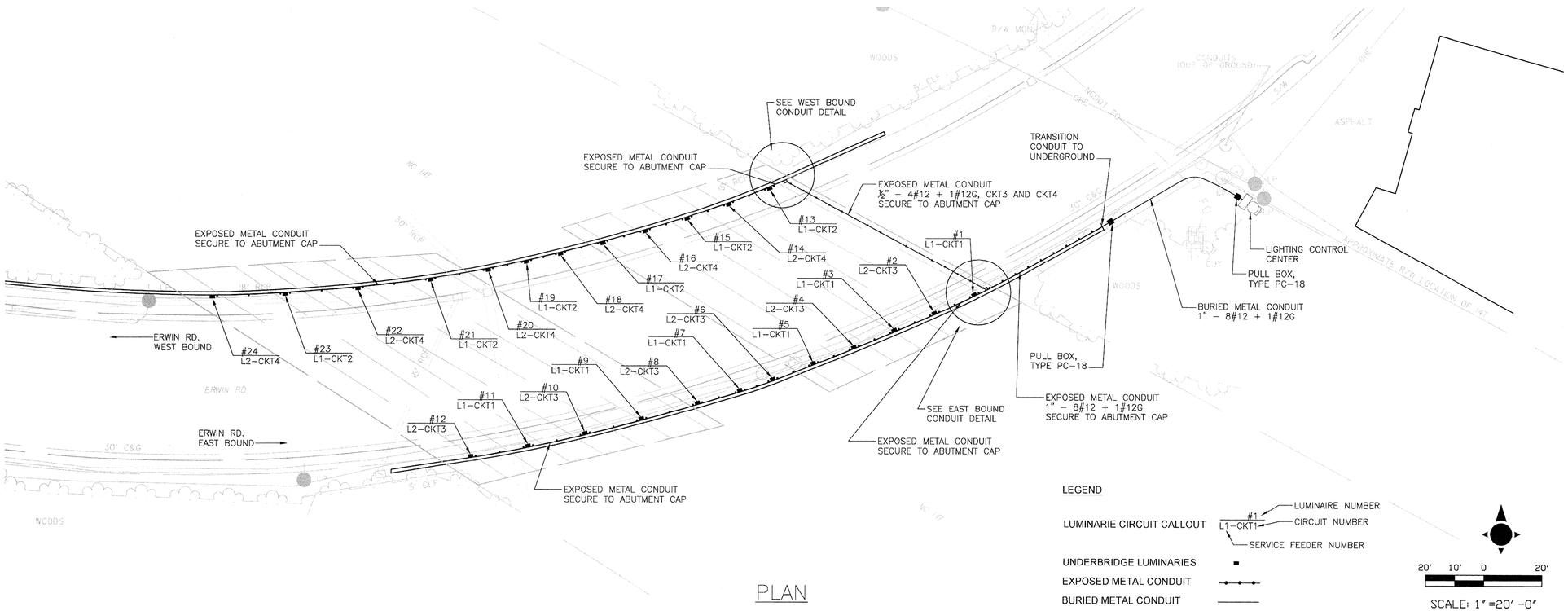


PLAN

LEGEND

LUMINARIE CIRCUIT CALLOUT — #1 L1–CKT1 — LUMINAIRE NUMBER; CIRCUIT NUMBER; SERVICE FEEDER NUMBER

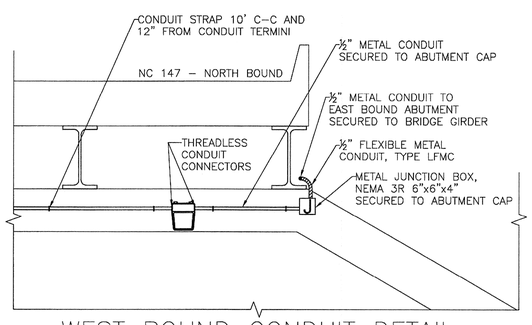
UNDERBRIDGE LUMINARIES

EXPOSED METAL CONDUIT

BURIED METAL CONDUIT

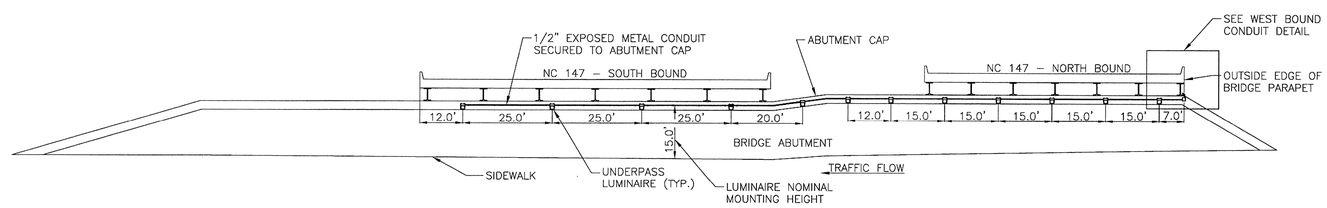
20' 10' 0 20'

SCALE: 1" =20' -0"



WEST BOUND CONDUIT DETAIL

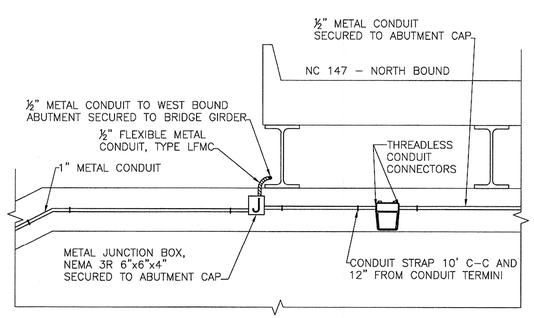
NOT TO SCALE



WEST BOUND BRIDGE ABUTMENT

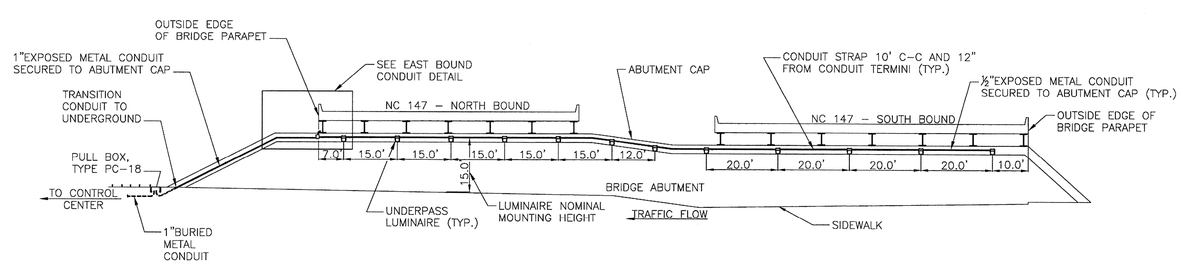
20' 10' 0 20'

SCALE: 1" =20' -0"



EAST BOUND CONDUIT DETAIL

NOT TO SCALE



EAST BOUND BRIDGE ABUTMENT

20' 10' 0 20'

SCALE: 1" =20' -0"

URS

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Duke University

REVISIONS

DATE	CHK	DESCRIPTION

SEAL

NORTH CAROLINA PROFESSIONAL SEAL 28288 ENGINEER JAMES HARRINGTON

29-APRIL-2014

PROJECT

NUMBER

DATE

DRAWING

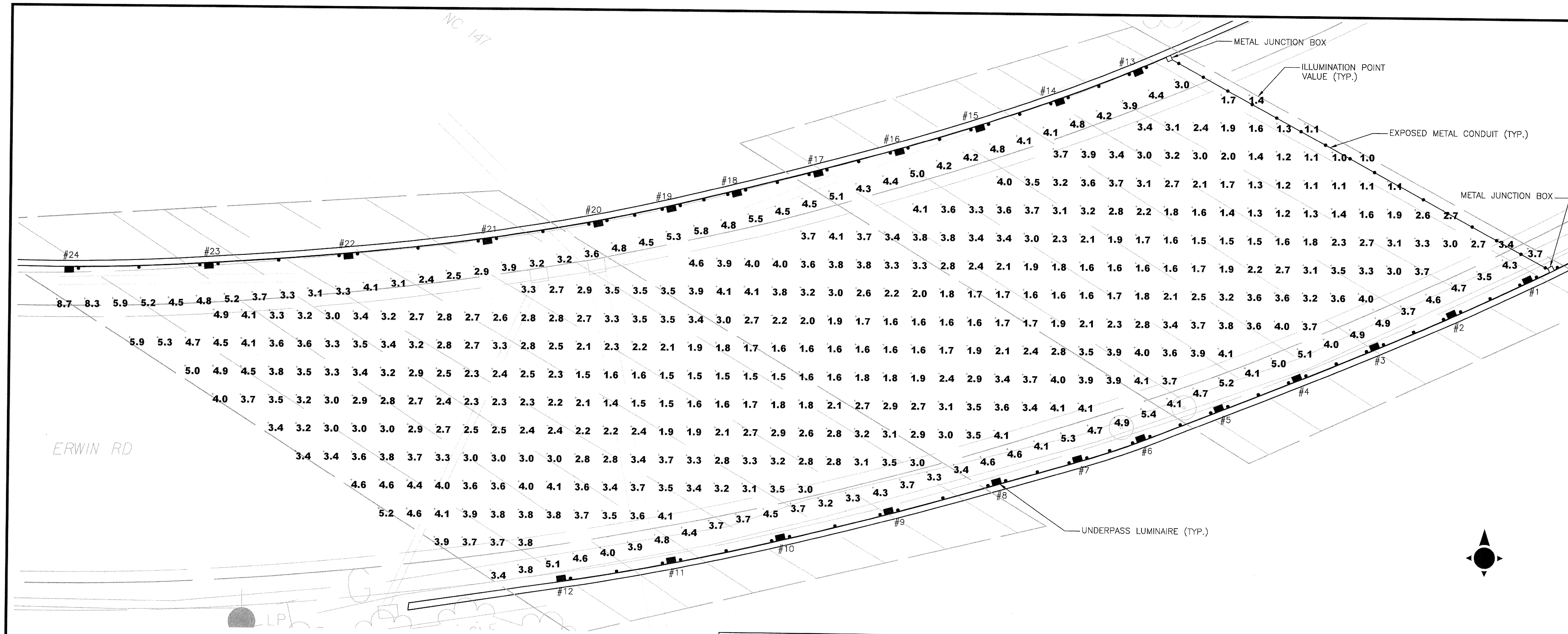
DRAWN BY LHM

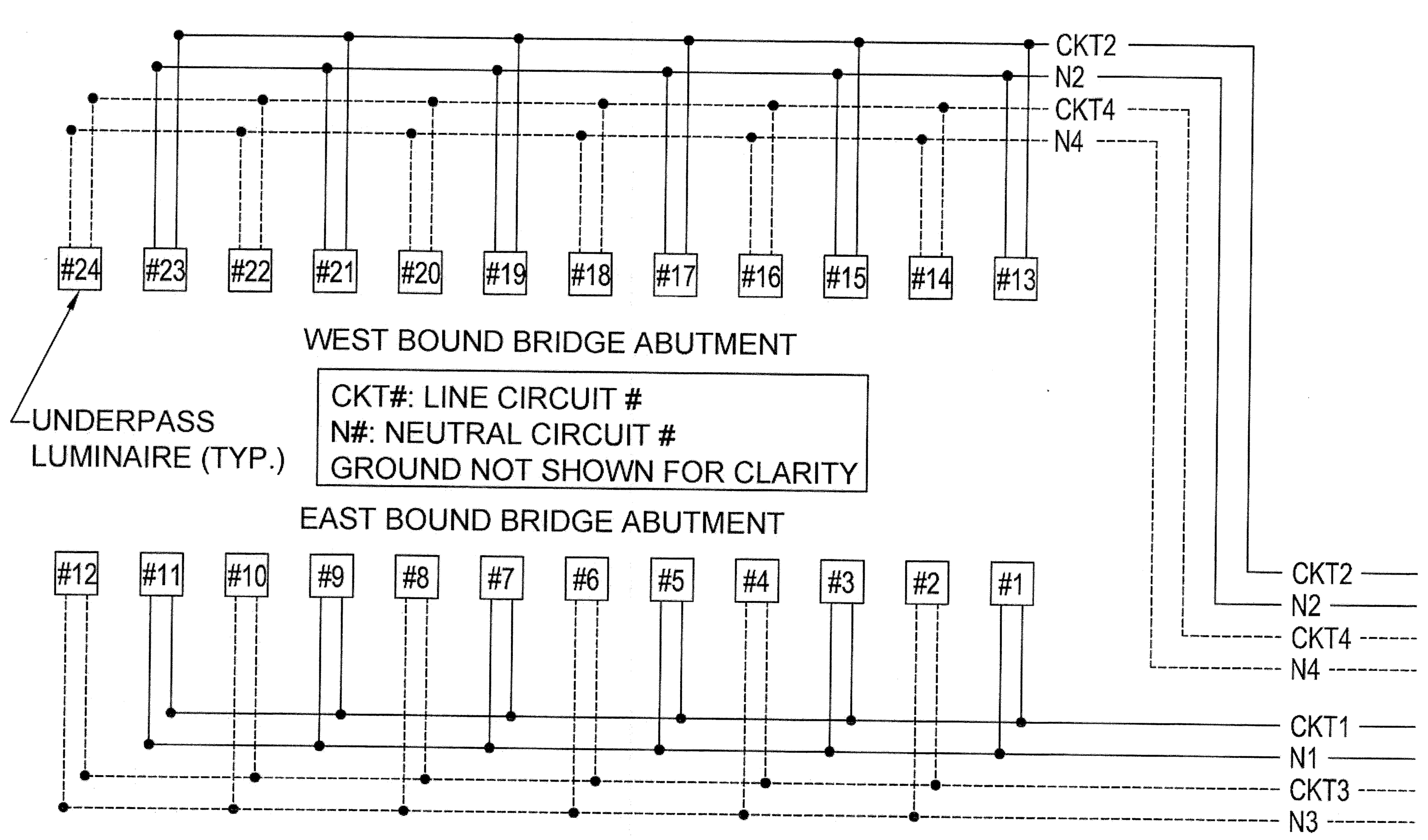
CHECKED BY EGE

SCALE NONE

ELECTRIC PLAN & ELEVATIONS

E–003





ELECTRICAL SKETCH

Erwin Rd Underpass

CONDUCTOR SIZING/VOLTAGE DROP CALCULATIONS
Erwin Rd. Control Center

PAGE 1 OF 2
MADE BY: JH DATE 03/13/14
CHKD. BY KC DATE 03/13/14
JOB NO. 31829296

GENERAL:

1. EACH SET OF CIRCUITS IS 120 VOLT, LINE-TO-Neutral, SINGLE-PHASE POWER
2. CONDUCTOR SIZES AND FORMULAS OBTAINED FROM:
   References:
   NEC-2011
3. METHODOLOGY USED:
3.1 DISTRIBUTE THE LOADS TO PROVIDE A PHASE BALANCE OF LESS THAN 5%.
3.2 DETERMINE VOLTAGE DROP ON EACH PHASE BASED ON CONDUCTOR SIZE SELECTED LENGTH OF RUN..
VD= (Z) * I * L * 2

3.3 SUM THE VOLTAGE DROP AT EACH LUMINAIRE.
3.4 DETERMINE PERCENT VOLT DROP BASED ON LINE VOLTAGE:

% VD=	=(VD/V)*100	FOR 120 VAC, 1-PHASE:	VDmax=3%=3.6V	Branch Circuits
			VDmax=5%=6.0V	Feeder & Branch Circuits

4. DEFINITIONS AND CONSTANTS:
   VD = VOLTAGE DROP
   Z = IMPEDANCE OF SELECTED CONDUCTOR SIZE, R = RESISTVITY/1000', X = INDUCTIVE REACTANCE/1000'
   I = CURRENT IN AMPERES
   L = LENGTH OF ONE-WAY CURRENT IN FEET
   V = VOLTAGE IN CIRCUIT = 1200V

240V Line-to-Line Example Luminaire Current

Power Factor (PF) = 0.85
VA = Watts/PF
Lum. Current = (VA/Line-Line Voltage) = Amps

Example
45w LED LUMINAIRE: VA = Watts / PF = 53 VA,
Luminaire Current = 53 / 120 = 0.44 A

Example
Three, 45W LUM. Powered Line-to-Neutral
#12 AWG wire, Z = 1.7358-ohms/1000-ft

	Line L1	Amp sum	Distance (ft)	Sum VD
LUM.-1	0.44	0.44	100	0.9165
LUM.-2	0.44	0.88	100	0.7638
LUM.-3	0.44	1.32	100	0.4583
TOTAL CURRENT	1.32	1.32	Max. VD	0.9165
			% Max. VD @ 120-v	0.76%

VD 45w Luminaire over 100-ft = 2 x Z x I x L
VD 45w Luminaire over 100-ft = 2 x 1.7358 x 0.44 x 100/1000
VD 45w Luminaire over 100-ft = 0.1528V

LUMINAIR CURRENT IN AMPERES @ 120-V, L-N

1000W HPS = 9.80	150W HPS = 1.47	1500W MH = 14.71	250W MH = 2.45
400W HPS = 3.92	100W HPS = 0.98	1000W MH = 9.80	175W MH = 1.72
250W HPS = 2.45	70W HPS = 0.69	400W MH = 3.92	150W MH = 1.47
30W LED @ 120v, PF = 0.85:	0.29	350W MH = 3.43	100W MH = 0.98
45W LED @ 120v, PF = 0.85:	0.44	310W MH = 3.04	70W MH = 0.69
60W LED @ 120v, PF = 0.85:	0.59	250W QZT @ 120v, PF=1.0:	2.08
70W LED @ 120v, PF = 0.85:	0.69	24W LED Obstruction ltg and monitor @ 120v	2.54
80W LED @ 120v, PF = 0.85:	0.78		

CONDUCTOR IMPEDANCE PER 1000 FEET
BASED ON 0.85 POWER FACTOR, **MAGNETIC** CONDUIT, @75 DEG-C
Z = R x Cos(Theta) + X x Sin(Theta)
Cos(Theta) = PF Sin(Theta) = Sqrt(1-(PF^2))
R = Wire Resistivity, NEC Table 9 X = Wire Reactance, NEC Table 9
PF= 0.85

WIRE	R	X	Z	WIRE	R	X	Z
#12 AWG=	2.0000	0.0680	**1.7358**				
#10 AWG=	1.2400	0.0630	**1.0872**	#1 AWG=	0.1600	0.0570	**0.1660**
#8 AWG=	0.7780	0.0650	**0.6955**	#1/0 AWG=	0.1200	0.0550	**0.1310**
#6 AWG=	0.4910	0.0640	**0.4511**	#2/0 AWG=	0.1000	0.0540	**0.1134**
#4 AWG=	0.3100	0.0600	**0.2951**	#3/0 AWG=	0.0790	0.0520	**0.0945**
#2 AWG=	0.2000	0.0570	**0.2000**	#4/0 AWG=	0.0630	0.0510	**0.0804**

CONDUCTOR SIZING AND VOLTAGE DROP CALCULATIONS

Erwin Rd Underpass
CONDUCTOR SIZING/VOLTAGE DROP CALCULATIONS
Erwin Rd. Control Center

PAGE 2 OF 2
MADE BY: JH DATE 3/13/2014
CHKD. BY KC DATE 3/13/2014
JOB NO. 31829296

Circuits L1, L2

LUM #	WATT	AMP BY LINE L1 CKT 1	L1 CKT 2	L2 CKT 3	L2 CKT 4	DIST Feet	SUM AMPS L1 CKT 1	L1 CKT 2	L2 CKT 3	L2 CKT 4	WIRE SIZE	Z TO USE	VD L1 CKT 1	L1 CKT 2	L2 CKT 3	L2 CKT 4	SUM VD L1 CKT 1	L1 CKT 2	L2 CKT 3	L2 CKT 4
24	45				0.44	25	0	0	0	0.44	#12	1.736		0.00		0.04		2.55		2.72
23	45		0.44			25	0	0.44	0	0.44	#12	1.736		0.04		0.04		2.55		2.68
22	45				0.44	25	0	0.44	0	0.88	#12	1.736		0.04		0.08		2.51		2.64
21	45		0.44			20	0	0.88	0	0.88	#12	1.736		0.06		0.06		2.48		2.57
20	45				0.44	15	0	0.88	0	1.32	#12	1.736		0.05		0.07		2.41		2.51
19	45		0.44			12	0	1.32	0	1.32	#12	1.736		0.05		0.05		2.37		2.44
18	45				0.44	15	0	1.32	0	1.76	#12	1.736		0.07		0.09		2.31		2.38
17	45		0.44			15	0	1.76	0	1.76	#12	1.736		0.09		0.09		2.25		2.29
16	45				0.44	15	0	1.76	0	2.2	#12	1.736		0.09		0.11		2.15		2.20
15	45		0.44			15	0	2.2	0	2.2	#12	1.736		0.11		0.11		2.06		2.09
14	45				0.44	15	0	2.2	0	2.64	#12	1.736		0.11		0.14		1.95		1.97
13	45		0.44			85	0	2.64	0	2.64	#12	1.736		0.78		0.78		1.83		1.83
12	45			0.44		20	0	0	0.44	0	#12	1.736	0.00		0.03		1.82		1.98	
11	45	0.44				20	0.44	0	0.44	0	#12	1.736	0.03		0.03		1.82		1.94	
10	45			0.44		20	0.44	0	0.88	0	#12	1.736	0.03		0.06		1.79		1.91	
9	45	0.44				20	0.88	0	0.88	0	#12	1.736	0.06		0.06		1.76		1.85	
8	45			0.44		15	0.88	0	1.32	0	#12	1.736	0.05		0.07		1.70		1.79	
7	45	0.44				12	1.32	0	1.32	0	#12	1.736	0.05		0.05		1.65		1.72	
6	45			0.44		15	1.32	0	1.76	0	#12	1.736	0.07		0.09		1.60		1.67	
5	45	0.44				15	1.76	0	1.76	0	#12	1.736	0.09		0.09		1.53		1.58	
4	45			0.44		15	1.76	0	2.2	0	#12	1.736	0.09		0.11		1.44		1.48	
3	45	0.44				15	2.2	0	2.2	0	#12	1.736	0.11		0.11		1.35		1.37	
2	45			0.44		15	2.2	0	2.64	0	#12	1.736	0.11		0.14		1.23		1.26	
1	45	0.44				7	2.64	0	2.64	0	#12	1.736	0.06		0.06		1.12		1.12	
JB						115	2.64	2.64	2.64	2.64	#12	1.736	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05
CC																				
Total Watts	1080																			

Circuits L1, L2	L1		L2	
TOTAL AMPS	2.64	2.64	2.64	2.64
AVE CURRENT	2.64			
DEVIATION FROM AVE.	0.00	0.00	0.00	0.00
MAX DEVIATION FROM AVERAGE	0.00			
PHASE IMBALANCE	0.0%			

CONTROL CENTER SUMMARY		
Erwin Rd. Control Center	**L1***	**L2**
TOTAL *	6.98	5.28
AVERAGE CURRENT	6.13	
DEVIATION FROM AVE.	0.85	0.85
PERCENT IMBALANCE	13.9%	

* Line L1 INCLUDES 1.7-Amps (200-Watts) FOR THE PHOTOCELL

Load Amps	2.6	Wire Size	
Design Amps / Breaker Size	3.3	#12	1.736

MAX VOLT DROP:		2.72
MAX VD @120v		2.3%

	AWG	CM
Equipment Ground without Volt Drop	#14	4110
Wire Size for Circuit Breaker (CBWS)	#14	4110
Voltage Drop Wire Size (VDWS)	#12	6530
Ratio, VDWS/CBWS	1.59	
Ratio x Ground Cir Mil	6530	
Ground Wire size per Ratio	**#12**	6530

Erwin Rd. Control Center	
Total KW*	1.3
Total KVA	1.5
Load Amps	7.2
Design Amps	9.1
Min. FDR OCPD	11.3

	Conduit Fill ID (in)	Area (in²)	40% (in²)	**#12 THWN** Area (in²)	# wires	Tot. Area	% Fill
1/2" RMC	0.632	0.3137	0.1255	0.0133	5	0.067	**21%**
1" RMC	1.049	0.8643	0.3457	0.0133	9	0.120	**14%**

Ampacity # wires	Adj.	#12	#10
		25	35
4 - 6	80%	20	28
7 - 9	70%	17.5	24.5
10 - 20	50%	12.5	17.5

Cooper, Lumark Wallpack LDWP-GL-4A-ED	**Erwin Rd. / Rte-147 Underpass**					
	Wattage 41		5000k		Lumens 2795	
	Lighting Summary				Veiling Lum. Ratio	Vertical Illum.,
	AVG (fc)	MIN (fc)	MAX (fc)	AVG/MIN		
Erwin Rd.	2.8	1.0	5.9	2.8	0.2	
Sidewalk, Westbound	4.4	2.4	8.7	1.8		2.0
Sidewalk, Eastbound	4.3	3.2	5.4	1.3		2.0

ILLUMINATION SUMMARY

P:\Jobs1\31829296_Erwin Road Lighting\CAD\ErwinRd_003.dwg [E-004] April 29, 2014 - 3:07pm lisa_mcarthur

URS
URS Corporation - North Carolina
1600 Perimeter Park Dr., Suite 400
Morrisville, NC 27560
NC LIC # C-2243
Phone 919-461-1100
Fax 919-461-1415

Duke University

REVISIONS

DATE	CHK	DESCRIPTION

SEAL

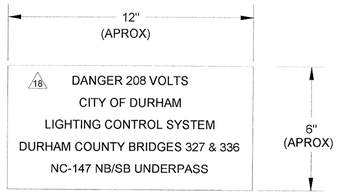
NORTH CAROLINA PROFESSIONAL SEAL 28248 ENGINEER JAMES HARRINGTON
29-APRIL 2014

PROJECT
NUMBER
DATE

DRAWING
DRAWN BY LHM
CHECKED BY EGE
SCALE NTS

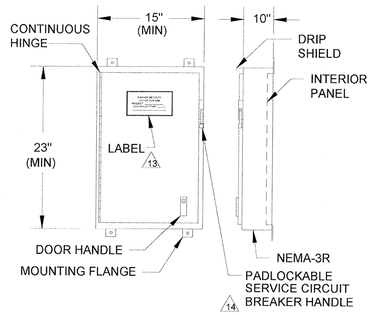
LIGHTING AND ELECTRICAL LAYOUT

E-004



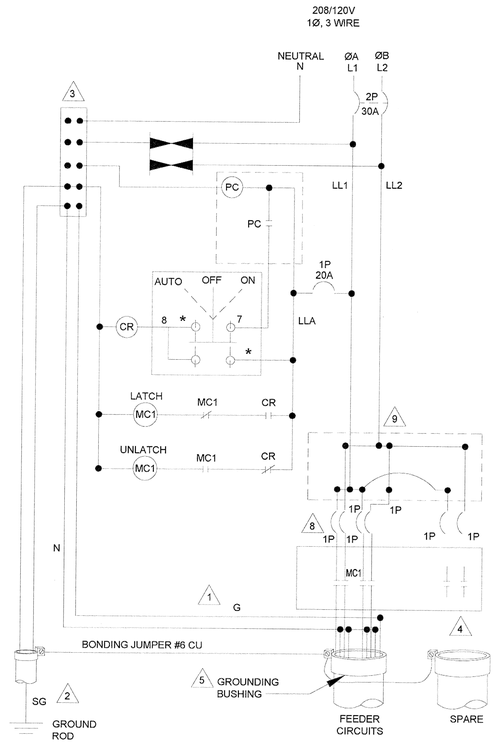
CONTROL CENTER LABELS

NOT TO SCALE

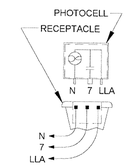


NEMA TYPE 3R STAINLESS STEEL ENCLOSURE

NOT TO SCALE

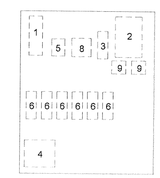


SCHEMATIC



PHOTOCELL CONNECTIONS

19



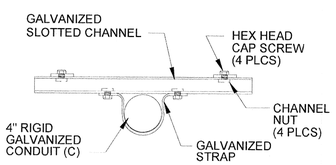
INTERIOR PANEL

COMPONENT LAYOUT

6 7 11

NOTES

1. EQUIPMENT GROUNDS (G) SHALL BE SIZED ACCORDING TO CIRCUIT DESCRIPTION. (SEE PLAN)
2. SYSTEM GROUND (SG) SHALL BE CONTINUOUS FROM THE NEUTRAL BAR TO THE GROUNDING ELECTRODE (GROUND ROD).
3. THE NEUTRAL BAR SHALL BE BONDED TO THE PANEL.
4. FEEDER CIRCUITS NOT SHOWN ON THE PLANS SHALL NOT BE INSTALLED, BUT CONDUIT SHALL BE INSTALLED AND CAPPED.
5. INSTALL A GROUNDING BUSHING ON EACH CONDUIT. CONNECT BONDING JUMPER AS REQUIRED BY NEC.
6. PROVIDE MANUFACTURER SUPPLIED MOUNTING BRACKETS OR SCREW STUDS PERMANENTLY ATTACHED TO THE BACK PANEL, FOR MOUNTING COMPONENTS.
7. THE CONTROL SYSTEM MUST BE LABELED "SUITABLE FOR USE AS SERVICE EQUIPMENT." REFER TO NCDOT SPECIFICATION 1408-2 FOR OTHER REQUIREMENTS.
8. 15 AMP BREAKER, 1-POLE.
9. PROVIDE MULTI-TAP LOAD LUGS OR POWER DISTRIBUTION BLOCKS.
10. CURRENT TRANSFORMER (T) CABINET AND METER MAY BE MOUNTED ON SERVICE POLE OR BACK OF CONTROL ENCLOSURE.
11. INSTALL LIGHTNING ARRESTOR ON OUTSIDE OF CABINET ASSEMBLY. NOT SHOWN FOR CLARITY.
12. SEE PLANS FOR SIZE OF CONDUITS AND/OR ELECTRICAL DUCT.
13. PERMANENTLY ATTACH A LABEL TO THE ENCLOSURE DOOR SHOWING THE WORK ORDER NUMBER, CONTROL SYSTEM LETTER DESIGNATION SHOWN IN THE LOAD SCHEDULE AT EACH CONTROL SYSTEM IN THE PLANS.
14. PROVIDE DOOR CLOSING MECHANISM INTERLOCKED WITH CIRCUIT BREAKER HANDLE.
15. STUB FEEDER CIRCUIT CONDUITS INTO JUNCTION BOX. CAP UNUSED CONDUITS. FEEDER CIRCUITS MUST BE MINIMUM 30" BELOW GRADE.
16. SEE NCDOT SPECIFICATION SECTION 1407 FOR SERVICE POLE AND SERVICE LATERAL.
17. SEE NCDOT SPECIFICATION SECTION 1411 FOR JUNCTION BOX INSTALLATION.
18. PROVIDE SAMPLE CONTROL CENTER LABELS TO CITY TRANSPORTATION DEPARTMENT FOR APPROVAL PRIOR TO ORDERING.
19. PHOTO CELL SHALL BE FIELD LOCATED AND APPROVED PRIOR TO INSTALLATION.

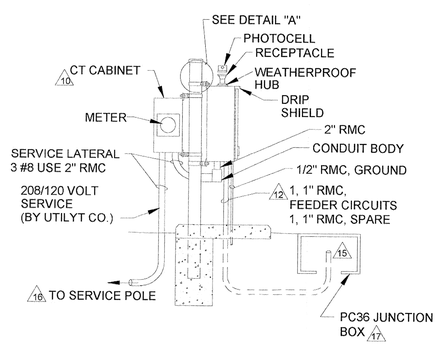


DETAIL "A"

NOT TO SCALE

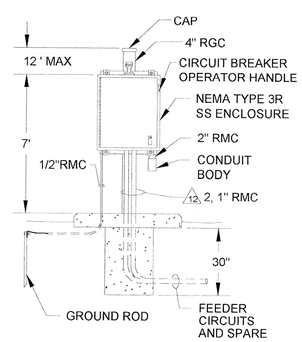
COMPONENT LIST

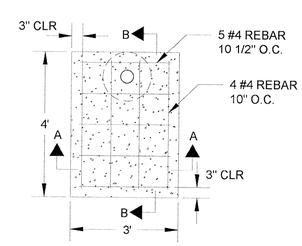
#	QTY	DESCRIPTION	SPECIFICATIONS
1	1	NEUTRAL BAR	
2	1	SERVICE CIRCUIT BREAKER	2P, 240V, 30A
3	1	CONTROL CIRCUIT BREAKER	1P, 120V, 20A
4	1	MECHANICALLY HELD CONTACTORS	6P, 240V, 30A W/120V COIL
5	1	CONTROL RELAY W/NC & NO CONTACT	120V, 10A, W/120V COIL
6	6	FEEDER CIRCUIT BREAKERS (INCLUDES 2 SPARE)	1P, 120V, 15A
7	1	LIGHTING ARRESTER	SPD TYPE-1
8	1	SELECTOR SWITCH (ON-OFF-AUTO)	240V, 10A
9	2	POWER DISTRIBUTION LUGS OR BLOCKS	
		MOUNTING BRACKETS OR SCREW STUDS	



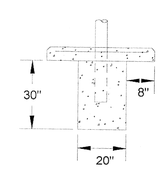
ASSEMBLY

NOT TO SCALE

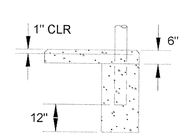




PLAN



SECTION A-A



SECTION B-B

FOUNDATION

NOT TO SCALE

URS
URS Corporation - North Carolina
1600 Perimeter Park Dr., Suite 400
Morrisville, NC 27560
NC LIC # C-2243
Phone 919-461-1100
Fax 919-461-1415

Duke University

REVISIONS

▲	DATE	CHK	DESCRIPTION

SEAL

NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 036240 JAMES HARRINGTON

29-APRIL-2014

PROJECT

NUMBER

DATE

DRAWING

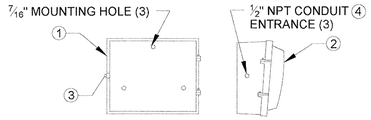
DRAWN BY LHM

CHECKED BY EGE

SCALE NTS

GENERAL DETAILS

E-005

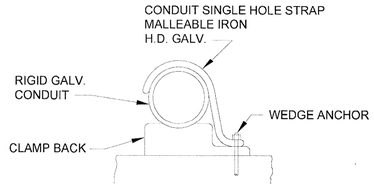


UNDERBRIDGE LUMINAIRE LED WALL PACK

NOT TO SCALE

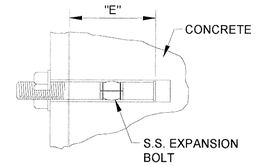
COMPONENTS:
1. DIE CAST ALUMINUM HOUSING, DOOR & HINGE
   COLOR: BLACK POWDER COATED
2. PRISMATIC REFRACTOR
3. SINGLE SCREW LATCH
4. FACTORY INSTALLED CONDUIT KNOCK-OUT

IES TYPE IV, NON-CUTOFF COOPER LIGHTING, LUMARK, 4000-LUMENS
120-VOLT, 41-WATT, COLOR TEMP 5000k, CATEGORY -C SURGE PROTECTION.



CONDUIT STRAP & BACK

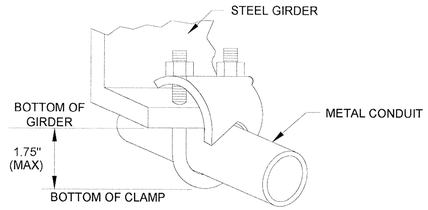
NOT TO SCALE



WEDGE ANCHOR

NOT TO SCALE

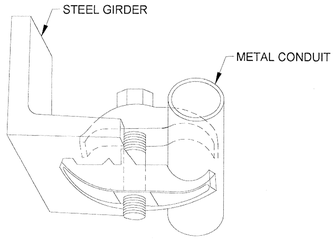
WEDGE ANCHOR SPECS		
SIZE	MIN."E"	PULLOUT lb
1/4"	1 1/2"	2600
3/8"	2"	5000
1/2"	2 1/2"	6300
5/8"	3"	8300



NOMINAL CONDUIT SIZE: 1/2"
MATERIAL:MALLEABLE IRON,
ELECTRO GALVANIZED FINISH INCLUDING THREADS

GIRDER CONDUIT CLAMP (OPTION 1)

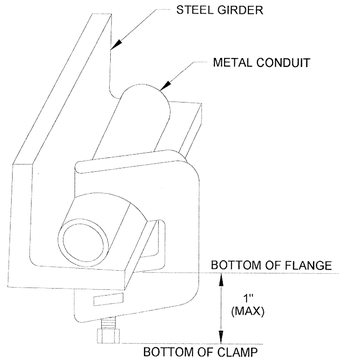
NOT TO SCALE



NOMINAL CONDUIT SIZE: 1/2"
MATERIAL:MALLEABLE IRON,
ELECTRO GALVANIZED FINISH INCLUDING THREADS

GIRDER CONDUIT CLAMP (OPTION 2)

NOT TO SCALE



NOMINAL CONDUIT SIZE: 1/2"
MATERIAL:1/8" STEEL,
GALV-KROM FINISH INCLUDING THREADS

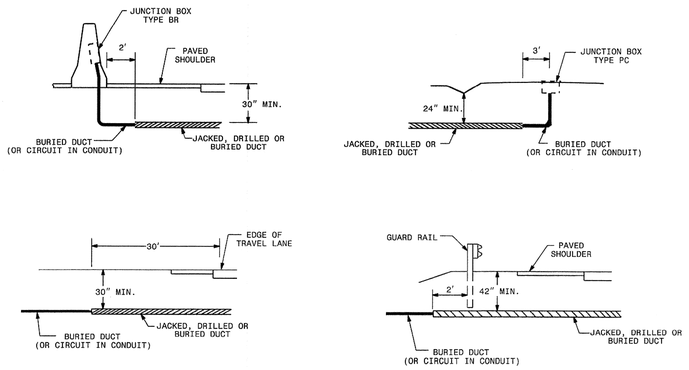
GIRDER CONDUIT CLAMP (OPTION 3)

NOT TO SCALE

STATE OF NORTH CAROLINA
DEPT. OF TRANSPORTATION
DIVISION OF HIGHWAYS
RALEIGH, N.C.

1-12

ENGLISH STANDARD DRAWING FOR
ELECTRICAL DUCT



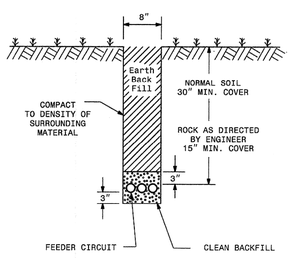
ELECTRICAL DUCT INSTALLATION

SHEET 1 OF 1
1409.01

STATE OF NORTH CAROLINA
DEPT. OF TRANSPORTATION
DIVISION OF HIGHWAYS
RALEIGH, N.C.

1-12

ENGLISH STANDARD DRAWING FOR
FEEDER CIRCUITS



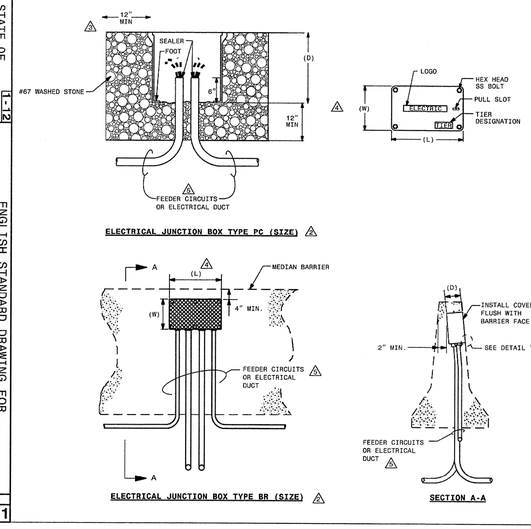
FEEDER CIRCUIT INSTALLATION

SHEET 1 OF 1
1410.01

STATE OF NORTH CAROLINA
DEPT. OF TRANSPORTATION
DIVISION OF HIGHWAYS
RALEIGH, N.C.

1-12

ENGLISH STANDARD DRAWING FOR
ELECTRICAL JUNCTION BOXES



ELECTRICAL JUNCTION BOX TYPE PC (SIZE) △3

ELECTRICAL JUNCTION BOX TYPE BR (SIZE) △3

SECTION A-A

DETAIL "B"

△ NOTES

△1 SEE STANDARD SPECIFICATIONS SECTION 1400-2H FOR SEALER AND MASTIC.

△2 INSERT PAY ITEM DESCRIPTION FOR (SIZE) TO DETERMINE PROPOSED JUNCTION BOX.

△3 SET TOP OF BOX FLUSH WITH CONCRETE IF REQUIRED TO BE PLACED IN SIDEWALKS OR OTHER CONCRETE STRUCTURES.

△4 SIZE IS SPECIFIED AS NOMINAL INSIDE DIMENSIONS FOR WIDTH (W), LENGTH (L) AND DEPTH (D). SEE PLANS FOR PROPOSED DIMENSIONS.

△5 SEE LAYOUT SHEETS FOR NUMBER AND SIZE OF FEEDER CIRCUITS AND ELECTRICAL DUCT.

SHEET 1 OF 1
1411.01

URS
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Phone 919-461-1100
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Duke University

REVISIONS

▲	DATE	CHK	DESCRIPTION

SEAL

NORTH CAROLINA PROFESSIONAL SEAL 18249 ENGINEER JAMES HARRINGTON
29-April-2014

PROJECT

NUMBER

DATE

DRAWING

DRAWN BY

CHECKED BY

SCALE

ELECTRICAL DETAILS

E-006

STATE OF NORTH CAROLINA
DEPT. OF TRANSPORTATION
DIVISION OF HIGHWAYS
RALEIGH, N.C.

1-12

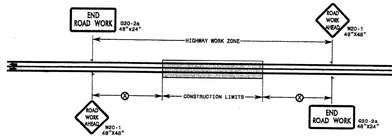
ENGLISH STANDARD DRAWING FOR

DETAIL DRAWING FOR TWO-WAY UNDIVIDED WORK ZONE WARNING SIGNS

SHEET 3 OF 3

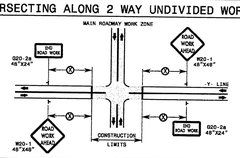
1101.01

TWO-WAY UNDIVIDED (L-LINES)



POSTED SPEED LIMIT (MPH)	RECOMMENDED MINIMUM SIGN SPACING (A)
≤ 60	600'
55	1000'

ROADWAYS INTERSECTING ALONG 2 WAY UNDIVIDED WORK ZONE (Y-LINES)



GENERAL NOTES

1- USE FLUORESCENT ORANGE SHEETING (TYPE VII OR HIGHER) ON ALL ADVANCED WORK ZONE SIGNS.

2- DO NOT INSTALL ADVANCE WARNING SIGNS MORE THAN 3 DAYS PRIOR TO BEGINNING OF WORK, UNLESS COVERED.

3- SIGNS SHOWN ARE REQUIRED FOR WORK ZONES THAT WILL REMAIN IN EFFECT OVERNIGHT. FOR SHORT-TERM DAILY MAINTENANCE TYPE OPERATIONS, THIS SIGNING APPLICATION IS OPTIONAL; MAY USE ONLY APPLICABLE ROADWAY STANDARD DRAWINGS INSTEAD. HOWEVER, IF THIS SIGNING APPLICATION IS USED, SIGNS MAY BE PORTABLE MOUNTED.

4- ALL SIGN SPACING DIMENSIONS ARE APPROXIMATE, FIELD ADJUST AS NECESSARY OR AS DIRECTED.

5- USE 3LB STEEL U-CHANNEL POST OR 4" X 4" WOOD POST FOR ALL WORK ZONE SIGNS. 3LB STEEL U-CHANNEL POSTS MUST MEET THE REQUIREMENTS OF STANDARD SPECIFICATION SECTION 1094-1(B), MAY BE GALVANIZED STEEL, OR MAY BE PAINTED GREEN BY THE POST MANUFACTURER. SQUARE STEEL TUBING POSTS HAVING EQUIVALENT STRENGTH OF THE 3 LB STEEL U-CHANNEL POST ARE ALSO ACCEPTABLE FOR USE. ERECT SIGNS PER ROADWAY STANDARD DRAWING 1110.01. PAYMENT FOR WOOD POSTS, 3LB STEEL U-CHANNEL AND SQUARE STEEL TUBING POSTS WITH SIGNS WILL BE MADE ACCORDING TO STANDARD SPECIFICATION "WORK ZONE SIGNS" SECTION 1110.

6- WHEN NECESSARY, USE SPLICING IN ACCORDANCE WITH ROADWAY STANDARD DRAWING NO. 1110.01.

7- DO NOT BACK BRACE SIGN SUPPORTS.

LEGEND

- STATIONARY SIGN
- DIRECTION OF TRAFFIC FLOW

STATE OF NORTH CAROLINA
DEPT. OF TRANSPORTATION
DIVISION OF HIGHWAYS
RALEIGH, N.C.

1-12

ENGLISH STANDARD DRAWING FOR

DETAIL DRAWING FOR TWO-WAY UNDIVIDED WORK ZONE WARNING SIGNS

SHEET 3 OF 3

1101.01

STATE OF NORTH CAROLINA
DEPT. OF TRANSPORTATION
DIVISION OF HIGHWAYS
RALEIGH, N.C.

1-12

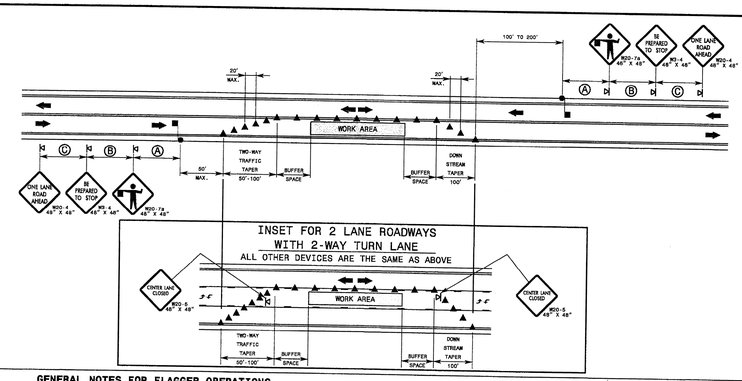
ENGLISH STANDARD DRAWING FOR

TEMPORARY LANE CLOSURES

2-LANE, 2-WAY ROADWAY-1 LANE CLOSED

SHEET 1 OF 15

1101.02



GENERAL NOTES FOR FLAGGER OPERATIONS

1- REFER TO STD. 1101.11 SHEET 4 FOR SIGN SPACING.

2- INSTALL LANE CLOSURES WITH THE TRAFFIC FLOW, BEGINNING WITH DEVICES ON THE UPSTREAM SIDE OF TRAFFIC.

3- REMOVE LANE CLOSURES AGAINST THE TRAFFIC FLOW, BEGINNING WITH DEVICES ON THE DOWNSTREAM SIDE OF TRAFFIC.

4- PLACE CONES THRU THE WORK AREA AT THE MAXIMUM SPACING EQUAL IN FEET TO 2 TIMES THE POSTED SPEED LIMIT.

5- EXTEND LANE CLOSURES AT THE BUFFER SPACE SUCH THAT STOPPING SIGHT DISTANCE IS PROVIDED TO THE FLAGGER (REFER TO STD. 1101.11 SHEET 2).

6- DO NOT STOP TRAFFIC IN ANY ONE DIRECTION FOR MORE THAN 5 MINUTES AT A TIME.

7- DRUMS OR SKINNY-DRUMS MAY BE USED IN LIEU OF CONES. REFER TO ROADWAY STANDARD DRAWING 1180.01 FOR SKINNY-DRUM REQUIREMENTS.

8- USE FLAGGERS TO CONTROL TRAFFIC AT INTERSECTIONS AFFECTED BY THE LANE CLOSURE. SUPPLEMENT FLAGGERS LOCATED AT INTERSECTIONS WITH FLAGGER AHEAD SIGNS (W20-7a) PLACED APPROXIMATELY 250 FT. IN ADVANCE OF THE FLAGGER. FOR SIGNALIZED INTERSECTIONS PLACE SIGNALS IN THE FLASH MODE AND RECOMMEND THE USE OF LAW ENFORCEMENT.

9- REFER TO 2009 MUTCD, CHAPTER 6, FOR FLAGGER CONTROL, REQUIREMENTS, AND PROCEDURES.

10- DO NOT EXCEED A 1 MILE LANE CLOSURE LENGTH UNLESS OTHERWISE SHOWN IN THE TMP OR AS DIRECTED BY THE ENGINEER.

GENERAL NOTES FOR PILOT CAR OPERATIONS

1- USE PILOT CARS WHEN DIRECTED BY THE ENGINEER.

2- IF ROADWAY WIDTH IS LESS THAN 22 FEET (EOP TO EOP), CONES MAY NOT BE REQUIRED ALONG WORK AREA, AND AT THE DISCRETION OF THE ENGINEER, CONES MAY BE OMITTED ALONG THE WORK AREA IF USING A PILOT CAR.

3- CONES ARE ALWAYS REQUIRED IN THE UPSTREAM AND DOWNSTREAM TAPERS.

4- MOUNT SIGN G20-4 "PILOT CAR FOLLOW ME" AT A CONSPICUOUS POSITION ON THE REAR OF THE PILOT VEHICLE.

5- DO NOT INSTALL MORE THAN ONE (1) MILE OF LANE CLOSURE, MEASURED FROM THE BEGINNING OF THE MERGE TAPER TO THE END OF THE LANE CLOSURE.

6- ADVISE RESIDENTS AND BUSINESSES WITHIN THE LANE CLOSURE LIMITS ABOUT METHODS OF SAFE EGRESS AND INGRESS FROM DRIVEWAYS DURING FLAGGING AND PILOT CAR OPERATIONS.

LEGEND

- FLAGGER
- CONE
- PORTABLE SIGN
- DIRECTION OF TRAFFIC FLOW

STATE OF NORTH CAROLINA
DEPT. OF TRANSPORTATION
DIVISION OF HIGHWAYS
RALEIGH, N.C.

1-12

ENGLISH STANDARD DRAWING FOR

TEMPORARY LANE CLOSURES

2-LANE, 2-WAY ROADWAY-1 LANE CLOSED

SHEET 1 OF 15

1101.02

STATE OF NORTH CAROLINA
DEPT. OF TRANSPORTATION
DIVISION OF HIGHWAYS
RALEIGH, N.C.

1-12

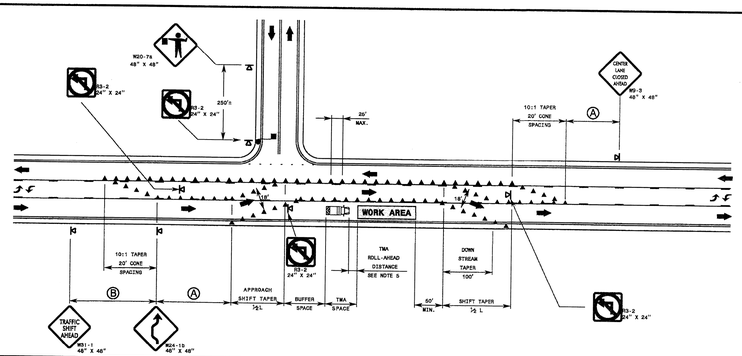
ENGLISH STANDARD DRAWING FOR

TEMPORARY LANE CLOSURES

2-LANE, 2-WAY ROADWAY WITH 2-WAY TURN LANE
1 THRU LANE CLOSED

SHEET 2 OF 15

1101.02



GENERAL NOTES

1- REFER TO STD. 1101.11, FOR "L" DISTANCE AND SIGN SPACING.

2- INSTALL LANE CLOSURES WITH THE TRAFFIC FLOW, BEGINNING WITH DEVICES ON THE UPSTREAM SIDE OF TRAFFIC. REMOVE LANE CLOSURES AGAINST THE TRAFFIC FLOW, BEGINNING WITH DEVICES ON THE DOWNSTREAM SIDE OF TRAFFIC.

3- PLACE CONES ADJACENT TO THE WORK AREA AT THE MAXIMUM SPACING EQUAL IN FEET TO 2 TIMES THE POSTED SPEED LIMIT. PLACE CONES SEPARATING OPPOSING TRAFFIC AT THE MAXIMUM SPACING OF 25 FEET.

4- EXTEND LANE CLOSURES AT THE BUFFER SPACE SUCH THAT STOPPING SIGHT DISTANCE IS PROVIDED TO THE BEGINNING OF THE APPROACH SHIFT TAPER (REFER TO STD. 1101.11 SHEET 2).

5- TMA'S ARE REQUIRED WHEN A BUFFER SPACE CANNOT BE ATTAINED, OR WHEN DIRECTED BY THE ENGINEER OR AS SHOWN IN THE PLANS. WHEN USED, POSITION TMA'S TO MAINTAIN A ROLL-AHEAD DISTANCE AS RECOMMENDED BY THE MANUFACTURER.

6- DRUMS OR SKINNY-DRUMS MAY BE USED IN LIEU OF CONES. REFER TO ROADWAY STANDARD DRAWING 1180.01 FOR SKINNY-DRUM REQUIREMENTS.

7- DO NOT EXCEED A 1 MILE LANE CLOSURE LENGTH UNLESS OTHERWISE SHOWN IN THE TMP OR AS DIRECTED BY THE ENGINEER.

LEGEND

- TMA
- FLAGGER
- CONE
- PORTABLE SIGN
- DIRECTION OF TRAFFIC FLOW

STATE OF NORTH CAROLINA
DEPT. OF TRANSPORTATION
DIVISION OF HIGHWAYS
RALEIGH, N.C.

1-12

ENGLISH STANDARD DRAWING FOR

TEMPORARY LANE CLOSURES

2-LANE, 2-WAY ROADWAY WITH 2-WAY TURN LANE
1 THRU LANE CLOSED

SHEET 2 OF 15

1101.02

STATE OF NORTH CAROLINA
DEPT. OF TRANSPORTATION
DIVISION OF HIGHWAYS
RALEIGH, N.C.

1-12

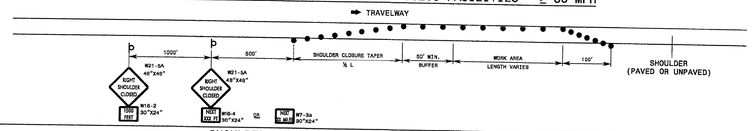
ENGLISH STANDARD DRAWING FOR

TEMPORARY SHOULDER CLOSURES

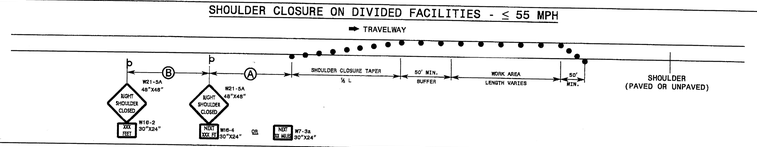
SHEET 1 OF 1

1101.04

SHOULDER CLOSURE ON CONTROLLED ACCESS FACILITIES - ≥ 60 MPH

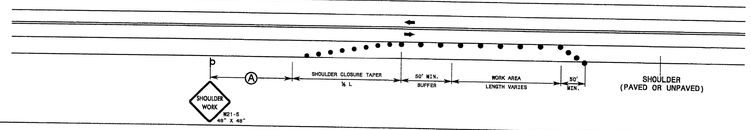


SHOULDER CLOSURE ON DIVIDED FACILITIES - ≤ 55 MPH



SHOULDER CLOSURE ON UNDIVIDED ROADWAYS

(SEE NOTE 5)



GENERAL NOTES

1- PLACE SHOULDER CLOSURE SIGNS ON THE SAME SIDE AS THE SHOULDER THAT IS CLOSED.

2- PLACE DRUMS IN THE SHOULDER TAPER AT THE MAXIMUM SPACING EQUAL IN FEET TO THE POSTED SPEED LIMIT. THE MAXIMUM SPACING OF DRUMS ALONG THE WORK AREA IS EQUAL IN FEET TO 2 TIMES THE POSTED SPEED LIMIT.

3- USE STATIONARY SIGNS FOR LONG TERM OPERATIONS (LONGER THAN 3 DAYS).

4- REFER TO STD. 1101.11 FOR "L" DISTANCE AND SIGN SPACING.

5- THE TWO-LANE, TWO-WAY DRAWING MAY BE APPLIED TO UNDIVIDED, MULTI-LANE FACILITIES.

LEGEND

- DRUM
- STATIONARY OR PORTABLE SIGN
- DIRECTION OF TRAFFIC FLOW

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ENGLISH STANDARD DRAWING FOR

TEMPORARY SHOULDER CLOSURES

SHEET 1 OF 1

1101.04

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REVISIONS

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SEAL

NORTH CAROLINA PROFESSIONAL SEAL 18470 ENGINEER GLENN EDENS 4/25/14

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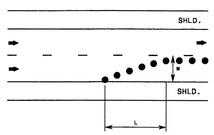
1-12

ENGLISH STANDARD DRAWING FOR
TRAFFIC CONTROL DESIGN TABLES
"L" DISTANCE AND CHANNELIZING
DEVICE TAPER CRITERIA

SHEET 1 OF 4
1101.11

EXAMPLE OF "L" & "W" DESIGNATIONS



TAPER LENGTH CRITERIA FOR CHANNELIZING DEVICES IN WORK ZONES

TYPES OF TAPERS	TAPER LENGTH
UPSTREAM TAPER	
MERGING TAPER	L MINIMUM
SHIFTING TAPER	½ L MINIMUM
SHOULDER TAPER	⅓ L MINIMUM
TWO-WAY TRAFFIC TAPER	50 - 100 FEET MAXIMUM
DOWNSTREAM TAPER	100 FEET MAXIMUM

QUICK REFERENCE - "L" DISTANCE TABLE

MINIMUM LONGITUDINAL DISTANCE "L" (FEET) (ROUNDED VALUES)

POSTED SPEED "S" (MPH)	LATERAL WIDTH "W" (FEET) 1	2	3	4	5	6	7	8	9	10	11	12
20	10	15	20	30	35	40	50	55	60	70	75	80
25	15	25	35	45	55	65	75	85	95	105	115	125
30	15	30	45	60	75	90	105	120	135	150	165	180
35	25	45	65	85	105	125	145	165	185	205	225	245
40	30	55	80	110	135	160	190	215	240	270	295	320
45	45	90	135	180	225	270	315	360	405	450	495	540
50	50	100	150	200	250	300	350	400	450	500	550	600
55	55	110	165	220	275	330	385	440	495	550	605	660
60	60	120	180	240	300	360	420	480	540	600	660	720
65	65	130	195	260	325	390	455	520	585	650	715	780
70	70	140	210	280	350	420	490	560	630	700	770	840

GENERAL NOTES

1- TABLE FOR "L" DISTANCE IS BASED ON CHANNELIZATION TAPER FORMULA FROM THE M.U.T.C.D.
WHERE:

SPEED LIMIT	FORMULA
40 MPH OR LESS	$L_{MIN} = \frac{W \times S^2}{60}$
45 MPH OR GREATER	$L_{MIN} = W \times S$

L = MINIMUM TAPER LENGTH IN FEET (LONGITUDINAL DISTANCE)
W = WIDTH OF OFFSET IN FEET (LATERAL DISTANCE)
S = POSTED SPEED LIMIT, OR OFF-PEAK 85 PERCENTILE SPEED IN MPH PRIOR TO WORK STARTING, OR THE ANTICIPATED OPERATING SPEED IN MPH

2- "L" DISTANCE IS FOR APPLICATION WITH CHANNELIZING DEVICE AND PAVEMENT MARKING TAPERS AND TRANSITIONS. CHANNELIZING DEVICES INCLUDE DRUMS, CONES, TUBULAR MARKERS, BARRICADES, RAISED ASPHALT ISLANDS, AND VERTICAL PANELS.

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ENGLISH STANDARD DRAWING FOR
TRAFFIC CONTROL DESIGN TABLES
"L" DISTANCE AND CHANNELIZING
DEVICE TAPER CRITERIA

SHEET 1 OF 4
1101.11

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ENGLISH STANDARD DRAWING FOR
TRAFFIC CONTROL DESIGN TABLES
BUFFER SPACE & SIGHT DISTANCE

SHEET 2 OF 4
1101.11

DESIGN SPEED (MPH)	MINIMUM SIGHT DISTANCE: STOPPING SIGHT DISTANCE (FEET)	MINIMUM SIGHT DISTANCE: PASSING SIGHT DISTANCE (FEET)	MINIMUM LONGITUDINAL BUFFER SPACE (FEET)
30	200	1090	85
35	250	1280	120
40	305	1470	155
45	360	1625	195
50	425	1835	240
55	495	1985	290
60	570	2135	345
65	645	2285	405
70	730	2460	470
75	820	2560	540
80	910	2660	615

GENERAL NOTES

1- TABLES ARE BASED ON THE AASHTO GREEN BOOK "A POLICY ON GEOMETRIC DESIGN OF HIGHWAYS AND STREETS" AND THE "MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES". MINIMUM SIGHT DISTANCE VALUES ARE FOR PASSENGER CAR VEHICLES ON WET AND LEVEL ROADWAYS. CONSULT THE AASHTO GREEN BOOK TO MAKE FINAL DETERMINATION OF STOPPING SIGHT DISTANCE REQUIREMENTS.

2- BUFFER SPACE TABLE IS BASED ON THE BRAKING DISTANCE PORTION OF STOPPING SIGHT DISTANCE FOR WET AND LEVEL PAVEMENTS.

3- USE OF STOPPING SIGHT DISTANCE IN TRAFFIC CONTROL PLAN APPLICATIONS INCLUDES PROVIDING SIGHT DISTANCE FOR TRAFFIC APPROACHING A LANE CLOSURE. PROVIDE 2-LANE, 2-WAY ROADWAYS STOPPING SIGHT DISTANCE TO THE FLAGGER. FOR LANE CLOSURES ON MULTILANE ROADWAYS PROVIDE STOPPING SIGHT DISTANCE TO THE BEGINNING OF THE LANE CLOSURE MERGE TAPER, OR FLASHING ARROW BOARD. EXTEND LANE CLOSURES AT THE BUFFER SPACE SUCH THAT STOPPING SIGHT DISTANCE IS PROVIDED.

4- USE OF MINIMUM PASSING SIGHT DISTANCE TABLE IN TRAFFIC CONTROL PLAN APPLICATIONS INCLUDES PROVIDING SIGHT DISTANCE REQUIREMENTS FOR PLACEMENT OF PAVEMENT MARKING PASSING/NO-PASSING ZONES FOR 2-LANE, 2-WAY ROADWAYS.

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ENGLISH STANDARD DRAWING FOR
TRAFFIC CONTROL DESIGN TABLES
BUFFER SPACE & SIGHT DISTANCE

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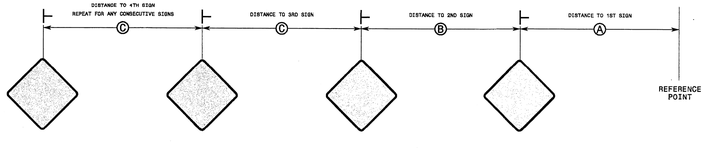
ENGLISH STANDARD DRAWING FOR
TRAFFIC CONTROL DESIGN TABLES
SPACING OF TEMPORARY SIGNS IN SERIES

SHEET 4 OF 4
1101.11

ADVANCE WARNING SIGN SPACING CHART			
POSTED SPEED LIMIT (MPH)	RECOMMENDED DISTANCE BETWEEN SIGNS (FEET)‡ Ⓐ	Ⓑ	Ⓒ
≤ 35	200	200	200
40-50	350	350	350
55	500	500	500
CONTROLLED ACCESS ROADS (≥ 55)	1000	1500	2700

STATIONARY OR PORTABLE SIGNS



GENERAL NOTES

1- REFER TO 2009 MUTCD.

2- USE THIS STANDARD DRAWING IN CONJUNCTION WITH OTHER TRAFFIC CONTROL ROADWAY STANDARD DRAWINGS WHERE SIGN SPACING DISTANCES A, B, C, ARE SPECIFIED.

3- APPLY THE ADVANCE WARNING SIGN SPACING CHART WHERE A SERIES OF 2 OR MORE SIGNS ARE USED. ALL SIGN SPACING DIMENSIONS ARE APPROXIMATE. FIELD ADJUST AS VARIOUS CONDITIONS OCCUR, SUCH AS LIMITED SIGHT DISTANCE, OBSTRUCTION INTERFERENCE, ETC.

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ENGLISH STANDARD DRAWING FOR
TRAFFIC CONTROL DESIGN TABLES
SPACING OF TEMPORARY SIGNS IN SERIES

SHEET 4 OF 4
1101.11

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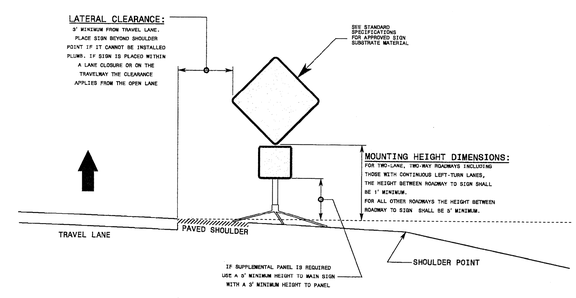
ENGLISH STANDARD DRAWING FOR
PORTABLE WORK ZONE SIGNS
MOUNTING HEIGHT & LATERAL CLEARANCE

SHEET 1 OF 1
1110.02



GENERAL NOTES

1- DIMENSIONS SHOWN ARE MINIMUM VALUES. MOUNT SIGNS SO THEY WILL BE CLEARLY VISIBLE TO APPROACHING TRAFFIC EVEN WHEN SIGNS ARE MOUNTED BEHIND TRAFFIC CONTROL DEVICES SUCH AS DRUMS, BARRIER, OR OTHER OBJECTS.

2- ALL PORTABLE SIGNS AND STANDS MUST MEET OR EXCEED THE REQUIREMENTS OF NCHRP 350 FOR CATEGORY II DEVICES. USE PORTABLE WORK ZONE SIGNS AND STANDS SPECIFICALLY DESIGNED FOR ONE ANOTHER.

3- ALL PORTABLE WORK ZONE SIGNS AND STANDS MUST BE LISTED ON THE DEPARTMENT'S APPROVED PRODUCTS LIST AT https://apps.dot.state.nc.us/vendor/approvedproducts.

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ENGLISH STANDARD DRAWING FOR
PORTABLE WORK ZONE SIGNS
MOUNTING HEIGHT & LATERAL CLEARANCE

SHEET 1 OF 1
1110.02

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NORTH CAROLINA PROFESSIONAL SEAL 18470 ENGINEER GLENN CORUS
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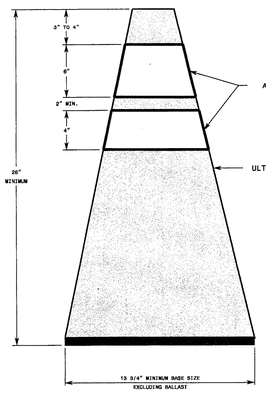
1-12

ENGLISH STANDARD DRAWING FOR

CONES

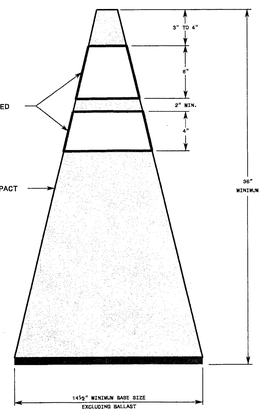
28 INCH CONE

(MINIMUM SIZE CONE FOR ALL CLASSES OF ROADS EXCEPT FREEWAYS AND INTERSTATES)



36 INCH CONE

(REQUIRED FOR FREEWAYS AND INTERSTATES)



WHITE RETROREFLECTIVE ADHESIVE SHEETING REQUIRED BETWEEN DUSK AND DAWN

ORANGE ULTRA-VIOLET STABILIZED IMPACT RESISTANT PLASTIC

GENERAL NOTES

1- ACHIEVE BALLASTING BY USING SPECIAL WEIGHTED BASES SUCH AS SAND BAG RINGS, DOUBLING CONES, OR BASES THAT CAN BE FILLED WITH BALLAST. SEVENTY PERCENT OF THE WEIGHT OF THE CONE MUST BE IN THE BASE. USE BALLAST'S THAT DO NOT PRESENT A HAZARD WHEN STRUCK.

2-SEE THE DEPARTMENT'S APPROVED PRODUCTS LIST AT https://apps.dot.state.nc.us/vendor/approvedproducts.

3-USE TYPE IV OR HIGHER HIGH INTENSITY PRISMATIC SHEETING.

SHEET 1 OF 1
1135.01

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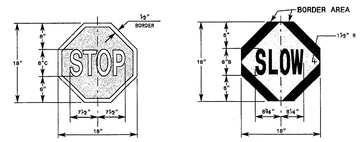
ENGLISH STANDARD DRAWING FOR

FLAGGERS

STOP/SLOW PADDLE

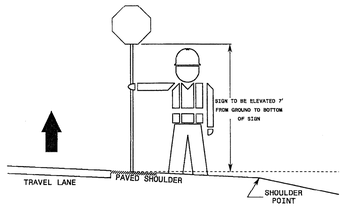


STOP:
LEGEND-WHITE REFLECTORIZED
BORDER-WHITE REFLECTORIZED
BACKGROUND-RED REFLECTORIZED

SLOW:
LEGEND-BLACK REFLECTORIZED
BORDER AREA-BLACK REFLECTORIZED
BACKGROUND-ORANGE REFLECTORIZED

NOTE: FOR OPERATIONS THAT ARE RESTRICTED FROM DUSK TO DAWN ONLY, USE REFLECTORIZED LEGENDS, BORDERS AND BACKGROUNDS.

FLAGGER AND PADDLE PLACEMENT



GENERAL NOTES

1- USE HAND SIGNALING DEVICES SUCH AS STOP-SLOW PADDLES, FLASHLIGHTS TO CONTROL TRAFFIC. USE STOP-SLOW PADDLES AS THE PRIMARY DEVICE.

2- FABRICATE STOP-SLOW PADDLES FROM SHEET METAL OR OTHER LIGHT SEMI RIGID MATERIAL. PROVIDE A RIGID HANDLE OF SUFFICIENT LENGTH SO THE PADDLE IS HELD AT 7 FEET ABOVE GROUND LEVEL.

3- PROVIDE STOPPING SIGHT DISTANCE TO EACH FLAGGER STATION (REFER TO STD. 1101.11 SHEET 2).

4- ILLUMINATE FLAGGER STATIONS DURING NIGHT OPERATIONS.

5- FOLLOW FLAGGER QUALIFICATIONS AND METHODS OF HAND-SIGNALING PROCEDURES IN ACCORDANCE WITH PART VI OF THE MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES.

6- ALL FLAGGERS MUST BE CERTIFIED BY AN NCDOT APPROVED SOURCE.

SHEET 1 OF 1
1150.01

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ENGLISH STANDARD DRAWING FOR

FLAGGING DEVICES

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ENGLISH STANDARD DRAWING FOR

WORK VEHICLE LIGHTING SYSTEMS AND TMA DELINEATION

LIGHT SYSTEM OPTIONS

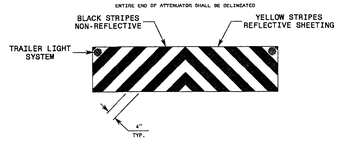
I. TRUCKS WITHOUT DUMP BODIES- CHOICE OF EITHER:
A. ONE ROUND (12" MINIMUM)- EITHER LED OR ROTATING FLASH WITH FULL AMBER LIGHTS AND AMBER DOME OR LIGHT BARS MAY BE HALF AMBER/HALF WHITE WITH AMBER DOME. (ALL WHITE LIGHT SYSTEMS ARE PROHIBITED)

B. 2 HIGH INTENSITY STROBES (CLASS 2)- AMBER LED/AMBER FLASH AND AMBER DOME MOUNTED ON EACH SIDE OF THE HEADBOARD

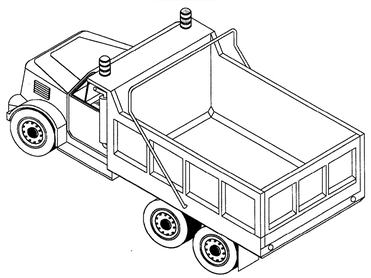
II. TRUCKS WITH DUMP BODIES- (NOT REQUIRED, BUT ENCOURAGED)
A. 2 HIGH INTENSITY STROBES (CLASS 2)- AMBER LED/AMBER FLASH AND AMBER DOME MOUNTED ON EACH SIDE OF THE CAB PROTECTOR

TMA DELINEATION

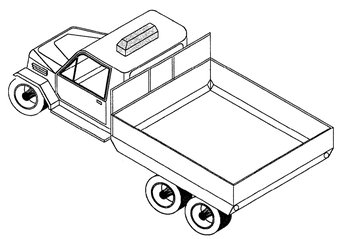
ENTIRE END OF ATTENUATOR SHALL BE DELINEATED



DUMP BODY



NON-DUMP BODY



GENERAL NOTES FOR TMA REQUIREMENTS

1- WHEN TMA'S USED FOR SHADOW VEHICLES, CONTACT THE TMA MANUFACTURER FOR SPECIFIC TRUCK REQUIREMENTS.

2- TMA MUST MEET OR EXCEED THE REQUIREMENTS OF NCHRP 350 TEST LEVEL II FOR WORK ZONES WITH POSTED SPEED LIMIT OF 45 MPH OR LESS; OR TEST LEVEL III FOR WORK ZONES WITH POSTED SPEED LIMIT OF 50 MPH OR GREATER. TMA MAY EITHER BE TRUCK MOUNTED OR TRAILER MOUNTED.

3- SEE THE DEPARTMENT'S APPROVED PRODUCT LIST AT https://apps.dot.state.nc.us/vendor/approvedproducts.

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1165.01

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NORTH CAROLINA PROFESSIONAL SEAL 18470 ENGINEERING GLENN EDENS, JR. 4/25/14

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