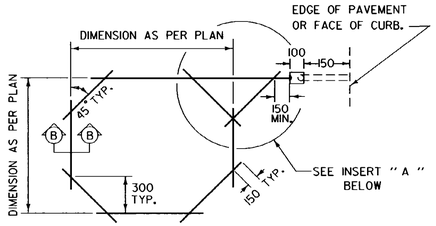
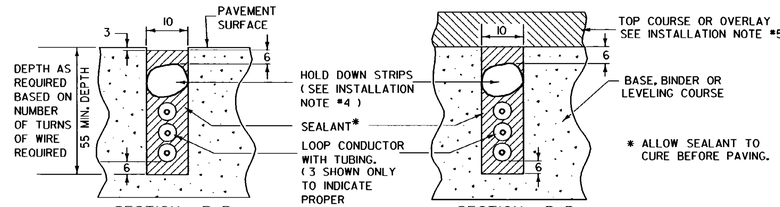


VEHICLE DETECTOR LOOP LAYOUT DETAIL



LOOP SAWCUT DETAIL

LONG LOOPS

LOOP INDUCTANCE DESIGN TABLE

LENGTH OF LOOP (m)	LOOP INDUCTANCE (μH) WIDTH OF LOOP (m) 1.8 m 1 TURN	1.8 m 2 TURNS	1.8 m 3 TURNS	2.4 m 1 TURN	2.4 m 2 TURNS	2.4 m 3 TURNS
3.0	-	96	203	-	102	215
4.5	-	136	286	-	142	298
6.0	-	175	370	-	181	382
7.5	-	215	454	-	220	466
9.0	-	254	537	-	260	549
10.5	-	293	-	-	299	-
12.0	104	333	-	106	338	-
13.5	117	372	-	119	378	-
15.0	129	411	-	131	417	-
16.5	141	451	-	143	457	-
18.0	154	490	-	155	496	-
19.5	166	529	-	168	535	-
21.0	178	569	-	180	575	-

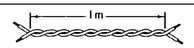
NOTE:

1. THE ABOVE INDUCTANCES ARE ESTIMATED VALUES USING THE FOLLOWING EQUATIONS:

   1 TURN: $L = 1.64P + 4.92D$
   2 TURNS: $L = 4.92P + 16.40D$
   3 TURNS: $L = 9.84P + 36.09D$

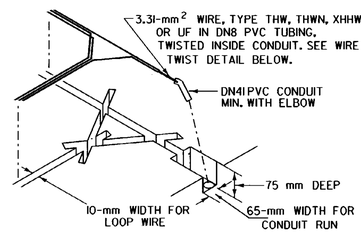
   WHERE:
   L = LOOP INDUCTANCE (μH)
   P = LOOP PERIMETER (m)
   D = LOOP LENGTH (m)

2. SEE NOTES 1 & 3 UNDER THE RECTANGULAR LOOP TABLE.

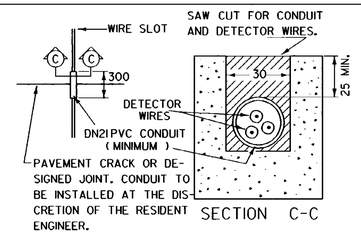


MINIMUM 15 TWISTS PER METER. BOTH WIRES SHALL BE TWISTED.

WIRE TWIST DETAIL



INSERT " A " LAYOUT DETAIL



DETECTOR WIRE ACROSS CRACKS OR JOINTS

RECTANGULAR LOOPS

LOOP INDUCTANCE DESIGN TABLE

LENGTH OF LOOP (m)	WIDTH OF LOOP (m) 1.2 m	1.8 m	2.4 m	3.0 m	LOOP PERIMETER (m)	LOOP INDUCTANCE (μH) 2 TURNS K=1.37	3 TURNS K=1.26	4 TURNS K=1.17	5 TURNS K=1.09
	2.4	1.8	-	-	7.2	39	82	135	196
	3.0	2.4	-	-	8.4	46	95	157	229
	3.6	3.0	2.4	-	9.6	53	109	180	262
	4.2	3.6	3.0	-	10.8	59	122	202	294
	4.8	4.2	3.6	3.0	12.0	66	136	225	327
	5.4	4.8	4.2	3.6	13.2	72	150	247	360
	6.0	5.4	4.8	4.2	14.4	79	163	270	392
	6.6	6.0	5.4	4.8	15.6	85	177	292	425
	7.2	6.6	6.0	5.4	16.8	92	191	314	458
	7.8	7.2	6.6	6.0	18.0	99	204	337	491
	8.4	7.8	7.2	6.6	19.2	105	218	359	-
	9.0	8.4	7.8	7.2	20.4	112	231	382	-
	9.6	9.0	8.4	7.8	21.6	118	245	404	-
	10.2	9.6	9.0	8.4	22.8	125	259	427	-
	11.1	10.5	9.9	9.3	24.6	135	279	461	-
	12.6	12.0	11.4	10.8	27.6	151	313	517	-

NOTE :

1. TO THE ABOVE LOOP INDUCTANCES, ADD 25 MICROHENRIES FOR EACH 30 m OF LEAD-IN CABLE FROM THE PAVEMENT LOOP TO THE CONTROLLER CABINET. LOOP LEAD-IN LENGTH SHALL NOT EXCEED 230 m.

2. THE FORMULA USED FOR THE TABLE ABOVE IS INDUCTANCE: $L = KPN^2$.
   WHERE $K = \frac{16.4}{10+N}$, N = NO. OF TURNS, P = LOOP PERIMETER.

3. IF LOOPS ARE CONNECTED IN SERIES (PREFERRED FOR SMALL LOOPS), THE TOTAL INDUCTANCE BECOMES THE SUM OF ALL INDUCTANCES. IF LOOPS ARE CONNECTED IN PARALLEL (PREFERRED FOR LONG LOOPS), THE COMBINED INDUCTANCE CAN BE CALCULATED FROM THE FOLLOWING EQUATION.

$$L_P = \left[\frac{1}{\frac{1}{L_1}+\frac{1}{L_2}+\frac{1}{L_3}\cdots\cdots}\right] + \text{LOOP LEAD-IN INDUCTANCES.}$$

GENERAL NOTES

1. THE TERM "VEHICLE DETECTOR LOOP" SHALL REFER TO THE SENSOR EQUIPMENT EMBEDDED IN THE PAVEMENT WHICH SENSES VEHICLE PASSAGE OR PRESENCE. THE TERM "CABINET AMPLIFIER" SHALL REFER TO THE ELECTRICAL OR ELECTRONIC DEVICE LOCATED IN THE CONTROLLER CABINET WHICH RESPONDS DIRECTLY TO A VEHICLE ACTUATION AND INTERFACES WITH THE CONTROLLER.

2. IF THE DISTANCE FROM THE SAWCUT TO THE CONTROLLER EXCEEDS 7.5 m, SHIELDED CABLE SHALL BE USED TO EXTEND LOOP LEAD-INS FROM A JUNCTION BOX, PULLBOX OR POLE BASE TO THE CABINET. IT SHALL MEET THE REQUIREMENTS OF ISMA SPEC. NO. 50-2.

3. VEHICLE DETECTOR LOOP SHALL BE INSTALLED IN SUCH A WAY AS TO MAXIMIZE SENSITIVITY AND BE CAPABLE OF DETECTING MOTORCYCLES AND BICYCLES, WHILE ELIMINATING FALSE CALLS FROM VEHICLES IN ADJACENT LANES. LOOPS SHOULD BE DESIGNED SO THAT THE TOTAL INDUCTANCE [LOOP(S) PLUS LEAD-IN(S)] AT THE AMPLIFIER IS BETWEEN 100 AND 450 MICROHENRIES (200-300 PREFERRED). FOR SINGLE LOOPS, THE LOOP INDUCTANCE SHOULD BE AT LEAST TWICE THAT OF THE LEAD-IN. FOR MULTIPLE LOOPS, THE INDUCTANCE ON THE STREET SIDE OF THE SPLICE SHOULD BE AT LEAST TWICE THAT ON THE CONTROLLER SIDE.

4. THE LOOPS SHALL BE CENTERED IN THEIR RESPECTIVE LANES, UNLESS OTHERWISE NOTED.

5. ALL LOOPS SHALL OPERATE IN THE PRESENCE MODE WITH THE CONTROLLER SET TO LOCKING MEMORY FOR "LEFT-ONLY" OR "THRU-ONLY" LANES. ALL OTHER LANES SHALL UTILIZE NON-LOCKING MEMORY, UNLESS OTHERWISE NOTED.

6. ALL LOOPS IN "RIGHT TURN ONLY" LANES OR LOOPS PLACED TO DETECT ONLY RIGHT TURNING VEHICLES SHALL HAVE DELAYED CALL LOOP AMPLIFIERS, UNLESS OTHERWISE NOTED.

7. ALL LOOP DETECTORS SHALL BE OF A TYPE THAT FAIL IN THE "ON" MODE.

8. ALL LOOP AND LEAD-IN WIRE SHALL BE 3.31-mm² AWG. THE RESISTANCE OF 3.31-mm² AWG IS 5.31 OHMS / 1000 m AT 25°C.

INSTALLATION NOTES

1. ALL SPLICES SHALL BE MADE IN PULLBOXES, JUNCTION BOXES OR POLE BASES. ALL SPLICES SHALL BE SOLDERED USING ROSIN CORE SOLDER AND FULLY SEALED BY THE APPLICATION OF DUAL-WALL, HEAT-SHRINKABLE TUBING, UNLESS OTHERWISE NOTED. A MINIMUM OF 1 m OF SLACK SHALL BE LEFT IN EACH CABLE IN EACH BOX OR BASE.

2. ALL LOOP WIRES SHALL BE INSTALLED IN PVC TUBING. THE TUBING ENDS SHALL BE SEALED USING LOOP SEALANT PRIOR TO INSTALLATION IN THE SAWCUT.

3. BEFORE LAYING IN THE LOOP WIRE, A 6-mm BEAD OF SEALANT SHALL BE PLACED IN THE SAWCUT AND ALLOWED TO SET UP SUFFICIENTLY TO GIVE THE WIRE SOME SUPPORT. EACH WIRE SHALL BE EASED INTO THE SAWCUT WITH A BLUNT WOODEN STICK.

4. THE LOOP WIRES SHALL BE HELD IN PLACE DURING INSTALLATION BY SHORT STRIPS OF POLYETHYLENE FOAM SEALANT BACKERS. THE STRIPS SHALL BE ABOUT 50 mm LONG AND PLACED EVERY 500 mm. THEY ARE TO REMAIN IN PLACE WHEN THE SLOT IS SEALED.

5. VEHICLE DETECTOR LOOPS SHALL BE PLACED IN SAWCUTS IN THE PAVEMENT COURSE IMMEDIATELY BELOW THE WEARING SURFACE AND PAVED OVER WHERE PRACTICAL. IF THE WEARING SURFACE IS MORE THAN 45 mm IN DEPTH, THE SAWCUT SHALL BE MADE AFTER THE WEARING SURFACE IS PLACED. IF PAVING IS NOT PART OF THE PROJECT, THE SAWCUT SHALL BE MADE IN EXISTING PAVEMENT.

6. IF LOOP WIRES ARE PLACED BELOW THE WEARING SURFACE, THE SEALANT SHALL BE PROPERLY CURED BEFORE THE FINAL PAVEMENT IS PLACED.

7. LOOP LEAD-INS FROM ADJACENT LOOPS ACTUATING DIFFERENT PHASES SHALL BE IN SEPARATE SAWCUTS AND CONDUITS TO THE PULLBOX OR POLE BASE.

8. LOOP LEAD-INS SHALL BE KEPT AT LEAST 300 mm AWAY FROM POWER WIRING, WHERE PRACTICAL.

9. ALL ELECTRICAL WORK AND MATERIALS SHALL MEET THE REQUIREMENTS OF THE NATIONAL ELECTRIC CODE.

10. LOOP WIRES FROM EACH LOOP AND/OR APPROACH SHALL BE COLOR CODED OR OTHERWISE IDENTIFIED AT EACH PULLBOX OR JUNCTION BOX, IN THE POLE BASE(S) AND AT THE TERMINAL BOARD IN THE CONTROLLER CABINET. FOLLOWING INSTALLATION, THE CONTRACTOR SHALL SUPPLY 2 COPIES OF A SCHEMATIC SHOWING THE FOLLOWING INFORMATION.
    1. NUMBER OF TURNS;
    2. DIMENSIONS FOR EACH LOOP;
    3. LOOP LEAD-IN ROUTING FROM THE SAWCUT TO THE CONTROLLER; AND
    4. TYPE OF CONNECTIONS AT EACH SPLICE (SERIES, PARALLEL OR SERIES-PARALLEL).

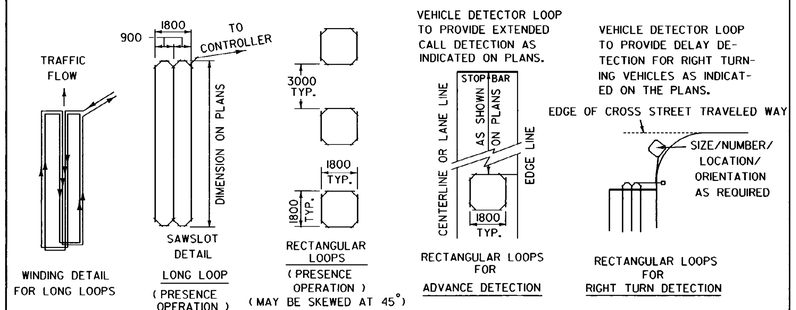
    ONE COPY SHALL BE LEFT IN THE CONTROLLER CABINET AND THE OTHER GIVEN TO THE TRAFFIC SHOP OR LOCAL OFFICIAL RESPONSIBLE FOR THE SIGNAL MAINTENANCE.

LOOP TESTING

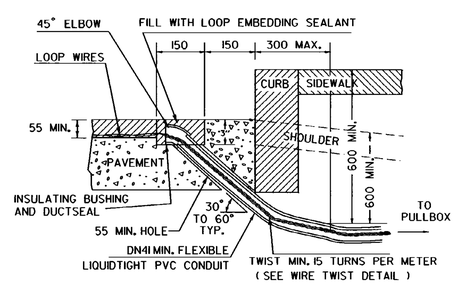
DURING INSTALLATION OF THE LOOPS, THE CONTRACTOR SHALL MEASURE THE LOOP INDUCTANCE, LEAKAGE TO GROUND AND LOOP RESISTANCE IN THE PRESENCE OF THE RESIDENT ENGINEER. THE CONTRACTOR SHALL PROVIDE THE APPROPRIATE EQUIPMENT. THE INSTALLATION SHALL BE CONSIDERED ACCEPTABLE IF:

1. THE INDUCTANCE READING IS WITHIN 10% ± OF THE CALCULATED VALUE;
2. THE INSULATION TEST (LEAKAGE TO GROUND) IS ABOVE 5 MEGOHMS FOR EXISTING LOOPS AND 100 MEGOHMS FOR NEW LOOPS USING A 500 VOLT DC INPUT; AND
3. THE LOOP RESISTANCE IS WITHIN 25% ± OF THE CALCULATED VALUE.

IF THE READINGS FALL OUTSIDE THE ABOVE RANGES, CORRECTIVE MEASURES MAY BE REQUIRED AND THE ENGINEER SHALL NOTIFY THE TRAFFIC AND SAFETY DIVISION. THE COST OF TESTING THE LOOPS AND ANY NECESSARY CORRECTIONS SHALL BE SUBSIDIARY TO THE ITEM "VEHICLE DETECTOR LOOP". THE CALCULATED VALUES SHALL BE SHOWN ON THE PLANS. LOOP TESTING IS NOT REQUIRED FOR TEMPORARY LOOPS.



TYPICAL LOOP DESIGNS



CONDUIT DETAIL FOR LOOP LEAD-IN TO CONTROLLER / PULL BOX

CONDUIT FILL DESIGN VALUES

AVAILABLE CONDUIT AREA: CONDUIT SIZE	O.D. (mm)	26 % FILL (mm²)	CONDUCTOR SIZE TABLE: NUMBER OF CONDUCTORS	CROSS SECTIONAL AREA (mm²) WIRE SIZE (mm²) 2.08	3.31	5.26	8.37	13.30
DN27	33.40	144.9	1	13.55	16.13	20.00	38.71	52.90
DN35	42.16	250.7	2	60.00	83.23	CALCULATE AS REQUIRED		
DN41	48.26	341.6	5	91.61	129.03			
DN53	60.32	562.8	7	109.68	167.74			
DN63	73.02	802.8	9	191.61	266.45			
DN78	88.90	1239.8	12	204.52	281.29			
DN91	101.60	1658.5	16	259.35	387.74			
DN103	114.30	2135.4	19	274.19	424.52			

OTHER STDS. REQUIRED: NONE

NOTE: ALL DIMENSIONS ARE IN MILLIMETERS (mm) EXCEPT WHERE NOTED.

REVISIONS AND CORRECTIONS

JUNE 13, 1997 - ORIGINAL APPROVAL DATE

APPROVED

DIRECTOR OF ENGINEERING

DIRECTOR OF CONSTRUCTION AND MAINTENANCE

VEHICLE DETECTOR LOOP DETAILS

VERMONT AGENCY OF TRANSPORTATION

VAOT Metric STANDARD E-172M