

GENERAL NOTES

INSTALLATION NOTES

1. THE TERM "VEHICLE DETECTOR LOOP" SHALL REFER TO THE SENSOR ELEMENT IMBEDDED IN THE PAVEMENT WHICH SENSES VEHICLE PASSAGE OR PRESENCE. THE TERM "CABINET AMPLIFIER" SHALL REFER TO THE ELECTRICAL OR ELECTRONIC DEVICE LOCATED IN THE CONTROL CABINET WHICH RESPONDS DIRECTLY TO A VEHICLE ACTUATION AND INTERFACES WITH THE CONTROLLER.
2. WHEN THE DISTANCE FROM THE VEHICLE DETECTOR LOOP TO THE CONTROLLER EXCEEDS 25 FEET, SHIELDED CABLE SHALL BE USED TO EXTEND LOOP LEAD-INS FROM A JUNCTION OR PULLBOX OR POLE BASE TO THE CABINET. IT SHALL MEET THE REQUIREMENTS OF IMSA SPEC. NO. 50-2.
3. WHEN THE DISTANCE FROM THE VEHICLE DETECTOR LOOP TO THE CONTROLLER EXCEEDS 250 FEET, #12 AWG WIRE SHALL BE USED FOR BOTH THE LOOP WIRE AND THE SHIELDED CABLE.
4. THE VEHICLE DETECTOR LOOP SHALL BE INSTALLED IN SUCH A WAY AS TO MAXIMIZE SENSITIVITY, AND SHALL BE CAPABLE OF DETECTING MOTORCYCLES AND BICYCLES, WHILE ELIMINATING FALSE CALLS FROM VEHICLES IN ADJACENT LANES. LOOPS SHALL BE DESIGNED SO THAT THE LOOPS AND FEEDER LINES TOTAL INDUCTANCE AT THE AMPLIFIER IS BETWEEN 100 AND 300 MICROHENRIES.
5. THE LOOPS SHALL BE CENTERED IN THEIR RESPECTIVE LANES, UNLESS OTHERWISE NOTED.
6. ALL LOOPS SHALL OPERATE IN THE PRESENCE MODE WITH THE CONTROLLER SET TO NON-LOCKING MEMORY, UNLESS OTHERWISE NOTED.
7. ALL LOOPS IN "RIGHT TURN ONLY" LANES SHALL HAVE DELAYED CALL LOOP AMPLIFIERS, UNLESS OTHERWISE NOTED.
8. PVC JACKETED WIRE OR CABLE SHALL NOT BE USED WHERE EXPOSED TO SUNLIGHT.

1. NO WIRE SPLICING EXCEPT IN PULL OR JUNCTION BOXES, AND POLE BASES. SPLICES SHALL BE SOLDERED (ROSIN CORE) AND WRAPPED IN PLASTIC TAPE AND COATED WITH A SEALANT USED FOR SUCH PURPOSES. AN EPOXY SPLICE SHALL BE USED WHEN CALLED FOR ON THE PLANS.
2. LOOP SEALANT SHALL BE APPLIED USING A PRESSURE SYSTEM.
3. ALL LOOP WIRES SHALL BE INSTALLED IN PVC TUBING, EXCEPT AS NOTED IN GENERAL NOTE #8. THE TUBING ENDS SHALL BE SEALED USING LOOP SEALANT PRIOR TO INSTALLATION IN THE SAWCUT.
4. BEFORE LAYING IN THE LOOP WIRE, A ONE-QUARTER INCH OF SEALANT SHALL BE PLACED IN THE SAW SLOT AND ALLOWED TO SET UP SUFFICIENTLY TO GIVE THE WIRE SOME SUPPORT. EACH WIRE SHALL BE PLACED IN THE SAW SLOT WITH A BLUNT WOODEN STICK AND SEALED BEFORE PLACING THE NEXT WIRE ON TOP UNTIL THE REQUIRED NUMBER OF TURNS IS COMPLETE.
5. THE LOOP WIRES SHALL BE HELD IN PLACE DURING INSTALLATION BY SHORT STRIPS OF POLYETHYLENE FOAM SEALANT BACKERS. THE STRIPS SHALL BE ABOUT 2" LONG AND PLACED EVERY 2 FEET. THEY ARE TO REMAIN IN PLACE WHEN THE SLOT IS SEALED.
6. VEHICLE DETECTOR LOOPS SHALL BE PLACED IN SAWCUTS IN THE BASE COURSE AND PAVED OVER WHENEVER POSSIBLE. IF PAVING IS NOT PART OF THE PROJECT, THE SAWCUTS SHALL BE MADE IN THE EXISTING PAVEMENT.
7. WHEN LOOP WIRES ARE PLACED IN THE BASE COURSE, THE SEALANT SHALL BE PROPERLY CURED BEFORE THE FINAL PAVEMENT IS PLACED.
8. LOOP LEAD-INS FROM ADJACENT LOOPS ACTUATING DIFFERENT PHASES SHALL BE IN SEPARATE SAWCUTS TO THE CURB PULLBOX.
9. LOOP FEEDERS SHALL BE AT LEAST ONE FOOT AWAY FROM POWER WIRING, WHENEVER POSSIBLE.
10. ALL ELECTRICAL WORK AND MATERIALS SHALL MEET THE REQUIREMENT OF THE NATIONAL ELECTRICAL CODE.
11. 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 (MINIMUM - FULL SIZE PLAN SCALE) SHOWING THE NUMBER OF TURNS & DIMENSIONS FOR EACH LOOP, THE LOOP LEAD-IN ROUTING FROM THE SAWCUT TO THE CONTROLLER AND THE 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 DISTRICT ENGINEER OR LOCAL OFFICIAL WHO IS RESPONSIBLE FOR THE SIGNAL MAINTENANCE.

LONG LOOPS VEHICLE DETECTOR LOOP INDUCTANCE DESIGN

LENGTH OF LOOP	WIDTH OF LOOP					
	4 FEET		6 FEET		8 FEET	
	1 TURN	2 TURNS	1 TURN	2 TURNS	1 TURN	2 TURNS
10	29	92	31	98	33	104
15	41	132	43	138	45	144
20	54	172	56	178	58	184
22	59	188	61	194	63	200
24	64	204	66	210	68	216
26	69	220	71	226	73	232
28	74	236	76	242	78	248
30	79	252	81	258	83	264
32	84	268	86	274	88	280
35	91	292	93	298	95	304
40	104	332	106	338	108	344
45	116	372	118	378	120	384
50	129	412	131	418	133	424
55	141	452	143	458	145	464
60	154	492	156	498	158	504
65	166	532	169	538	170	544
70	179	572	181	578	183	584
80	204	-	206	-	208	-
90	229	-	231	-	233	-
100	254	-	256	-	258	-

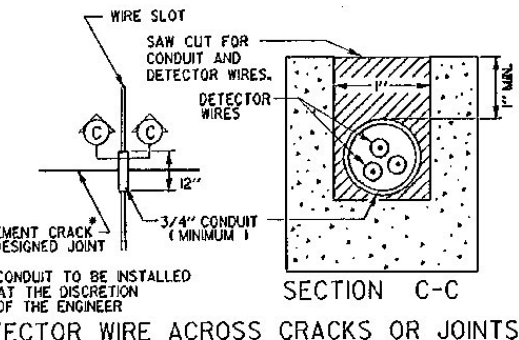
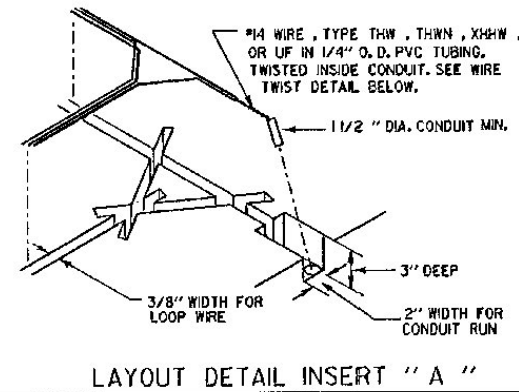
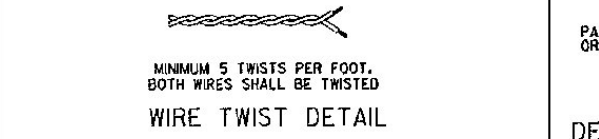
NOTE #1. SEE NOTE #1 FOR RECTANGULAR LOOPS.

2. THE ABOVE INDUCTANCES ARE ESTIMATED VALUES USING THE FOLLOWING EQUATIONS.

1 TURN = (PERIMETER X 0.5) + (LOOP LENGTH X 1.5)

2 TURN = (PERIMETER X 1.5) + (LOOP LENGTH X 5.0)

3. SEE NOTE #3 FOR RECTANGULAR LOOPS.



RECTANGULAR LOOPS VEHICLE DETECTOR LOOP INDUCTANCE DESIGN TABLE

LENGTH OF LOOP	WIDTH OF LOOP				LOOP PERIMETER (FT.)	LOOP INDUCTANCE (MICROHENRIES)			
	4 FEET	6 FEET	8 FEET	10 FEET		1 TURN K _v .45	2 TURNS K _v .42	3 TURNS K _v .38	4 TURNS K _v .36
	8	6	-	-		24	11	40	82
10	8	-	-	28	13	47	96	161	
12	10	-	-	32	14	54	109	184	
14	12	-	-	36	16	60	123	207	
16	14	-	10	40	18	67	137	230	
18	16	-	12	44	20	74	151	254	
20	18	-	14	48	22	81	164	277	
22	20	-	16	52	23	87	178	300	
24	22	-	18	56	25	94	192	323	
26	24	-	20	60	27	101	205	346	
28	26	-	22	64	29	108	219	369	
30	28	-	24	68	31	114	232	392	
32	30	-	26	72	32	121	246	415	
34	32	-	28	76	34	128	260	438	
36	34	-	30	80	35	135	274	461	
38	36	-	32	84	37	142	288	484	
40	38	-	34	88	38	149	302	507	
42	40	-	36	92	40	156	316	530	
44	42	-	38	96	41	163	330	553	
46	44	-	40	100	42	170	344	576	
48	46	-	42	104	43	177	358	599	
50	48	-	44	108	44	184	372	622	
52	50	-	46	112	45	191	386	645	
54	52	-	48	116	46	198	400	668	
56	54	-	50	120	47	205	414	691	
58	56	-	52	124	48	212	428	714	
60	58	-	54	128	49	219	442	737	
62	60	-	56	132	50	226	456	760	
64	62	-	58	136	51	233	470	783	
66	64	-	60	140	52	240	484	806	
68	66	-	62	144	53	247	498	829	
70	68	-	64	148	54	254	512	852	
72	70	-	66	152	55	261	526	875	
74	72	-	68	156	56	268	540	898	
76	74	-	70	160	57	275	554	921	
78	76	-	72	164	58	282	568	944	
80	78	-	74	168	59	289	582	967	
82	80	-	76	172	60	296	596	990	
84	82	-	78	176	61	303	610	1013	
86	84	-	80	180	62	310	624	1036	
88	86	-	82	184	63	317	638	1059	
90	88	-	84	188	64	324	652	1082	
92	90	-	86	192	65	331	666	1105	
94	92	-	88	196	66	338	680	1128	
96	94	-	90	200	67	345	694	1151	
98	96	-	92	204	68	352	708	1174	
100	98	-	94	208	69	359	722	1197	

NOTE #1. TO THE ABOVE LOOP INDUCTANCES, ADD 25 MICROHENRIES FOR EACH 100 FEET OF LEAD-IN CABLE FROM THE PAVEMENT LOOP TO THE DETECTOR CABINET. LOOP FEEDER LENGTH SHALL NOT EXCEED 750 FEET FOR A SINGLE OR MULTIPLE LOOP SYSTEM.

2. THE INDUCTIVE FORMULA USED FOR THE TABLE ABOVE IS $L = K \cdot N^2$, WHERE $K = \frac{5}{10 \cdot N}$. THIS IS THE MARYLAND-ILLINOIS FORMULA FROM A REPORT ON VEHICLE DETECTORS, BY KLATT (1973).

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

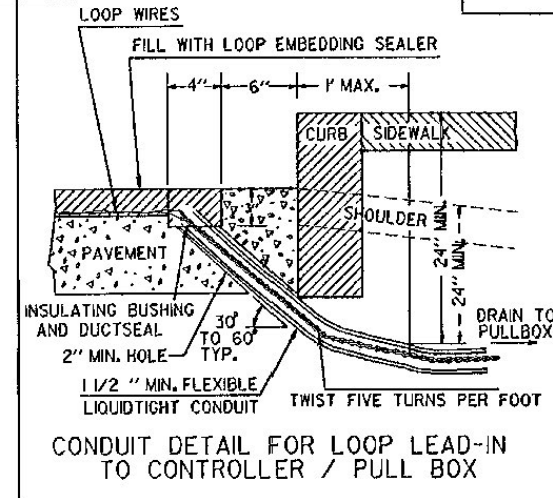
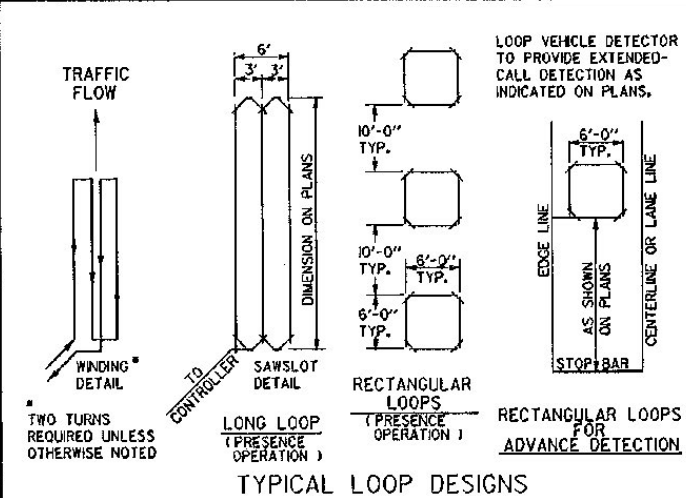
$$L = \left[\frac{1}{\frac{1}{L_1} + \frac{1}{L_2} + \dots} \right] + \text{LOOP FEEDER INDUCTANCES.}$$

LOOP TESTING

DURING INSTALLATION OF THE LOOPS, THE CONTRACTOR, IN THE PRESENCE OF THE ENGINEER, SHALL MEASURE THE LOOP INDUCTANCE, LEAKAGE TO GROUND AND LOOP RESISTANCE. 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 LEAKAGE TO GROUND IS ABOVE 1 MEGOHM.
3. THE LOOP RESISTANCE IS WITHIN 25% ± OF THE CALCULATED VALUE.

IF THE READINGS FALL OUTSIDE THE ABOVE RANGES, CORRECTIVE MEASURES SHALL BE TAKEN 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.



CONDUIT FILL DESIGN VALUES

AVAILABLE CONDUIT AREA		CONDUCTOR SIZE TABLE					
SIZE	26% FILL (IN ²)	CROSS SECTIONAL AREA (IN ²)		GAUGE			
1"	0.23	#14	#12	#10	#8	#6	
1 1/4"	0.39	1	.021	.025	.031	.060	.082
1 1/2"	0.53	2	.033	.129	CALCULATE AS REQUIRED		
2"	0.87	3	.142	.200			
2 1/2"	1.24	7	.170	.260			
3"	1.92	9	.297	.413			
3 1/2"	2.57	12	.317	.436			
		16	.402	.601			
		19	.425	.658			

* 1984 NATIONAL ELECTRICAL CODES INDICATES 40% FILL

REVISIONS AND CORRECTIONS

APPROVED

SEPT. 10, 1987
DATE

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VEHICLE DETECTOR LOOP DETAILS



STANDARD E-172